ANNAMALAI UNIVERSITY

Faculty of Engineering and Technology

Department of Electronics and Communication Engineering

B.E. Electronics and Communication Engineering

Four Year Degree Programme

Choice Based Credit System

(Full - Time)

Revised Regulations & Syllabi

(Students Admitted From the Academic Year 2018-2019)

VISION

To provide innovative, creative and technically competent Electronic and Communication Engineers for industry and society through excellence in Technical Education and Research.

MISSION

To provide quality education in the field of Electronics and Communication Engineering through periodically updating curriculum, effective teaching-learning process, best laboratory facilities and collaborative ventures with the industries.

To inculcate innovative skills, research aptitude, team-work, ethical practices among students so as to meet out expectations of the industry as well as society.

To adopt the best educational methods to improve teaching learning process continuously.

To provide students with hands on training on latest technology with supporting software.

To facilitate effective interactions among faculty and students, and foster networking with alumni, industries and other reputed institutions.

B.E.(ECE)-PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

S.No.	PROGRAMME EDUCATIONAL OBJECTIVES
PEO1	To prepare students to excel in undergraduate Programme and to succeed in industry / technical profession through quality education.
PEO2	To provide students with solid foundation in mathematics, basic science and engineering fundamentals necessary to analyze, formulate and solve problems in the field of Electronics and Communication engineering.
PEO3	To inculcate a strong flavour of project activities among the students and impart them with good scientific and engineering knowledge including proficiency in hardware languages, use of latest software tools, so as to analyze, design and create novel products and provide solutions to real life problems.
PEO4	To impart the professional and ethical attitude, effective communication and presentation skills, teamwork skills, multidisciplinary approach, and an ability to integrate engineering issues to broader social contexts to students.
PEO5	To provide student with an academic environment aware of excellence, outstanding leadership, written ethical codes and guidelines with moral values, and the life-long learning needed for a successful professional career.

B.E.(ECE)- PROGRAMME OUTCOMES (POS)

S.No	PROGRAMME OUTCOMES
PO1	**Engineering Knowledge** Apply the knowledge of mathematics, basic science and engineering fundamentals in finding solutions to Complex problems in the field of electronics and communication engineering
PO2	**Problem Analysis** Analyze the problem identify and formulate the computing requirements appropriate to its Solutions
PO3	**Design/development of Solutions** Capable of designing a system component or process that meet specific needs with appropriate considerations for health, safety, societal and environmental issues.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. Design and conduct experiment as well as to analyze and interpret data.
PO5	**Modern tool usage:** Use latest simulation tools current techniques Software and Hardware skills for analyzing and obtaining solutions to engineering problems.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Possess adequate knowledge required for sustainable development keeping in view of environmental impacts and contemporary issues.
PO8	**Ethics:** Acquire strong ethical and professional responsibilities adherence to quality and abide rules and regulations of eminent organizations or industries.
PO9	**Individual and Team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering 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.
PO11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments
PO12	**Life-Long learning:** Engage in self education and lifelong learning

B.E.(ECE)-MAPPING OF PO WITH PEO

MAPPING OF PO WITH PEO					
POs	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
PO1	✓	✓	✓		
PO2	✓	✓	✓		
PO3		✓	✓		
PO4		✓	✓		✓
PO5	✓	✓	✓		
PO6	✓			✓	✓
PO7				✓	
PO8	✓			✓	✓
PO9		✓	✓		✓
PO10				✓	✓
PO11			✓		✓
PO12	✓		✓		✓

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETBS101	**BS-I**	Physics	3	1	0	25	75	100	4
ETBS102	**BS-II**	Mathematics – I	3	1	0	25	75	100	4
ETES103	**ES-I**	Basic Electrical Engineering	3	1	0	25	75	100	4
ETBP104	**BSP-I**	Physics Laboratory	0	0	3	40	60	100	1.5
ETSP105	**ESP-I**	Electrical Engineering Laboratory	0	0	2	40	60	100	1
ETSP106	**ESP-IV**	Engineering workshop/ Manufacturing Practices	1	0	4	40	60	100	3
						Total Credits			**17.5**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS201	**HS-I**	English	2	0	0	25	75	100	2
ETBS202	**BS-III**	Chemistry	3	1	0	25	75	100	4
ETES203	**ES-II**	Programming for Problem Solving	3	0	0	25	75	100	3
ETBS204	**BS-IV**	Mathematics – II	3	1	0	25	75	100	4
ETHP205	**HSP-I**	Communication Skills and Language Laboratory	0	0	2	40	60	100	1
ETBP206	**BSP-II**	Chemistry Laboratory	0	0	3	40	60	100	1.5
ETSP207	**ESP-III**	Computer Programming Lab	0	0	4	40	60	100	2
ETSP208	**ESP-II**	Engineering Graphics and Drafting	1	0	4	40	60	100	3
						Total Credits			**20.5**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming III Semester.									

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETBS301	**BS-V**	Engineering Mathematics III	3	1	-	25	75	100	4
ETES302	**ES-III**	Environmental Studies	3	-	-	25	75	100	3
ETES303	**ES-IV**	Data structures & Algorithms	3	-	-	25	75	100	3
ECES304	**ES-V**	Basic Electronics	2			25	75	100	2
ECPC305	**PC-I**	Network Theory	3	-	-	25	75	100	3
ECPC306	**PC-II**	Digital System Design	3	1		25	75	100	4
ECSP307	**ESP-V**	Basic Electronics Lab	-	-	3	40	60	100	1.5
ECCP308	**PCP-I**	Network Analysis Lab	-	-	3	40	60	100	1.5
ECCP309	**PCP-II**	Digital System Design Lab	-	-	3	40	60	100	1.5
ETIT310	**IT-I**	Internship Inter/ Intra Institutional Activities*	***Four** weeks during the summer vacation at the end of **II Semester***				100	100	**4.0**
***For the **Lateral entry students** total credit for III Semester is **23.5** as they are exempted from internship during summer vacation of II semester.*						**Total Credits**			**27.5**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECBS401	**BS-VI**	Probability Theory and Stochastic process	3	-	-	25	75	100	3
ECES402	**ES-VI**	Material Science	2	-	-	25	75	100	2
ECPC403	**PC-III**	Analog Circuits	3	-	-	25	75	100	3
ECPC404	**PC-IV**	Microprocessors and Micro Controllers	3	-	-	25	75	100	3
ECPC405	**PC-V**	Analog Communication	3	-	-	25	75	100	3
ECPC406	**PC-VI**	Signals and Systems	3	-	-	25	75	100	3
ECCP407	**PCP-III**	Analog Circuits Lab	-	-	3	40	60	100	1.5
ECCP408	**PCP-IV**	Microprocessors and Micro Controllers Lab	-	-	3	40	60	100	1.5
ECCP409	**PCP-V**	Analog Communication Lab	-	-	3	40	60	100	1.5
						Total Credits			**21.5**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.									

SEMESTER V

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
ECPC501	**PC-VII**	Digital Communication	3	-	-	25	75	100	3
ECPC502	**PC-VIII**	Digital Signal Processing	3	-	-	25	75	100	3
ECPC503	**PC-IX**	VLSI Design	3	-	-	25	75	100	3
ECPC504	**PC-X**	Electromagnetic Waves	3			25	75	100	3
ECPE505	**PE-I**	Professional Elective I	3	-	-	25	75	100	3
ECPE506	**PE-II**	Professional Elective II	3	-		25	75	100	3
ECCP507	**PCP-VI**	Digital Communication Lab	-	-	3	40	60	100	1.5
ECCP508	**PCP-VII**	Digital Signal Processing Lab	-	-	3	40	60	100	1.5
ECCP509	**PCP-VIII**	VLSI Design Lab	-	-	3	40	60	100	1.5
ETIT510	**IT-II**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***IV Semester***				100	100	**4.0**
						Total Credits			**26.5**

SEMESTER VI

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
ECPC601	**PC-XI**	Embedded Systems	3	-	-	25	75	100	3
ECPC602	**PC-XII**	Data Communication and Networks	3	-	-	25	75	100	3
ECPE603	**PE-III**	Professional Elective - III	3	-	-	25	75	100	3
ECPE604	**PE-IV**	Professional Elective - IV	3	-	-	25	75	100	3
ECPE605	**PE-V**	Professional Elective –V	3	-	-	25	75	100	3
YYOE606	**OE-I**	Open Elective - I	3	-	-	25	75	100	3
ECCP607	**PCP-IX**	Embedded Systems Lab	-	-	3	40	60	100	1.5
ECCP608	**PCP-X**	Data Communication and Networks Lab	-	-	3	40	60	100	1.5
						Total Credits			**21.0**

Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS701	**HS-II**	Engineering Ethics	2	-	-	25	75	100	2
ECPC702	**PC-XIII**	Microwave Engineering	3	-	-	25	75	100	3
ECPE703	**PE-VI**	Professional Elective-VI	3	-	-	25	75	100	3
ECPE704	**PE-VII**	Professional Elective-VII	3	-	-	25	75	100	3
YYOE705	**OE-II**	Open Elective - II	3	-	-	25	75	100	3
ECCP706	**PCP-XI**	Microwave Engineering Lab	-	-	3	40	60	100	1.5
ETIT707	**IT-III**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***VI Semester***				100	100	**4.0**
						Total Credits			**19.5**

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECOE801	**OE-III**	Open Elective – III	3	-	-	25	75	100	3
ECOE802	**OE-IV**	Open Elective – IV	3	-	-	25	75	100	3
ECPV803	**PV-I**	Project Work and Viva-Voce	-	**PR** 10	**S** 2	40	60	100	6
						Total Credits			**12**

L	No. of Lecture Hours	**TR**	No. of Hours for Discussion on Industrial Training
T	No. of Tutorial Hours	**S**	No. of Seminar Hours on Industrial Training/Project
P	No. of Practical Hours	**PR**	No. of Hours for Discussion on Project work
CA	Continuous Assessment Marks	**FE**	Final Examination Marks
Credits	Credit Points allotted to that course	**Total**	Total Marks

S.NO	COURSE CODE	LIST OF PROFESSIONAL ELECTIVES
1.	**ECPESCN**	Information Theory and Coding
2.	**ECPESCN**	Antennas and Propagation
3.	**ECPESCN**	Control Systems
4.	**ECPESCN**	Biomedical Electronics
5.	**ECPESCN**	Electronic Measurements and Instrumentations
6.	**ECPESCN**	Fiber Optic Communication
7.	**ECPESCN**	Digital Image and Video Processing
8.	**ECPESCN**	Mixed Signal Design
9.	**ECPESCN**	Wireless Sensor Networks
10.	**ECPESCN**	High Speed Electronics
11.	**ECPESCN**	Nano Electronics
12.	**ECPESCN**	Scientific Computing
13.	**ECPESCN**	Computer Architecture
14.	**ECPESCN**	DSP Processor Architecture and Programming
15.	**ECPESCN**	Mobile Adhoc Networks
16.	**ECPESCN**	Introduction to MEMS
17.	**ECPESCN**	Cellular Mobile Communication
18.	**ECPESCN**	Digital Design Through Verilog

S.NO	COURSE CODE	LIST OF OPEN ELECTIVES
1.	**ECOESCN**	Soft Computing Techniques
2.	**ECOESCN**	Satellite Communication
3.	**ECOESCN**	Wavelets
4.	**ECOESCN**	Power Electronics
5.	**ECOESCN**	Radar and Navigation Aids
6.	**ECOESCN**	Network and Information Theory
7.	**ECOESCN**	Cloud Computing
8.	**ECOESCN**	Modern Communication Systems
9.	**ECOESCN**	Multimedia Compression Technique
10.	**ECOESCN**	Advanced Microprocessor and Microcontroller

S.NO	COURSE CODE	LIST OF HONOURS ELECTIVE	CREDITS
1.	**ECHESCN**	Transmission Lines and Waveguides	3
2.	**ECHESCN**	CMOS Analog IC Design	3
3.	**ECHESCN**	Data Structures and C++	3
4.	**ECHESCN**	Speech and Audio Processing	4
5.	**ECHESCN**	Adaptive Signal Processing	4
6.	**ECHESCN**	Mobile Communication and Networks	3

S.NO	COURSE CODE	LIST OF MINOR ENGINEERING ELECTIVE	CREDITS
1.	**ECMISCN**	Electronic Devices	3
2.	**ECMISCN**	Communication Engineering	3
3.	**ECMISCN**	Linear Integrated Circuits and Applications	3
4.	**ECMISCN**	Computer Networks	4
5.	**ECMISCN**	Telecommunication Switching and Networks	3
6.	**ECMISCN**	Wireless Communication	4

ETBS301	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To learn partial and differential equations, Fourier series, Boundary value problems.
- To learn the transforms such as Sine, Cosine, Fourier transform and Z transforms
- To gain Knowledge of the method to find the solution of difference Method.

UNIT I

Partial Differential Equations

Formation of Partial Differential Equations by Eliminating Arbitrary Constants and Arbitrary Functions-Solution of Standard Type of First Order Partial Differential Equations - Lagrange's Linear Equation - Linear Partial Differential Equations of Second Order with Constant Coefficients.

UNIT II

Fourier Series

Dirichle's Conditions - General Fourier Series - Odd and Even Functions - Half Range Sine Series - Half Range Cosine Series - Complex Form of Fourier Series - Parseval's Identity.

UNIT III

Boundary Value Problems

Solutions of One Dimensional Wave Equation - One Dimensional Heat Equation (Without Derivation) - Fourier Series Solutions in Cartesian Co-Ordinates.

UNIT IV

Fourier Transform Fourier Integral Theorem (Without Proof) - Fourier Transform Pair- Sine and Cosine Transforms - Properties - Transforms of Simple Functions – Convolution Theorem - Parseval's Identity.

UNIT V

Z- Transform and Difference Equations

Z – Transform – Elementary Properties- Inverse Z –Transform-Convolution Theorem-Solution of Difference Equation Using Z Transform.

TEXT BOOKS

1. Kandasamy P., Thilagavathy. K. and Gunavathy, K., "Engineering Mathematics" Series. S.Chand & Co.Ltd.New Delhi. 2007.
2. Venkatraman M.K., "Engineering Mathematics" series, the National Pub Co., Chennai. 2003.

REFERENCES

1. Veerarajan T., "Engineering Mathematics" Series, Tata McGraw Hill Pub Co., Ltd. New Delhi, 2006.
2. Singaravelu. A., "Engineering Mathematics" Series, Meenakshi Publication, Chennai, 2004.

COURSE OUTCOMES

At the end of the course the students will be able to acquire knowledge on

1. Be capable of mathematically formulating certain practical problems in terms of partial differential equation. Solve them and physically interpret the results.
2. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical Fourier analysis that an engineer may have to make from discrete data.
3. 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.
4. Have grasped to 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.
5. Have learnt the basics of z-transform in its applicability to discretely varying functions. gained the skill to formulate certain problems in terms of difference equations and solve them using the z-transform techniques bringing out the elegance of the procedure involved.

Mapping with Programme Outcomes(POs)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1				✓					✓			✓
CO2	✓	✓			✓			✓	✓		✓	
CO3	✓	✓		✓	✓							
CO4			✓			✓				✓		
CO5		✓					✓					

ETES302	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the student about global environmental problems and natural disasters.
- To give the ideas about advance technologies of Engineering that will useful to protect environment.

UNIT I

Introduction

Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using

mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles

UNIT II

Ecosystem

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem –

Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT III

Diversity

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India -Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV

Pollution

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation – Consumerism and Waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of Environmental Legislation.

UNIT V

Social Welfare

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

Field Work

Visit to a local area to document environmental assets river / forest / grassland / hill / mountain - Visit to a local polluted site - Urban / Rural / Industrial / Agricultural - Study of common plants, insects, birds -Study of simple ecosystems-pond, river, hill slopes, etc. **(Field work Equal to 5 lecture hours)**

TEXT BOOKS

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R).

REFERENCES

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
2. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
3. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
4. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
5. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
6. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
7. Survey of the Environment, The Hindu (M)
8. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

(M) MAGAZINE (R) REFERENCE (TB) TEXTBOOK

COURSE OUTCOMES

At the end students can able to

1. Understand the importance of environment.
2. Analyze the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4. Employ awareness among the society about environmental problems and natural disasters.
5. Practice according to the present and future environmental issues.

Mapping with Programme Outcomes(POs)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1							✓				✓	
CO2		✓				✓			✓			
CO3			✓					✓				
CO4	✓			✓	✓	✓	✓			✓		✓
CO5		✓				✓		✓		✓		

ETES303	DATA STRUCTURE & ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures

UNIT I

Introduction

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

UNIT II

Stacks and Queues

DT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT III

Linked Lists

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT IV

Trees

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT V

Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis

TEXT BOOKS

1. Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Illustrated Edition,Ellis Computer Science Press.
2. E.Balagurusamy, Data structures using C, Mc.Graw Hill,2013.

REFERENCES

1. Mark Allen Weiss, Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition Addison-Wesley Publishing Company.
2. R.G. Dromey, "How to Solve it by Computer", 2nd Impression by Pearson Education.

COURSE OUTCOMES

Student will able

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. To write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. To implement Graph search and traversal algorithms and determine the time and computation complexity.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓				✓					✓
CO2		✓	✓	✓		✓			✓		✓	
CO3	✓	✓		✓								
CO4			✓								✓	
CO5	✓	✓			✓	✓		✓		✓		

ECES304	BASIC ELECTRONICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To gain a basic knowledge on Active and passive components
- To learn the principles of diodes and transistors suitable for various applications
- To gain a basic knowledge on characteristics of transistors.
- To learn the concepts of analog devices

UNIT I

P-N Junction Diode

Energy bands in intrinsic and extrinsic semiconductors- Carrier transport: diffusion current- drift current, mobility and resistivity – PN Junction Diode: Construction and Characteristics – Energy Band Structure – Current Equation- Diode Resistance–Transition and Diffusion Capacitance-Effect of Temperature on PN Junction Diodes – Small signal switching model –Breakdown Mechanisms in Semiconductor Diodes- Avalanche Breakdown– Zener Diode Characteristics.

UNIT II

Rectifiers, Regulators and Special Semiconductor Devices

Analysis of half wave Rectifier, Full wave Rectifiers: Centre tap and Bridge rectifiers without filters and with C, L and LC filters –series and shunt voltage regulators –Special Semiconductor devices: Principle of Operation and Characteristics of Schottky diode, Tunnel Diode ,Varactor Diode, SCR and Semiconductor Photo Diodes and UJT.

UNIT III

Bipolar Junction Transistor

Bipolar Junction Transistor –construction–current components– I-V characteristics – Non-ideal effects – Equivalent circuits – Ebers-Moll, Hybrid-PI Models – Switching characteristics – frequency limitations-Analysis of transistor amplifier circuit using h parameters.

UNIT IV

Transistor Biasing and Stabilization

Operating Point, the DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in VBE and β , Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability.

UNIT V

Field Effect Transistor

The Junction Field Effect Transistor :Construction, principle of operation – Pinch-off Voltage – I-V characteristics, Comparison of BJT and FET, JFET Small Signal Model, MOSFET-Construction, principle of operation, MOSFET Characteristics in Enhancement and Depletion modes. FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor.

TEXT BOOKS

1. Jacob Millman, Christos Halkias and Satyabrata Jit, Millman's, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2010.
2. David A. Bell, "Electronic Devices and Circuits", 5thEdition, Oxford University Press, 2008.

REFERENCES

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education, 2009.
2. S.Salivahanan, N.Sureshkumar and A.Vallavaraj, "Electronic Devices and Circuits", 2nd Edition, Tata McGraw Hill, 2008.
3. Allen Mottershead "Electronic Devices and Circuits", Prentice Hall of India, 2008.

COURSE OUTCOMES

Upon completion of this course the students will have

1. Acquired knowledge on basic semi conductor theory.
2. Acquired knowledge on characteristics of PN junction diode and its applications.
3. Understand the characteristics and working of BJTs and FETs
4. Ability to design biasing circuits for BJTs and JFETs
5. Understand the applications of transistors.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓		✓			
CO2	✓	✓		✓						✓	✓	
CO3	✓		✓			✓						
CO4			✓						✓			
CO5			✓	✓	✓			✓				✓

ECPC305	NETWORK THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To prepare the students to have a basic knowledge in analyze of electric networks.
- To study various network theorems and solving methods .
- To give basic knowledge of Trigonometric and exponential Fourier series
- To study resonant circuits and properties of Laplace transforms**.**
- To analyze various three phase circuits, star and delta connections.

UNIT I

DC and AC Circuits

DC Circuits – Current and Voltage Sources – Ohms Law and Kirchhoff's Law – Mesh and Nodal Analysis - Resistive Circuits – Series and Parallel Reduction method – Voltage and Current Division – Source Transformation technique - Star delta transformation – AC Circuits –Inductors, Capacitors – Voltage - Current Relationship - Steady State Analysis of RL, RC, RLC Circuits with Sinusoidal Excitation – Phasor Diagram - Power Factor – Real, Apparent and Reactive Power

UNIT II

Network theorems

Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits.

UNIT III

Steady state and Transient Analysis

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values – Fourier transform and continuous spectra. (Steady state sinusoidal analysis using Phasor)

Laplace transforms and properties: Partial fractions – singularity functions – waveform synthesis – analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions – Transient behavior – concept of complex frequency

UNIT IV

Network Functions

Poles and Zeros: Terminal Pairs and Ports, Network Function for the One Port and Two Port, The Calculation of Network Function - (a) Ladder Network (b) General Networks. Poles and Zero of Network Functions, Restrictions on Pole and Zero Locations for Driving-Point Functions, Restrictions on Pole and Zero Locations for Transfer Functions, Time domain Behavior from the Pole and Zero Plot, Stability of Networks.

UNIT V

Frequency Domain Application

Two port network and interconnections – parameters- Behaviours of series and parallel resonant circuits.Design of constant-k low pass, high pass, band pass and band reject filters.

TEXT BOOKS

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. John D Ryder ; "Networks, Lines and Fields", Second Edition, Pearson Publication 2015.

REFERENCES

1. Sudhakar,A., Shyammohan,S.P.; Circuits and Network; Tata McGraw-Hill New Delhi, 1994
2. A William Hayt, "Engineering Circuit Analysis"8th Edition, McGraw-Hill Education

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓		✓			✓
CO2				✓					✓	✓		
CO3	✓		✓			✓					✓	
CO4			✓		✓							
CO5		✓	✓					✓				

ECPC306	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To introduce Number systems and arithmetic operations on binary numbers.
- To introduce basic postulates of Boolean algebra, Boolean functions and methods to simplify Boolean expressions.
- To acquire knowledge on design and analysis of combinational circuits using PLDs.
- To understand the realization of combination circuits To outline the procedures for analysis and design of synchronous and asynchronous sequential circuits.
- To introduce different logic families, semiconductor memories and related technology.

UNIT I

Introduction

Number system and their Interconversions-Complements-Representation of Signed binary numbers - Binary arithmetic - Floating Point Numbers –Binary codes: BCD,84-2-1, Excess 3, Gray and Alpha numeric codes. Boolean algebra-Postulates and theorems - Boolean functions-Canonical and Standard forms-Minimization techniques: Karnaugh map minimization (SOP and POS minimization)-Don't care conditions-Tabulation method-Implementation of logic functions using gates –NAND and NOR implementation.

UNIT II

Combinational Logic and PLDs

Design procedure-Half adder - Full adder-Half subtractor- Full subtractor-Parallel binary adder-Parallel adder/subtractor- BCD adder-Binary multiplier-Code convertors-Magnitude comparator-Parity generator and checker-Decoders-Encoders-Priority encoder-Multiplexer and Demultiplexer-Implementation of combinational logic using Multiplexer-Programmable Logic Devices-PROM-PLA-PAL-Implementation of combination logic using PLDs.

UNIT III

Synchronous Sequential Logic

Flip-flops –SR, D, JK, T Flip-flops, Master-Slave flip-flop- Triggering of Flip-Flops-Flip-Flop Excitation table-Moore and Mealy models- Analysis and Design of clocked sequential circuits-State Minimization –State assignment-Circuit Implementation-Design of Counters – Synchronous counters - Ripple counters-BCD counter-Modulo-N counters-Shift registers-Universal Shift register-Johnson and ring counter.

UNIT IV

Asynchronous Sequential Logic

Introduction-Modes of operation- Fundamental Mode asynchronous Circuits-Analysis of Fundamental mode asynchronous Circuits-Analysis of a circuit with SR Latches-Design Procedure-Reduction of state and flow tables-Cycles, Races-Race free state assignments-Hazards-Essential Hazards-Pulse mode asynchronous circuits.

UNIT V

Digital Logic Families and Semiconductor Memories

Characteristics of digital IC-logic families: RTL and DTL-TTL-ECL-MOS-CMOS-Comparison of various logic families-Semiconductor memories-ROM and RAM organization- Basic Memory cell - Memory decoding-Memory expansion-Static and Dynamic RAM.

TEXT BOOKS

1. William H. Gothmann, "Digital Electronics", 2nd Edition, Prentice Hall, 2001.
2. R.AnandaNatarajan, "Digital Design", PHI, 2011.

REFERENCES

1. M.Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India, 2008.
2. R.P.Jain, "Modern Digital Electronics", 4th Edition, Tata McGraw-Hill Education, 2010.

COURSE OUTCOMES

Upon completion of the course the students will be able to

1. Explain number system and Boolean postulates and Realize Boolean functions with minimum number of logics.
2. Design and analyze combinational circuits and Implement combinational logic in PLDs.
3. Design and implement synchronous and asynchronous sequential circuits
4. Describe various logic families in digital IC.
5. Understand semiconductor memories and related technology.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓			✓		✓		✓		✓	
CO2		✓	✓	✓				✓				
CO3		✓			✓							
CO4			✓			✓		✓		✓	✓	
CO5	✓								✓	✓		✓

ECSP307	BASIC ELECTRONICS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To verify the characteristics and applications of various semiconductor devices.

LIST OF EXPERIMENTS

1. Study of color codes and soldering practice
   Characteristics of junction diode, Zener diode
2. Zener diode as voltage regulators.
3. Half wave and full wave rectifiers without filter
4. Half wave and full wave rectifiers with filter
5. Simulate the wave shaping circuit using MultiSim
6. Transistor biasing circuits
7. Study of characteristics of transistor using MultiSim

8. Characteristics of FET
9. Characteristics of UJT
10. Characteristics of SCR
11. Characteristics of LDR and Photo Transistor.

COURSE OUTCOMES

At the end of course students will

1. Design and experiment with various application circuits using diodes
2. Understand the practical characteristics of BJT and JFET.
3. Apply principles and characteristics of semiconductor devices in designing simple application circuits.
4. Design and experiment with various signal circuits using BJTs and FETs.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓					✓		
CO2	✓		✓				✓		✓			✓
CO3			✓			✓					✓	
CO4			✓	✓				✓				

ECCP308	NETWORK ANALYSIS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To verify basic laws on circuits and verify various network theorems.
- To understand Resonance concepts in AC circuits.
- To compute parameters for single and cascaded two-port Network.

LIST OF EXPERIMENTS

1. Verification of Ohm's Law
2. Verification of Kirchoff's Current Law
3. Verification of Kirchoff's Voltage Law
4. Verification of Superposition Theorem
5. Verification of Thevinin's and Norton's Theorem
6. Verification of Maximum Power Transfer Theorem
7. Verification of Reciprocity Theorem
8. Study of AC circuits.
9. Study of Resonance Circuits
10. Computation of Network Parameters for Symmetric Network
11. Computation of Network Parameters for Asymmetric Network
12. Network Parameters for Cascaded Network.

COURSE OUTCOMES

At the end of course students will

1. Understand how to analyze circuits using Network theorems.
2. Acquire knowledge on resonance concepts in AC circuits.
3. Model networks using Network Parameters.
4. Understand how to compute parameters for single and cascaded two-port Network.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓				✓		✓			✓	
CO2	✓	✓		✓			✓					
CO3	✓		✓							✓		
CO4					✓				✓			✓

ECCP309	DIGITAL SYSTEM DESIGN LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

1. To Design Combinational and sequential Digital circuits.

LIST OF EXPERIMENTS

1. Study of Logic Gates.
2. Design of unit Adders and Subtractors,
3. Design and Implementation of Binary Four-bit parallel adder.
4. Design of Code Convertors.
5. Design of Multiplexer and Demultiplexer.
6. Design of encoders and Decoders.
7. Study of Flip Flops
8. Construction of Shift Register
9. Design of Modulo Counters.
10. Design of Non Sequential Counter
11. Frequency Divider using IC7490
12. Design of Sequence Generator and Detector
13. Study of Fault Diagnosis in Combinational Circuits.

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

1. Design simple combinational logic circuits using gates
2. Verify the functionalities of various gates.
3. Understand the characteristics of flip-flops
4. Apply the design Procedures to design basic sequential circuits.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			✓	✓		✓			✓	✓		
CO2	✓	✓		✓								
CO3					✓							✓
CO4	✓	✓	✓				✓	✓				

ECBS401	PROBABILITY THEORY AND STOCHASTIC PROCESS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the concepts of probability & random signals.
- Know the theorems related to random signals.
- To give exposure to the students about the properties of random signal & random processes.
- To introduce the concepts of transmission of random process through LTI.

UNIT I

Sets and set operations

Probability space, Conditional probability and Bayes theorem, Combinatorial probability and sampling models.

UNIT II

Random Variables

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions

UNIT III

Operations on Random Variables

Joint distributions, functions of one and two random variables, moments of random variables, Conditional distribution, densities and moments, Characteristic functions of a random variable: Markov, Chebyshev and Chernoff bounds

UNIT IV

Random Sequences and Convergence

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT V

Random Process and Power Spectral Density

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

TEXT BOOKS

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education

2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic
3. Processes,'' Fourth Edition, McGraw Hill.
4. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International

REFERENCES

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,1971.

2. P.G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.
3. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Understand properties of random signal processes.
3. Investigate characteristics of random processes
4. Make use of theorems related to random signals
5. To understand propagation of random signals in LTI systems.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓		✓		✓	✓			
CO2					✓				✓			✓
CO3	✓	✓	✓		✓					✓		
CO4				✓	✓			✓			✓	
CO5	✓	✓					✓					✓

ECES402	**MATERIAL SCIENCE**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES

- To impart fundamental understanding of how the various properties of materials drawn from different length scales of electronic and molecular structures that can be used in designing electronic devices.
- To gain vast knowledge of various conducting, superconducting, semiconducting, magnetic, dielectric, optical, smart and nano composite materials

UNIT I

Conducting Materials

Classical Free Electron Theory of Metals - Electrical Conductivity of Al - Drawbacks of Classical Theory - Quantum Free Electron Theory of Metals and its Importance - Density of States - Fermi-Dirac Statistics - Calculation of Femi Energy and its Importance - Concept of Hole-Origin of Band Gap in Solids (Qualitative Treatment Only) - Effective Mass of Electron - High Resistivity Alloys Superconductors - Properties and Applications.

UNIT II

Semiconducting Materials

Elemental and Compound Semiconductors and Their Properties - Carrier Concentration Intrinsic Semiconductors - Carrier Concentration in N-Type and P-Type Semiconductors - Variation of Fermi Level and Carrier Concentration with temperature - Hall Effect – Applications.

UNIT III

Magnetic and Dielectric Materials

Different Types of Magnetic Materials and Their Properties - Domain Theory of Ferromagnetism - Heisenberg Criteria - Hysteresis Energy Product of a Magnetic Material - Merits and their Applications - Magnetic Recording Materials - Metallic Glasses - Active and Passive Dielectrics and their Applications - Ferro Electrics – Piezo Electrics.

UNIT IV

Optical Materials

Optical Properties of Metals, Insulators and Semiconductors - Phosphorescence and Fluorescence - Excitons, Traps and Colour Centres and their importance - Different Phosphors Used in CRO Screens - Liquid Crystal as Display Material - Thermography and its Applications - Photoconductivity and Photo Conducting Materials.

UNIT V

New Engineering Materials

Smart materials – Shape memory alloys – Chromic materials (Thermo, Photo and Electro) – Rheological fluids – Metallic glasses – Advanced ceramics – Composites. Bio-materials: Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements – Skin implants – Tissue engineering – Biomaterials for organ replacement (Bone substitutes) – Biosensor.

TEXT BOOKS

1. Arumugam M., "Materials Science", Anuradha Technical Book Publishers, 2005.
2. Indulkar C.S. and Thiruvengadem. S, "Introduction to Electrical Engineering Materials",5th Edition, S.Chand& Co New Delhi, 2010.

REFERENCES

1. Donald R. Askland and Pradeep P. Phule, "The Science and Engineering of Materials", 5th Edition, Cengage Learning Publisher, USA, 2006
2. Sze S.M. and Kwok K., "Physics of Semiconductor Devices", 3rd Edition, John Wiley, India, 2007.
3. Pillai S.O, "Solid State Physics", 6th Edition, New Age International Publisher, India, 2009
4. Dekker A.J., "Electrical Engineering Materials" Prentice Hall of India, 2006.

COURSE OUTCOMES

At the end of the course, the students would

1. Acquire knowledge of a wide variety of materials
2. Analysis of suitability of materials for various applications in designing products useful for the society.
3. Gain knowledge of new engineering materials such as nano and optical materials

4. To gain vast knowledge of various magnetic, dielectric, optical, smart and nano composite materials.
5. To gain vast knowledge of various conducting, superconducting, semiconducting materials.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓		✓		✓	✓			
CO2	✓	✓			✓							
CO3		✓	✓	✓		✓				✓		
CO4	✓									✓		✓
CO5							✓					✓

ECPC403	**ANALOG CIRCUITS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To gain knowledge about the basic electronic circuits
- To acquire an in-depth knowledge of low frequency and high frequency analysis of BJT and FET amplifiers
- To design large signal amplifiers and tuned amplifiers
- To design feedback amplifiers and oscillators
- To design the wave shaping circuits

UNIT I

Diode Circuits, Amplifier models

Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance for BJT and FET amplifier for BJT and FET. small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT II

Frequency Models and Feedback Amplifiers

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascade amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

UNIT III

Oscillators

Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators, crystal oscillator.

UNIT IV

Operational Amplifier

Design of differential amplifier for a given specification, design of gain stages and output stages, compensation. **OP-AMP applications**: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Astable, Bistable Multivibrator, Schmitt trigger and its applications.

UNIT V

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. **Analog-to-digital converters (ADC)**: Single slope, dual slope, successive approximation, flash etc.

TEXT BOOKS

1. Ramakant A.Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edition, Prentice Hall, 2000.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edn, Cambridge University Press, 1989.

REFERENCES

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. A.S.Sedra and K.C.Smith, Microelectronic Circuits, Saunder's College Publishing, Edn IV.
3. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edn

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓		✓			✓	✓		✓		
CO2					✓	✓						
CO3	✓		✓					✓	✓		✓	
CO4	✓	✓										
CO5				✓						✓		✓

ECPC404	MICROPROCESSORS AND MICRO CONTROLLERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The student should be made to

- Study the Architecture of 8085 and 8086 microprocessor.
- Learn the detail aspects of I/O and Memory Interfacing circuits.
- Study the Architecture of 8051 microcontroller.
- Study about 8051 micro controller interfacing with various applications
- Do Assembly language programming in clear perspective

UNIT I

8085 Microprocessor

Microprocessor architecture and assembly language – Organization of 8085 microprocessor – memory and I/O devices –Instructions set –data transfer, arithmetic, logic and branch operations – counters and time delays – Stack – subroutine – interrupts – simple programs.

UNIT II

8086 Microprocessor

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 III

Peripheral Devices

8255 Programmable Peripheral Interface – 8253 Programmable Interval Timer – 8559 Programmable Interrupt Controller – Direct Memory Access (DMA) and 8257 DMA Controller – 8279 Programmable Keyboard Display Interface – 8251 and serial I/O and Data Communication.

UNIT IV

8051 Architecture

Architecture of 8051 –Special Function Registers -I/O Ports – Memory Organization - Addressing modes - Instruction set – Assembly Language Programming – Assembly Code for Arithmetic and Logic Operations.

UNIT V

Microcontroller Interfacing

Programming 8051 Timers – Timer programming - Serial Port Programming - Interrupts Programming – LCD and Keyboard Interfacing - ADC, DAC and Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

TEXT BOOKS

1. N Senthil Kumar, M Saravanan and S Jeevananthan,"Microprocessors and Microcontrollers", Oxford University Press, 2010.
2. Ramesh Goankar, Microprocessor Architecture Programming and Application with 8085/8080a, 6th Edition Penram International Publishing (India), 2013.

REFERENCES

1. Kenneth J.Ayalar, 'The 8051 Microcontroller Architecture Programming and Applications",Fourth Edition, Thomson,2005.
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
3. Doughlas V Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH,2012.
4. Muhammad Ali Mazidi, Janice GillispieMazidi, "8051 Microcontroller and Embedded Systems", Second Edition PHI, 2014.

COURSE OUTCOMES

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

1. Understand the architecture of 8085 and 8086 microprocessor.
2. Acquire knowledge on Peripheral Devices.
3. Understand the architecture of 8051 microcontroller based systems.
4. Able to write simple programs on Programming of 8085 and 8086 microprocessor and 8051 microcontrollers.
5. Understand the Interfacing of 8051 microcontroller for various applications.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓											
CO2		✓	✓					✓	✓		✓	✓
CO3	✓	✓		✓	✓	✓	✓					
CO4		✓								✓		✓
CO5	✓							✓				

ECPC405	**ANALOG COMMUNICATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To give a brief knowledge in random process and sources of noise in Communication Systems.
- To expose the concepts of basic communication in analog domain and Amplitude modulation/demodulation
- To familiarize the Angle modulation/ demodulation
- To know the working knowledge of the fundamental pulse modulation

UNIT I

Introduction to Random Process and Noise Theory

Random Process Definition - Stationary Process – Mean – Autocorrelation - PSD of Stationary Process – Gaussian Process.

Noise – Shot Noise, Thermal Noise, White Noise, Narrow Band Noise –Time domain representation of Narrow Band Noise - Signal to Noise Ratio, Probability of Error – Noise Band Width - Effective Noise Temperature- Noise Figure.

UNIT II

Amplitude Modulation

Introduction-communication system model-modulation-Need for modulation-Amplitude modulation- AM with carrier-DSB-SC-SSB-SC – VSB-Time and frequency domain representation-Bandwidth requirements and power relations-Generation and Detection of AM with carrier signal-Square Law Modulator, Square Law Detector, Envelope Detector- Generation and Detection of DSB-SC signal-Balanced Modulator, Ring Modulator, Coherent Detection-Costas Loop- Generation and Detection of SSB-SC signal-Phase discrimination method, Coherent detection-Comparison of AM systems-Frequency Division multiplexing.

UNIT III

Angle Modulation

Basic Definitions, Types of Angle Modulation, Relationship between PM and FM Frequency deviation – Types of FM – Single tone Narrow Band, Wide-Band FM , Remarks about PM – Multi tone Wide-Band FM – Transmission Bandwidth of FM Waves– FM Modulators–Parameter Variation Method (Direct Method), Armstrong method (Indirect Method) – FM Demodulators – Slope Detector, Balanced Slope Detector, Foster Seely Discriminator – Ratio Detector.

UNIT IV

Transmitters and Receivers

AM transmitter – low level transmitter, high level transmitter – AM Receivers – TRF receivers, Superheterodyne receivers– Noise in AM systems.

FM transmitter - Direct and Indirect Method of Frequency Modulation – FM Superheterodyne Receiver–Effect of Noise in Angle Modulated Systems – Threshold Effect in FM system - Threshold Improvement - Pre-emphasis and De-emphasis Circuits – Frequency Modulation with Feedback(FMFB).

UNIT V

Analog Pulse Modulation

Sampling of Band Limited Low Pass Signals-Pulse Amplitude Modulation-Generation and Detection-Time Division Multiplexing-Pulse Time Modulation-Generation and Detection of PTM Signals-cross talk in PTM-Bandwidth of PTM signals-performance of pulse modulation systems.

TEXT BOOKS

1. R.P.Singh and S.D. Sapre," Communication Systems Analog and Digital", 2nd Edition, Tata McGraw- Hill Publishing,2007.
2. Kennedy G., Bernard Davis "Electronic Communication Systems", McGraw Hill, 5th Edn reprint, 2011.

REFERENCES

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.
2. Wayne Tomasi, "Electronic Communication Systems-Fundamentals Through Advanced",5th Edition, Pearson Education, 2004.
3. SimonHaykins,"Communication Systems", 4th Edition, John Wiley, 2007.
4. Taub and Schilling, "Principles of Communication Systems", 4th Edition McGraw Hill, 2013.
5. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" 2nd Edn, TMH, 2006.
6. B. Carlson, "Introduction to Communication Systems", 5th Edition, McGraw Hill, 2009.

COURSE OUTCOMES

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

1. Discuss principles of different analog modulation Techniques
2. Analyze and Design AM and FM modulation and Demodulation circuits.
3. Analyze the noise performance of AM and FM systems
4. Describe various pulse modulation techniques.
5. Design a prototype model of Transmitter and Receiver Circuits.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓					✓		✓				
CO2		✓	✓								✓	✓
CO3				✓			✓		✓			
CO4	✓	✓			✓				✓			
CO5			✓			✓						

ECPC406	**SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

The objectives of this course are

- To develop good understanding about signals, systems and their classification
- To provide with necessary tools and techniques to analyze electrical networks and systems
- To develop expertise in time-domain and frequency domain approaches to the analysis of continuous and discrete systems;
- To introduce to the basics of probability, random variables and the various
- distribution and density functions; and
- To develop students' ability to apply modern simulation software to system

UNIT I

Introduction to Signals and Systems

Signals and systems as seen in everyday life, and in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

UNIT II

LSI Systems

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift in variant systems. System representation through differential equations and difference equations.

UNIT III

Fourier Transform

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

UNIT IV

Laplace Transform and z-Transform

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.The *z*-Transform for discrete time signals and systems- eigen functions, region of convergence, *z*-domain analysis.

UNIT V

State-space Analysis and Sampling

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

TEXT BOOKS

1. P. Ramesh Babu and R.Anandanatarajan, “Signals and Systems”, 4th Edition, Scitech, 2011.
2. A.V.Oppenheim, A.S.Willsky and I.T.Young, "Signals and Systems", Prentice Hall, 1983.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

REFERENCES

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. Robert A.Gabel, Richard A.Roberts, "Signals and Linear Systems", John Wiley&Sons,1995.
3. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
4. J. Nagrath, S.N.Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Represent & classify signals, Systems & identify LTI systems
2. Find Fourier transform for different signals
3. Analyze the Continuous Time systems by performing Convolution
4. Understand Discrete-time systems and LTI systems.
5. Analyze DT systems & their realization using Z-transforms

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓							✓			✓	
CO2					✓				✓			
CO3		✓	✓	✓								✓
CO4	✓				✓		✓					
CO5		✓	✓			✓				✓		

ECCP407	**ANALOG CIRCUITS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

1. To design BJT and FET amplifiers and to study their frequency characteristics.
2. To design Oscillators using discrete components and using MultiSim software.

LIST OF EXPERIMENTS

1. Frequency response of BJT amplifier
2. Frequency response of FET amplifier
3. Design and analysis of Differential Amplifiers.
4. Design and analysis of feedback amplifier
5. Design of RC phase shift oscillator
6. Design of Class B power amplifier
7. Design of Single tuned amplifiers.
8. Design of Astable Multivibrator using transistors
9. Design of Schmitt trigger
10. Design and Simulation of Bistable multivibrator using MultiSim
11. Design and Simulation of Complementary Symmetry push pull amplifier using MultiSim
12. Design and Simulation of Hartley oscillator using MultiSim
13. Design and Simulation of Colpitt's oscillator using MultiSim

COURSE OUTCOMES

At the end of course students will

1. Design Oscillators and amplifiers using discrete components.
2. Able to use MultiSim software for design and analysis of electronic circuits.
3. To Design BJT and FET amplifiers and to study their frequency characteristics.
4. To design Oscillators using discrete components and using MultiSim software.

Mapping with Programme Outcomes(POs)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓						✓			✓	✓
CO2	✓			✓	✓					✓		
CO3		✓							✓			
CO4		✓	✓				✓					

ECCP408	**MICROPROCESSORS AND MICRO CONTROLLER LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

- To study programming concepts of micro controllers using assembly language program.
- To study programming concepts of microprocessors and controllers using assembly language program.
- To study various peripheral IC interfacing and programming.
- To study various programming concepts of arithmetic and logical operations.

LIST OF EXPERIMENTS

1. Simple programs for sorting given set of numbers in ascending and descending order.
2. Arithmetic operations using 8085 Microprocessor.
3. Arithmetic operations using 8086 Microprocessor.
4. Study of Programmable Peripheral Interface 8255
5. Study of Programmable Timer 8253
6. Study of Serial Data Transfer Using 8251 USART.
7. Study of Programmable Interrupt Controller 8259.
8. Waveform generation using two channel 8-bit DAC0800.
9. Interfacing 0809ADC to 8085 Processor.
10. Interfacing of Stepper Motor to 8085 Processor.
11. Study of 8051 microcontroller and interfacing Seven Segment LED Display
12. Study of 8097 microcontroller and interfacing DAC and ADC in 8097microcontroller
13. Study of Microcontroller PIC 16F877 and its applications
14. Code Conversion Programs using 8051 Controller.

COURSE OUTCOMES

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

1. Understand the instruction sets of 8085 and 8086 microprocessors and controllers to write assembly code for Data handling and arithmetic and logic operations.
2. Interface and Program various peripheral ICs.
3. Able to program microprocessor and Micro controllers for Real time applications.
4. Interfacing a external devices with microprocessors.
5. Design a simple applications with microprocessors and microcontrollers.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓											
CO2									✓			
CO3	✓				✓			✓		✓		
CO4	✓	✓		✓	✓				✓			
CO5		✓	✓		✓		✓	✓	✓		✓	✓

ECPC409	**ANALOG COMMUNICATION LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

- To investigate various analog modulation and demodulation circuits.
- To study and verify sampling theorem.
- To understand various pulse modulation techniques.
- To experimentally study characteristics of filter circuits.

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation.
2. DSB-SC Modulation and Demodulation.
3. SSB-SC Modulation and Demodulation.
4. Frequency Modulation and Demodulation.
5. Pre-emphasis and De-emphasis circuits.
6. Verification of Sampling Theorem.
7. Generation and Detection of PAM, PWM and PPM signals.
8. Time Division Multiplexing
9. Frequency Division Multiplexing.
10. Study of Receiver characteristics.
11. Study of Equalizer and attenuator.

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

1. Demonstrate various analog modulation and demodulation circuits.
2. Construct filter circuits for Receivers and able to analyze Receiver characteristics.
3. Demonstrate Various Pulse modulation and Demodulation circuits.
4. Design Internal circuits within transmitter and receiver.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓			✓		
CO2		✓	✓	✓					✓		✓	
CO3	✓					✓		✓				
CO4	✓				✓							✓

ECPC501	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The objectives of this course is

- To detail about different means of base band digital transmission.
- To familiarize the students about the types of digital band pass transmission.
- To provide basic knowledge about the use of various channel coding techniques.
- To illustrate the concepts of synchronization and Equalization techniques.
- To understand spread spectrum techniques.

UNIT I

Baseband Transmission and Reception

Block Diagram of Typical Digital Communication System – PCM – Uniform and Non Uniform Quantization, Companding – Baseband Transmission– DPCM –DM – ADM – Detection of Signals in Gaussian Noise – Matched Filter – BER of Binary Signalling – Inter Symbol Interference – Pulse Shaping to reduce ISI.

UNIT II

Bandpass Signalling

M-ary Signalling and Performance: ASK, FSK, PSK, DPSK, QPSK, QAM, MPSK, MFSK – Detection of Signals in Gaussian Noise – Coherent and Non Coherent Detection – Error Performance of Binary and M-ary systems.

UNIT III

Channel Coding

Convolution Encoding – Maximum Likelihood Decoding – Viterbi Decoding – Sequential Decoding – Reed Solomon Encoding and Decoding.

UNIT IV

Equalization and Synchronisation

Channel Characterization- Eye Pattern- Equalization Filter Types – Transversal, Decision Feedback, Preset and Adaptive Equalization – Filter Update Rate.

Receiver Synchronisation – Frequency, Phase, Symbol and Frame – Network Synchronisation –Open Loop and Closed Loop.

UNIT V

Spread Spectrum Techniques

Spread Spectrum - PN Sequences, Direct Sequence and Frequency Hopping Spread Spectrum Systems, Synchronisation in Spread Spectrum Techniques - Multiple Access Techniques – TDMA, FDMA, CDMA, SDMA.

TEXT BOOKS

1. Simon Haykin, "Digital Communications",4th Edition, John Wiley and Sons, 2016.
2. Bernard Sklar, "Digital Communication" 2nd Edition, Prentice Hall, Upper Saddle River, NJ, 2001.

REFERENCES

1. Taub and Schilling, "Principles of Communication systems", 4th Edition, Tata McGraw Hill Co. India, 2015.
2. Bruce Carlson, "Principles of Digital Communication", McGraw Hill 5th Edition 2009.
3. Ziemer R.F and Tramer W.H., "Principles of Communication", Jaico Publishing House 1st Edition, 2000.

COURSE OUTCOMES

At the end of the course students will be able to

1. Explain different means of base band and band pass digital transmission.
2. Apply various channel coding techniques for data transmission.
3. Illustrate the concepts of synchronization and Equalization techniques.
4. Understand spread spectrum techniques.
5. Design basic Encoder and decoder circuits.

Mapping with Programme Outcomes(Pos)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓			✓			✓			
CO2	✓	✓	✓	✓							✓	
CO3	✓	✓						✓				✓
CO4	✓	✓										
CO5				✓			✓			✓		

ECPC502	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study DFT and its computation
- To study the design structures of digital filters and Z-transform
- To study the design of Digital IIR filters
- To study the design of Digital FIR filters
- To study the fundamentals of digital signal processors.

UNIT I

Discrete Fourier Transform Discrete Signals and Systems

A Review – Introduction to Discrete Fourier transform (DFT) –Properties of DFT – Circular convolution – Comparison between Linear convolution and Circular convolution – Fast Convolution Procedures - Overlap-save method, Overlap-add method – Fast Fourier Transform (FFT): Decimation-in-time (DIT) algorithm – Decimation-in-frequency algorithm – FFT radix-2 DIT, DIF implementation — IDFT using Direct FFT Algorithm.

UNIT II

Design of Digital IIR Filters

Design of IIR filters: Analog filter approximation, Butterworth, Chebyshev and Elliptic filters – Frequency band transformation – Digital filter design equations low pass, high pass, bans pass and band stop – Impulse Invariant technique for IIR filter – Impulse Invariant pole mapping – Bilinear transformation – Bilinear transformation pole mapping.

UNIT III

Design of Digital FIR Filters Structure of FIR filters

Linear Phase FIR digital Filters – Minimizing design criteria (Fourier design technique) – Filter design using Windowing technique (Rectangular, Hamming, Hanning Window) – Kaisar Window.

UNIT IV

Digital Filter Structures Definition of digital filters

Properties of digital filters – Z transform - Definition –Properties – ROC – Transfer function – Poles and Zeros – Z-Transforms and Frequency response relationships – Inverse Z-Transform – Realization of digital filters- direct form- Transposed form – Canonic – Cascade- Parallel and Ladder form - Quantization noise introduced by analog-to-digital conversion – Finite register length effects in the realization of IIR and FIR digital filters and in DFT computation.

UNIT V

Digital Signal Processors Generic DSP Architecture

Architecture of TMS 320C5X and TEXAS 5416 processor – memory and I/O Organization – CPU –Program control – Addressing modes – Assembly Language Instructions – On chip peripherals – Clock, watch dog and real time Interrupt, event manager units – Interface units – Simple Programs.

TEXT BOOKS

1. Proakis J.G, Manolakis D.G, "Digital Processing" Principles, Algorithms and Applications, Fourth Edition, Prentice Hall of India, 2007.
2. Ramesh Babuand C Durai, "Digital Signal Processing", Laxmi Publications, 2005.

REFERENCES

1. Mitra S.K, "Digital Signal Processing – A computer Based Approach, Second Edition", Tata McGraw Hill, 2000.
2. Oppenheim A.Vand Schaffer R.W, "Digital Signal Processing", Prentice Hall 1st Edition 2015.
3. Johnson J.R, "Introduction to Digital Signal Processing" Prentice Hall of India, New Delhi, 1994.
4. Venkatramani. B and Bhaskar.M, "Digital Signal Processors", TMH, 2002.

COURSE OUTCOMES

The students will be able to understand the

1. Computation procedures for DFT using FFT algorithms
2. Analysis and design of FIR and IIR filters.
3. Finite word length effects in filter design
4. Fundamentals of digital signal processors
5. DSP Processor Architecture and Programming

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓	✓			✓						✓
CO2		✓		✓				✓				
CO3	✓									✓	✓	
CO4	✓				✓				✓			
CO5				✓			✓					

ECPC503	**VLSI DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

The course intends to provide an understanding of VLSI Design process and to bring both

system and circuit view on design together.

- To study the Characteristics of MOS, CMOS transistors.
- To learn transistor level CMOS logic design.
- To understand NMOS and CMOS fabrication process, design rules.
- It offers a profound understanding of principle of operation of various Analog circuits.
- To impart knowledge about designing digital circuits like adders and multipliers.

UNIT I

VLSI Design Concepts

Evolution of VLSI – VLSI Design Flow- Design Domains: Behavioral, Structural and Physical Design –VLSI Design Styles: Full Custom - Semi Custom Approaches.

MOS Devices and Circuits: MOS Structure- MOS Current Equation – Channel Length Modulation-Body Effect –MOSFET capacitances-CMOS Logic Design: Static Characteristics of CMOS Inverter, Dynamic Behavior of CMOS Inverter–Realization of logic functions in CMOS-Transistor Sizing.

UNIT II

VLSI Fabrication Techniques

An Overview of Wafer Fabrication, Wafer Processing – Oxidation – Patterning – Diffusion – Ion Implantation – Deposition – CMOS Processes – N-well, P-well- Twin Tub, Silicon on Insulator – CMOS Process Enhancements – Interconnects, Circuit elements-CMOS Latch Up and Prevention.

Design Rules-Need for Design Rules-CMOS Lambda Based Design Rules-Stick Diagram and Layout for CMOS Inverter.

UNIT III

Analog VLSI

Introduction to Analog VLSI - Analog Circuit Building Blocks – Switches-Active resistors - Current Sources and Sinks - Current mirrors/amplifiers –CMOS Inverting Amplifiers - CMOS Differential Amplifiers -CMOS Two Stage op-amp - Multipliers-Switched Capacitor Filter.

UNIT IV

Digital VLSI

Logic Design: Switch Logic and Gate Logic - Dynamic CMOS Logic - Structured Design Examples: Simple Combinational Logic and Clocked Sequential Design.

Sub-System Design: Design of Shifters, Design of Adders: Ripple Carry Adders, Carry Select Adder, Manchester Carry –Chain Adder, Carry Look- Ahead Adder, Design of Multipliers: Serial, Parallel and Pipelined Multiplier Arrays, Booth Multiplier, Wallace Tree Multiplier.

UNIT V

Programmable ASICs AND VHDL

Architecture and Programming technologies of CPLD and FPGA – VHDL - Hardware Modeling Issues –VHDL Code Structure: Library declaration, Entities and Architectures –Data Types- Operators-Concurrent and Sequential statements-Signals and Variables-Packages and Libraries - Introduction to Behavioral, Dataflow and Structural Modeling- Simple VHDL Code Examples.

TEXT BOOKS

1. Douglas A.Pucknell and Kamran Eshranghiaon. "Basic VLSI Design", Prentice Hall of India, New Delhi,Third Edition,2005.
2. Randall L.Geiger, Phillip E.Allen, NoelR.Strader", VLSI Design techniques for Analog and Digital Circuits",TataMcGraw Hill Edition 2010.
3. Bhaskar. J. "A VHDL Primer", PHI, 1999.

REFERENCES

1. Neil H.E.Weste,David Harris,Ayan Banerjee, "CMOSVLSI Design: A Circuits and Systems Perspective", Third Edition, Pearson Edition,2005.
2. John P. Uyemura "Introduction to VLSI Circuits and Systems", John wiley & Sons, inc, 2003.
3. Eugene D Fabricus., "Introduction to VLSI Design", McGraw Hill International edition.
4. Jan Rabaey, Anantha Chandrakasan, Borivoje Nikolic, " Digital Integrated Circuits: A Design Perspective", Pearson Second Edition, 2005.
5. Douglas Perry, "Circuit design with VHDL", McGraw Hill International, Third Edition, 1999.

COURSE OUTCOMES

Upon completion of the course the students will be able to

1. Describe a VLSI Design flow for any complex digital system
2. Design CMOS circuit to realize specific logic functions and draw their symbolic layouts
3. Analyze various sub-circuits used in analog IC
4. Design and analyze digital circuits like multipliers, adders
5. Describe architecture and programming technologies of FPGA and CPLD.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓					✓						
CO2	✓	✓		✓				✓		✓		
CO3			✓		✓							
CO4		✓							✓		✓	
CO5	✓	✓					✓					✓

ECPC504	**ELECTROMAGNETIC WAVES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the different types of Coordinate systems.
- To encapsulate the students with electric and Magnetic field terminologies.
- To make the students comprehend the various applications of Gauss law.
- To elucidate the different method of determining magnetic field occurring in a solenoid, toroid etc.
- To familiarize the various propagation techniques of waves and their polarization phenomenon.

UNIT I

Electrostatics

Introduction to co-ordinate system: Cartesian, Cylindrical and Spherical, Review of vector calculus, Coulomb's Law in Vector Form - Electric Field due to discrete charges - Electric field due to continuous charge distribution - Electric Scalar Potential-Relationship between potential and electric field -Gauss Law-gauss Divergence theorem- Laplace's and Poisson's equation

UNIT II

Magnetostatics and Time Varying Fields

The Biot-Savart Law - Magnetic Field intensity due to a finite and infinite wire carrying a current - Magnetic field intensity on the axis of a circular and rectangular loop carrying a current - Ampere's circuital law-Displacement current - Faraday's law -Modified form of Ampere's circuital law - Maxwell's equations in integral and differential form– Poynting Vector and pointing theorem.

UNIT III

Electromagnetic Waves

Derivation of Wave Equation - Uniform Plane Waves - Maxwell's equation in Phasor form - Wave equation in Phasor form - Plane waves in free space and in a homogenous material. Wave equation for a conducting medium - Plane waves in lossy dielectrics - Propagation in good conductors - Skin effect. Linear, Elliptical and circular polarization - Reflection of Plane Wave from a conductor-normal incidence - Reflection of Plane Waves by a perfect dielectric - normal and oblique incidence-Brewster angle.

UNIT IV

Transmission Lines

Transmission Lines- Equations of Voltage and Current on Ttansmission line – Propagation constant and characteristic impedance, and reflection coefficient and VSWR – Impedance Transformation on Loss-less and Low loss Transmission line – Power transfer on TX line – Smith Chart, Admittance Smith Chart – Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

UNIT V

Waveguides

Solutions of Wave Equations in Rectangular Coordinates – TE and TM Modes in Rectangular Waveguides – Impossibility of TEM Mode in Rectangular Waveguides-Excitation of Modes InRectangular Waveguides. Circular Waveguides: Solutions of Wave Equations in Circular Waveguides – TE, TM and TEM Modes in Circular Waveguides- Excitation of Modes in Circular Waveguides

TEXT BOOKS

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
3. William H Hayt & John Buck ,"Engineering Electromagnetics"5th edition, Tata McGraw Hill India, 2005.

REFERENCES

1. Narayana Rao, N: Engineering Electromagnetics, 3rd edition., Prentice Hall, 1997.
2. David Cheng, Electromagnetics, Prentice Hall.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL.
3. Use sections of transmission line sections for realizing circuit elements.
4. Calculate reflection and transmission of waves at media interface.
5. Understand principle of radiation and radiation characteristics of an antenna.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓					✓						✓
CO2		✓		✓				✓				
CO3			✓		✓					✓	✓	
CO4		✓			✓				✓			
CO5	✓			✓			✓					

ECCP507	**DIGITAL COMMUNICATION LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

The objectives of this course is

- To experimentally study various baseband and band pass digital modulations.
- To understand data coding and error control coding techniques.
- To use MATLAB software in simulation and performance analysis of digital modulation techniques

LIST OF EXPERIMENTS

1. Pulse Code modulation and demodulation.
2. Delta modulation and demodulation.
3. Adaptive Delta modulation.
4. Companding.
5. Sigma delta modulation and demodulation.
6. Time division multiplexing and Demultiplexing.
7. Data coding and decoding techniques for Return to Zero format and Multilevel Binary Format.
8. Data coding and decoding techniques for Phase Encoded Format.
9. ASK, FSK,PSK modulation and demodulation.

10. QPSK modulation and demodulation.
11. Synchronization techniques in PCM.
12. DPSK modulation and demodulation using MATLAB.
13. QAM modulation and demodulation using MATLAB.
14. Performance Analysis of ASK, FSK, PSK modulation schemes.
15. Error control coding techniques using MATLAB.

COURSE OUTCOMES

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

1. Demonstrate various digital base band and pass band modulation techniques.
2. Verify data coding and error control coding techniques.
3. Understand various synchronization techniques used in digital communication.
4. Use MATLAB software for the analysis and implementation of digital modulation techniques.

Mapping with Programme Outcomes(POs)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓					✓				
CO2	✓	✓				✓			✓		✓	
CO3	✓	✓					✓					✓
CO4		✓		✓	✓					✓		

ECCP508	**DIGITAL SIGNAL PROCESSING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

- To realize arithmetic, logical, data transfer and convolution operations on DSP processors using assembly code.
- To Design digital filters using DSP processors.
- To Develop simple algorithms for signal processing and test them using MATLAB.
- To analyze and design LTI-Digital systems using MATLAB.

LIST OF EXPERIMENTS

1. Perform the given Arithmetic Operations and Data Transfer using TMS320C50
2. Obtain the Linear and Circular Convolution using TMS320C50
3. Design of II R and FIR filter using TMS320C50
4. Waveform Generation Using TMS320C50
5. Perform the arithmetic and logical operations using TMS320C5416 and TMS320F6713.
6. Generation and Simple Operations of Signals Using MATLAB

7. Determine the Impulse Response and Step Response of a Causal LTI System
8. Frequency Response of First Order and Second Order System using MATLAB
9. Obtain the Convolution and Correlation of the given sequence using MATLAB
10. 10. Design of IIR Filters using MATLAB
11. Design of FIR using Windowing Techniques using MATLAB
12. Simple Operations on Images using MATLAB

COURSE OUTCOMES

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

1. Experiment concepts of Digital Signal processing and its applications using MATLAB.
2. Understand programming concepts of TMS320C50,TMS320C5416 and TMS320F6713 processors.
3. Develop digital filters using MATLAB and DSP processors.
4. Familiarize with the convolutional and correlation operations.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓		✓			✓				✓
CO2		✓			✓	✓	✓			✓	✓	
CO3		✓	✓		✓							
CO4				✓								

ECCP509	**VLSI DESIGN LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

The objectives of this course is

- To gain expertise in design, development and simulation of digital circuits with VHDL.
- To implement digital circuits on FPGA/CPLD devices.
- To analyse and implement basic circuits using Tanner tool.

LIST OF EXPERIMENTS

1. Study of Xilinx simulation and synthesis tool.
2. Design of unit adders and subtractors
3. Design and testing of parallel adder-subtractor.
4. Design and testing of BCD adder.
5. Design and testing of multiplexer and demultiplexer.
6. Design and testing of four bit magnitude comparator.
7. Design and testing of array multipliers.
8. Design and testing of flip-flops.
9. Design and testing of synchronous counters.
10. Design and testing of asynchronous counters.
11. Design and testing of scrambler and descrambler.

Experiments using TANNER tool

12. Functional verification of CMOS inverter.
13. Functional verification of CMOS universal logic gates.
14. Analysis of Differential amplifier.
15. Layout of CMOS inverter.

Tools: Xilinx software, Tanner tool

COURSE OUTCOMES

Upon completion of the course the student will be able to

1. Develop a architecture of digital circuit for various applications
2. Develop VHDL model for digital circuits.
3. Implement digital circuits on FPGA/CPLD devices.
4. Develop layout of CMOS logic gates.

Mapping with Programme Outcomes (POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓									
CO2			✓		✓							
CO3	✓									✓		
CO4			✓		✓							

ECPC601	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide a clear understanding on the basic concepts, Building Blocks of Embedded System.
- To teach the fundamentals of Embedded processor Modeling , Bus Communication in processors, Input/output interfacing
- To introduce on processor scheduling algorithms , Basics of Real time operating system

UNIT I

Introduction to Embedded Systems

Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods-memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock.

UNIT II

Embedded Networking and Interrupts Service Mechanism

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS485 –USB – Inter Integrated Circuits (I2C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism- Introduction to Basic Concept Device Drivers

UNIT III

High Performance RISC Architecture – ARM

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 .

UNIT IV

Software Development Tools

Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design. Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram-Modeling techniques - structural, Behavioral, Activity Diagrams.

UNIT V

RTOS Based Embedded System Design

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication- shared memory, message passing, Comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, RT Linux.

TEXT BOOKS

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.
2. Peckol, "Embedded System Design", John Wiley & Sons, 2010.
3. ARM System-on-Chip Architecture,Second Edition, by Steve Furber,PEARSON, 2013

REFERENCES

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2009
3. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
4. EliciaWhite,"Making Embedded Systems",O'Reilly Series,SPD,2011
5. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006

COURSE OUTCOMES

1. Describe the differences between the general computing system and the embedded system.
2. Foster ability to understand the role of embedded systems in industry.
3. Understand and develop programming using ARM processor.
4. Understand the concepts of Software Development Tool and Programming
5. Design real time embedded systems using the concepts of RTOS.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							
CO2	✓		✓									
CO3	✓											
CO4	✓		✓	✓					✓		✓	✓
CO5	✓	✓					✓					

ECPC602	DATA COMMUNICATION AND NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the concept of data communication and data coding techniques.
- To comprehend the use of different types of digital data interfaces and modems.
- To understand the concept of network architecture and protocols
- To understand the division of network functionalities into layers.
- To be familiar with the components required to build different types of networks.
- To be exposed to the required functionality at each layer
- To learn the flow control and congestion control algorithms

UNIT I

Basic Concepts

Introduction – Data communication system – Data communication links: Point- to - Point- Multipoint-Topology- Digital data transmission – Digital data rates – Serial and Parallel data formats – Encoded data formats – OSI model – Protocols and Standards – Transmission modes – Categories of network.

UNIT II

Digital Data Interfaces and Modems

Interconnection devices - Inter connection issues - DTE – DCE interface – Other interface standards – Network Interface Cards - MODEMS – Cable modem – Unguided media – Transmission impairments performance- Interconnection of LANS- IEEE 802.6 man – X.25 packet switched protocols – ATM, Frame relay – IEEE 802.11 wireless LANS using CSMA/CD.

UNIT III

Data Link Layer

Logical link control Functions: - Framing, Flow control, Error control: CRC, LLC protocols: - HDLC. Medium access layer:- The Channel Allocation Problem, Multiple Access Protocols, Data link layer: Design issues – Service primitives – Stop and Wait - Sliding window protocols –Go-back N- Selective repeat protocols.

UNIT IV

Network and Transport Layers

Network layer: Design issues - Routing algorithm - Congestion control algorithms internetworking. Quality of Service. Transport layer: Design issues - The Transport Service - Elements of transport protocol- Connection management - Performance Issues.

UNIT V

Session, Presentation and Application Layers

Session Layer: Design issues - Remote procedure call – Abstract syntax notation - Presentation Layer: Design issues - Data compression techniques - cryptography - Application Layer: DNS-(Domain Name System) - File Transfer, Access and Management -Electronic mail - Virtual Terminal - World Wide Web.

TEXT BOOKS

1. Behrouz A. Forouzan, “Data Communication and Networking”, Tata McGraw Hill, New Delhi, Second Edition, 2006.
2. Andrew S. Tanenbaum. "Computer Networks", 5th Edition, Prentice Hall of India, 2011.

REFERENCES

1. William.A.Shay, “Understanding Data Communication Networks”, Books/Cole Thomson Learning, Singapore, First Edition, 2001.
2. William Stalling, “Data and Computer Communication”, PHI, New Delhi, Fifth Edition, 2001.
3. Schwartz M., "Computer Communication", McGraw Hill, 2002.
4. Gerd E. Keiser," Local Area Networks", McGraw Hill Publication, 2nd edition, 2002.
5. Bertsekas D. and Gallagher R., "Data networks, 2nd Edition, Prentice Hall of India, 2004

COURSE OUTCOMES

1. Have a good understanding of the data communication system and modes of transmission.
2. Have a basic knowledge of the use of digital data interfaces.
3. Have a working knowledge of network architecture and protocols.
4. Identify the components required to build different types of networks.
5. Choose the required functionality at each layer for given application.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓							✓		
CO2	✓	✓				✓		✓				
CO3	✓	✓	✓				✓					
CO4	✓	✓	✓	✓					✓		✓	
CO5	✓				✓							✓

ECCP607	EMBEDDED SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

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

COURSE OUTCOMES

On completion of the course, students will be able to

1. Write programs in ARM for a specific Application
2. Interface memory and Write programs related to memory operations
3. Interface A/D and D/A convertors with ARM system
4. Write programs for interfacing keyboard, display, motor and sensor.
5. Formulate a mini project using embedded system.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							
CO2	✓	✓						✓		✓		
CO3	✓	✓	✓			✓					✓	
CO4		✓	✓									✓
CO5	✓	✓	✓	✓						✓		

ECCP608	DATA COMMUNICATION AND NETWORKS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

The objectives of this course is

- To explain about basic network components and devices in a network
- To find out performance of different wired LAN protocols
- To analyze wireless LAN protocol
- To use different algorithms for finding out shortest path between any nodes

LIST OF EXPERIMENTS

1. Demonstration of network devices and crimping of Ethernet cable.
2. Performance Study of ALOHA protocol for packet communication between nodes in a network.
3. Performance Study of CSMA protocol for data communication between nodes in a network.
4. Performance Study of CSMA – CD protocol for data communication between nodes in a network.
5. Performance Study of Token Bus access method in a bus network.
6. Performance Study of Token Ring access method in a ring network.
7. Performance Study of Stop-and-Wait and Go-back N protocol for data transfer between two nodes in a network.
8. WLAN realization and throughput measurement.
9. Simulation of shortest path between any two nodes using Distance Vector Routing Protocol and Link State Routing Protocol.

COURSE OUTCOMES

On completion of the course, students will be able to

1. Understand fundamental underlying principles of computer networking devices.
2. Implement basic wired LAN protocol such as ALOHA in a network and find its performance.
3. Implement IEEE standard protocols for wired LAN such as IEEE 802.3, 802.4 and 802.5 and find its performance.
4. Implement wireless LAN protocol in a network and find its performance.
5. Understand the algorithm for finding shortest path between any two nodes in a network.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓			✓	✓		✓			
CO2	✓	✓	✓	✓							✓	
CO3	✓	✓					✓	✓		✓		✓
CO4	✓	✓										
CO5		✓					✓					

ETHS701	ENGINEERING ETHICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

The objectives of this course is

- To understand the moral and ethical dimensions in engineering
- To take balanced decisions.
- To understand the ethical problems and principles through theory, historical case studies and research and presentation.
- To allow students to explore the relationship between ethics and engineering
- To apply classical moral theory and decision making to engineering issues encountered in academic and professional careers

UNIT I

Moral Reasoning and Ethical Theories

Senses of Engineering Ethics – Verity of Moral Issues – Types of Inquiry – Moral Dilemmas -Moral Autonomy – Kohlberg's Theory - Gilligan's Theory – Consensus and Controversy – Professions and Professionalism – Professional Ideas And Virtues - Uses of Ethical Theories.

UNIT II

Engineering as Social Experimentation

Engineering As Experimentation - Engineering As Responsible Experiments – Research Ethics – Code of Ethics – Industrial Standards - A Balanced Outlook Law-The Challenger Case Study.

UNIT III

Engineer Responsibility for Safety

Safety And Risk - Assessment of Safety And Risk – Risk Benefit Analysis - - Red fucing Risk – The Government Regulator's Approach to Risk – Chernobyl Case Studies and Bhopal

UNIT IV

Responsibility and Rights

Collegiality and Loyalty - Respect for Authority – Collective Bargaining – Confidently – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V

Global Issues

Multinational Corporation - Business Ethics – Environmental Ethics – Computer Ethics – Role in Technological Development - Weapons Developments – Engineering as Managers – Consulting Engineers - Engineers as Expert Witness and Advisors – Honesty – Moral Leadership - Sample Code of Conduct.

TEXT BOOKS

1. Govindarajan, M, Natarajan.S. and Senthilkumar .V S. " Professional Ethics And Human Values." PHI Learning , New Delhi, 2013.
2. Mike Mertin and Roland Schinzinger, "Ethics Engineering ", McGraw Hill, New York, - 4th Edition,2005.

REFERENCES

1. Charles E Harries, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases," Thompson Learning, 4th Edition,2004
2. Charles D Fleddermann, " Engineering Ethics ," Prentice Hall, New Mexico,1999
3. John R Boatright, " Ethics and the Conduct of Business," Pearson Education,-2003
4. Edmund G Seebauer and Robert L Barry," Fundamentals of Ethics for Scientists and Engineers.' Oxford University Press , 2001
5. David Ermann and Michele S Shauf," Computers, Ethics and Society," Oxford University Press, Third Edition2003.

COURSE OUTCOMES

At the end of the course, the student will able to

1. Understand the relationship between the Engineer and the Society.
2. Learn the importance of codes in engineering practice.
3. Acquire knowledge on the legal, moral and ethical aspects in Engineering.
4. Understand the moral and ethical dimensions in engineering.
5. Knowledge about Multinational Corporation.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓		✓	✓					✓
CO2	✓					✓		✓		✓		
CO3	✓		✓				✓			✓		✓
CO4	✓				✓						✓	
CO5		✓					✓		✓			

ECPC702	**MICROWAVE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

The objectives of this course is

- To impart the essential knowledge to the students to learn about the Microwave generators working with different kinds of Microwave Components.
- To enhance the students proficiency about microwave solid state devices and deriving scattering matrix.
- To provide sufficient Information about Noise analysis in Microwave Engineering.
- To accomplish a thorough idea about direct and indirect Microwave parameter measurements.

UNIT I

Microwave Network Analysis

Impedance and Admittance Matrices Scattering Parameter, Properties of S-Matrix, Shifting of Reference Plane in Two Port Network, Losses in Microwave Circuits- Insertion Loss, Transmission Loss, Return Loss, Reflection Loss, Conversion Between ABCD And S Parameter, S- Matrix of Some Two Port Networks-Multi Port Networks.

UNIT II

Microwave Linear Beam Tubes

Construction - Operation of Two Cavity Klystron Amplifier- Power Output and Efficiency Consideration-Multi Cavity Klystron Amplifier -Single Cavity Reflex Klystron Oscillator- Mode Characteristics - Power Output and Efficiency Consideration-Slow Wave Structure-Travelling Wave Tube (TWT)-Comparison of TWT and Klystron-Backward Wave Oscillator (BWO).

UNIT III

Microwave Crossed-Field Tube and Solid State Devices

Construction – Operation of Magnetron Oscillator, Hull Cut-Off Condition - Principles of Gunn Effect, Operation of Gunn Diode Oscillator and its Applications - Principles and Operation of IMPATT, TRAPATT, Parametric Amplifier.

UNIT IV

Microwave Devices

Active Devices – Pi Equivalent Model of Radio Frequency Junction Transistors and Field Effect Transistors – Degeneration Circuits – Current Sinks -Micro Wave Hybrid Tees, E-Plane, H-Plane, E-H Plane Tees and its Application-Hybrid Ring-Directional Coupler – Attenuators-Phase Changers-Matched Termination-Corner, Bend, Twister-Slotted Section - Microwave Propagation in Ferrites, Faraday Rotation, Ferrite Devices, Gyrator, Isolator and Circulator.

UNIT V

Microwave Measurements

Measurement of Voltage Stranding Wave Ratio, Double – Minimum Method - Measurement of Frequency, Wave Length, Attenuation, Power, Impedance-Measurement of Antenna Radiation Pattern- Measurement of Antenna Gain-Measurement of Beam Width – VSWR

TEXT BOOKS

1. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd Edition, PHI, 2005.
2. Kulkarni. M, “Microwave and Radar Engineering”3rd Edition, Umesh Publications, 2008.

REFERENCES

1. David, Pozar. M, “Microwave Engineering”, 4thEditionInc., John Wiley and Sons, 2008.
2. Collins. R.E., “Foundation of Microwave Engineering”, McGraw Hill, 3rd Edition 2005.
3. Annapurna das, “Microwave Engineering”, TMH, 2nddEdition 2006.
4. Sharma, K.K., “Fundamental of Micro and Radar Engineering”, S. Chand & Co New Delhi, 2011.

5. Herbert Reich. J., Skolnik. J.G., Ordung. P.F. and Krauss. H.L., "Microwave Principles", Distributors, C.B.S Publishers- New Delhi -2004.

COURSE OUTCOMES

At the end of the course, the student will able to

1. Understand the working principles of Microwave Solid and Non solid state devices.
2. Analysis of the characteristics and behavior of Microwave Networks and components.
3. Analyze about Measurement concepts in Microwave Engineering.
4. To provide sufficient Information about Noise analysis in Microwave Engineering.
5. To accomplish a thorough idea about direct and indirect Microwave parameter measurements.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓				✓	✓		
CO2	✓	✓					✓	✓	✓			
CO3	✓			✓								
CO4	✓					✓					✓	
CO5			✓									✓

ECCP706	MICROWAVE ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To Study the characteristics of microwave sources and microwave components.
- To Study the radiation characteristics of Horn and parabolic antennas.
- To study microwave measurements.

LIST OF EXPERIMENTS

1. Study of Microwave Components
2. VI Characteristics and Frequency Response of Gunn Oscillator
3. Mode Characteristics of Reflex Klystron Oscillator
4. Measurement of Attenuation, VSWR, Wave Length and Operating Frequency using Microwave Test bench
5. Characteristics of E, H and Magic Tee Plane using Microwave Test bench
6. Characteristics of Circulator using Reflex Klystron Oscillator
7. Measurement of Radiation Characteristics of Horn.
8. Measurement of Radiation Characteristics of Parabolic antenna

9. Characteristics of Directional Coupler 3dB and 20dB using Microwave Test bench
10. Measurement of Unknown Impedance of Pyramidal Antenna using Gunn oscillator
11. Measurement of Dielectric Constant for the given solid using Microwave Test bench.

COURSE OUTCOMES

At the end of the course students will be able to

1. Demonstrate characteristics of Microwave sources and components.
2. Analyze radiation pattern for Microwave antennas.
3. Measure Unknown impedance, Microwave power, attenuation and VSWR using appropriate bench setup.
4. Analyze the radiation characteristics of Horn and parabolic antennas.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓			✓			✓				
CO2		✓	✓									✓
CO3	✓	✓			✓							
CO4	✓			✓			✓					

ECPV803	PROJECT WORK AND VIVA-VOCE	L	PR	S	C
		0	10	2	06

COURSE OBJECTIVES

- To attempt the solution to the problem by analytical/simulation/experimental methods and validate with proper justification.
- To carry out thesis work which is an integral part of the thesis consisting of problem statement, literature review, thesis overview and scheme of implementation.

METHOD OF EVALUATION

- The student undergoes literature survey and identifies the topic of thesis and finalizes in consultation with Guide/Supervisor and prepare a comprehensive thesis report after completing the work to the satisfaction of the supervisor.
- The progress of the thesis is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.
- A thesis report is required at the end of the semester.
- The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

1. Review quality of Literature survey and Novelty in the problem
2. Assess clarity of Problem definition and Feasibility of problem solution
3. Validate the relevance to the specialization
4. Acquire Knowledge on the clarity of objective and scope
5. Improve the quality of Written and Oral Presentation

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓		✓						✓	
CO2	✓	✓	✓	✓	✓						✓	✓
CO3	✓	✓			✓	✓					✓	✓
CO4	✓	✓	✓				✓	✓		✓	✓	✓
CO5	✓	✓	✓		✓			✓			✓	✓

PROFESSIONAL ELECTIVES

ECPESCN	INFORMATION THEORY AND CODING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce to the students, the concept of information and entropy of Information.
- To understand the mathematical foundation of compression.
- To acquire Knowledge in error control and security of information.

UNIT I

Information Theory Basics

Information-Measure of information-Information rate-Entropy- Entropy of symbols- Continuous and discrete messages-Joint and conditional Entropies- Basic relationship among different entropy.

UNIT II

Mutual Information and Coding Theorem

Entropy for Discrete Ensembles– Properties of Entropy of a Binary memory less source – Extension of a binary memory less source – Source Coding Theorem – Shannon Fanon coding - Huffman Coding-Uniquely detectable codes.

UNIT III

Shannon's and Channel Coding Theorem

Channel Representations-Binary symmetric channel –Binary erasure Channel-Markov Sources- Shannon noisy and noiseless coding theorem – Properties – Channel capacity –Shannon Hartley Law –Channel coding theorem - Lempel-Ziv coding.

UNIT IV

Linear and Cyclic Codes

Linear block Codes – Generator matrices – Parity check matrices – Encoder – Syndrome and error correction – Minimum distance –Error correction and Error detection capabilities – Cyclic codes.

UNIT V

Other Coding Techniques

Convolution codes – Encoder – Generator matrix – Generator Polynomial-State diagram – Distance properties - Maximum likelihood decoding – Viterbi decoding – Sequential decoding –Hadamard matrices and Hadamard codes – BCH codes – Description, decoding – Reed Solomon code.

TEXT BOOKS

1. Ranjan Bose – Information Theory, Coding, and Cryptography – McGraw Hill, India – 2008 (2nd Edition) – ISBN: 9780070669017.
2. Das, S.K.Mullick, P.K.Chatterjee, "Principles of Digital Communication", Wiley Easter Limited, 1986.
3. N.Abramson, Information and Coding, McGraw Hill,1963.

REFERENCES

1. Thomas M. Cover, Joy A. Thomas - Elements of Information Theory – Wiley, and India – 2nd Edition – ISBN: 9788126541942.
2. Shu Lin and D.J.CostelloJr.Error Control Coding, Prentice Hall, 1983.
3. M.Mansurpur, Introduction to Information theory, McGraw Hill, 1987.
4. R.B.Ash,InformationTheory,Prentice Hall,1970.

COURSE OUTCOMES

At the end of the course, the student will demonstrate the ability to:

1. Understand the Concept of Information and Entropy.
2. Understand Shannon's Theorem for Coding.
3. Calculation of Channel Capacity.
4. Apply Coding Techniques.
5. Illustrate Various Coding Techniques.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓					✓					
CO2		✓	✓					✓				
CO3	✓			✓					✓			
CO4			✓	✓							✓	
CO5				✓	✓							✓

ECPESCN	ANTENNAS AND PROPAGATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To give insight to fundamentals of antenna
- To provide complete understanding about the characteristics of different antenna
- types and antenna arrays
- To enrich knowledge about the present day technologies in the field of antenna
- To introduce printed antenna and its design
- To provide information advancement in antennas particularly smart antennas

UNIT I

Antenna Fundamentals

Fundamental Concepts- Physical concept of radiation-Radiation pattern-near- and far-field regions-reciprocity-directivity and gain- effective aperture-polarization- input impedance- efficiency-Friis transmission equation-radiation integrals and auxiliary potential functions

UNTI II

Wire Antenna and Aperture Antennas

Radiation from Wires and Loops- Infinitesimal dipole-finite-length dipole-linear elements near Conductors-dipoles for mobile communication-small circular loop-Aperture and Reflector Antennas-Huygens' principle-radiation from rectangular and circular apertures-design considerations-Babinet's principle-Radiation from sectorial and pyramidal horns-design concepts- prime-focus parabolic reflector and case grain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas-frequency independent antennas-broadcast antennas.

UNIT III

Antenna Arrays

Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation Amplitudes-extension to planar arrays- synthesis of antenna arrays using Schelkun off polynomial method- Woodward-Lawson method.

UNIT IV

Special Purpose Antennas

Loop Antennas, Folded Dipoles, Travelling Wave Antennas, V And Rhombic Antennas, Horn Antennas, Reflector Antennas, Parasitic Elements And Yagi Arrays, Wideband Antennas, Log Periodic Antennas. Babinet's Principle - Slot Radiators, Parabolic Reflectors - Radiation Pattern, Aperture Distributions and Efficiencies - Feeding Techniques for Parabolic Antennas.

UNIT V

Microstrip Antenna

Micro strip Antennas- Basic characteristics of micro strip antennas-feeding methods- methods of analysis-design of rectangular and circular patch antennas

TEXT BOOKS

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982

REFERENCES

1. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
2. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
4. R.E. Crompton, Adaptive Antennas, John Wiley

COURSE OUTCOMES

Completing the course students will be able to

1. Explain the various antenna parameters
2. Describe about different types of antenna and their radiation characteristics
3. Analyze and design Microstrip antenna and antenna arrays
4. Design antenna arrays using various synthesis technique
5. Provide an alternative to traditional antena design through smart antennas.

Mapping with Programme Outcomes(POs)												
Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓			✓			
CO2	✓											
CO3		✓		✓				✓			✓	
CO4			✓		✓							
CO5	✓						✓			✓		✓

ECPESCN	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Modeling of translational and rotational system, block diagram reduction techniques and
- Signal flow graph for obtaining transfer function.
- Transient analysis of various standard inputs for first order and second order system.
- Frequency response analysis and frequency domain specification by bode plot and polar plot.
- Stability analysis by Routh -Hurwitz criterion and Nyquist stability criterion.
- State space analysis (writing state equation for physical, phase, canonical variables.)
- Concept of controllability and observability.

UNIT I

System Modelling

Introduction to Control System -Basic Elements in Control Systems - Open Loop and Closed Loop Systems - Differential Equation Representation of Physical Systems - Transfer Function – Mathematical Modeling of Electrical and Mechanical Systems (Translational and Rotational Systems)-Block Diagram Representation of a System - Block Diagram Reduction Techniques - Signal Flow Graph.

UNIT II

Time Domain Analysis

Standard Test Signals - Analysis of I Order and II Order Systems - Time Domain Specifications - Steady State Error - Generalized Error Co-Efficients – Effect of Adding Zero to System-P, PI, PD, and PID Compensation-Stability Analysis - Routh Hurwitz Criterion - Nyquist Stability Criterion -Root Locus Technique.

UNIT III

Frequency Domain Analysis

Frequency Response - Frequency Domain Specifications –Correlation Between Frequency and Time Domain Specifications- Gain and Phase Margin-Bode Plot – Polar Plot -Constant M and N Circles -Nichols Chart-Series and Parallel Compensators-Lead, Lag, Lead and Lag Compensators.

UNIT IV

Digital Control Systems

Introduction - Basic Digital Control System - Sampling - Sample And Hold Circuits –Open and Closed Loop Sampled Data System- Discrete Time Signal - Linear Discrete Time Signal - Pulse Transfer Functions - Z Transform Analysis Sampled Data Control Systems -Stability Analysis - Jury's Stability Criterion.

UNIT V

State Space Analysis

Introduction - State Space Formulation - State Space Representation of Continuous and Discrete Time Systems - State Diagram - State Space Representation Using Physical, Phase and Canonical Variables –Diagonal Canonical Form-Jordon Canonical Form Diagonalization- Concept of Controllability and Observability.

TEXT BOOKS

1. Nagrath J.and Gopal M.,"Control system engineering", New Age International (p) Ltd., 5th Edition, 2008.
2. Kuo B.C., "Digital control systems",2nd Edition, Oxford University Press, 2002.

REFERENCES

1. Ogata K., "Modern control engineering", 5thEdition, Prentice Hall, 2010.
2. Gopal M., "Digital control and state variable methods", Tata McGraw-Hill Education, 2003.
3. R.Anandhanatarajan, P.Rameshbabu "Control system engineering, SciTech Publication Pvt Ltd., 2013.
4. Kuo B.C., "Automatic control systems",John Wiley,9th Edition - 2003.

COURSE OUTCOMES

After completion of the subject, students able to get a knowledge in various aspects of

1. Mathematical models for such electrical and mechanical systems
2. Equivalent state space model for given system
3. Time and Frequency domain analysis with response to test inputs
4. Analysis of sampled data control system using Z-transform.
5. Stability analysis by Routh -Hurwitz criterion and Nyquist stability criterion.

Mapping with Programme Outcomes(POs)												
Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓				✓		✓					
CO2	✓					✓			✓			✓
CO3		✓		✓					✓	✓		
CO4											✓	
CO5	✓		✓					✓				

ECPESCN	BIOMEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

COUSE OBJECTIVES

The student should be made to

- Learn the working of human body starting from Cells.
- Exposed to electrical and non-electrical physiological measurements and bio amplifiers
- Know the principle, design and application of various human assist devicesand aids

UNIT I

Introduction to Human Physiology

Brief introduction to human physiology – Structure of cell, function of each components of the cell – Anatomy of human heart, Cardiac cycle, ECG – Anatomy and physiological aspects of respiration – Anatomy and physiological aspects of GI System, Digestion and absorption – Anatomy of human kidney.

UNIT II

Biomedical transducers

Biomedical transducers: displacement,velocity, force,acceleration, flow, temperature, potential, dissolved ions and gases.

UNIT III

Bio-Potential Amplifiers

Bio-electrodes – Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, Need for bio-amplifier - bio-potential amplifiers for ECG, EMG, EEG &etc

UNIT IV

Measurement of non-electrical parameters

Measurement of blood temperature, pressure and flow Impedanceplethysmography Ultrasonic, Xrayand nuclear imaging.

UNIT V

Prosthetic Equipment

Prostheses and aids: pacemakers, defibrillators, heart-lung machine,artificialkidney, Hand and arm replacement – limb prosthesis – Visual Aids – Hearing and speech aids - Safety aspects.

TEXT BOOKS

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. Arthur.C.Guyton, “Medical Physiology” Prism Book Pvt. Ltd.1996.
3. R. Ananda Natarajan,”Biomedical Instrumentation and Measurements”,second edition,Prentice hall of India,1995.

REFERENCES

1. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.
2. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor &Francics ,CRC Press, 2006.
3. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Understand the functioning of human body
2. Understand the application of the electronic systems in biological and medical applications.
3. Understand the practical limitations on the electronic components while handling biosubstances.
4. Understand and analyze the biological processes like other electronic processes.
5. Understand the role and importance of assist devices and the importance of rehabilitation and related aspects.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							
CO2	✓			✓		✓		✓			✓	
CO3							✓			✓		
CO4	✓	✓		✓								
CO5			✓		✓						✓	✓

ECPESCN	ELECTRONIC MEASUREMENTS AND INSTRUMENTATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the basic functional elements of instrumentation and the fundamentals of electronic instruments
- To introduce To educate on the comparison between various measurement techniques
- To introduce various recorders, transducers and the data acquisition systems
- To understand the fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, Function Generator and Analyzer, Display devices, Data acquisition systems and transducers.

UNIT I

Block Schematics of Measuring Systems

Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC

Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT II

Transducers

Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchronous, Special Resistance Thermometers, Digital Temperatue sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

UNIT III

Bridges

Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge. Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure - High Pressure, Vacuum level, Temperature - Measurements, Data Acquisition Systems.

UNIT IV

Oscilloscopes

CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications - Special Purpose Oscilloscopes **-** Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT V

Signal Analyzers and Generators

AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal - AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator, Video Signal Generators, and Specifications

TEXT BOOKS

1. H.S.Kalsi, “Electronic instrumentation”, TMH, 2nd Edition 2004.
2. A.D. Helbincs, W.D. Cooper ,”Modern Electronic Instrumentation and Measurement Techniques”, PHI, 5th Edition, 2003.

REFERENCES

1. David A. Bell, “Electronic Instrumentation and Measurements”, Oxford Uiv. Press, 1997.
2. B. M. Oliver, J. M. Cage,”Electronic Measurements and Instrumentation” TMH Reprint.
3. Emest O. Doebelin and Dhanesh N Manik, “Measurement Systems” - 6th Ed., TMH.
4. K. Lal Kishore, “Electronic Measurements and Instrumentations” by Pearson Education ,2010.
5. T. R. Padmanabham ,“Industrial Instrumentation”, Springer 2009.

COURSE OUTCOMES

Upon a successful completion of this course, the student will be able to:

1. Describe the fundamental concepts and principles of instrumentation and apply the measurement techniques for different types of tests.
2. Able to select specific instrument for specific measurement function and Understand principle of operation, working of different electronic instruments like digital multi meter, vector voltmeter.
3. Learners will apply knowledge of different oscilloscopes like CRO, DSO. Students will understand functioning, specification, and applications of signal analyzing instrument
4. Acquire knowledge of display instruments, amplifier measurements and CRO Distinguish recorders, transducers, data acquisition systems and display devices. frequency and period measurements.
5. Select the instrument to be used based on the requirements and Understand and analyze different signal generators and analyzers and the design of oscilloscopes for different applications.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					
CO2	✓											
CO3	✓	✓		✓								
CO4					✓				✓			
CO5	✓		✓					✓				✓

ECPESCN	FIBER OPTIC COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Be familiar with the operating principles of fiber optics and its characteristics.
- Describe modulation, multiplexing and de multiplexing in fiber optic systems.
- Perform noise and error analysis on fiber optic communication systems

UNIT I

Overview of Optical fiber Communications

Historical Background of Optical Communication, Electromagnetic spectrum, Optical Spectral bands, Evolution of fiber optic system, Multiplexing Techniques, Advantages & Applications of OFC, Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

UNIT II

Optical fibers : Structures, Wave guiding and Fabrication

Different types of optical fibers, Comparison of Optical fiber Communication Systems With other Communication System, Optical laws and definitions, optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers ,single mode and graded index fibers, Derivation for numerical aperture, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT III

Optical Sources and Detectors

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, fiber-to-fiber joints, LED coupling to single mode fibers, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

UNIT IV

Advances and Overview of Optical Components

Nonlinear effects in fiber optic links. Optical couplers, Tunable sources and Filters, optical MUX/DEMUX Concept of self-phase modulation, group velocity dispersion and solution based communication.

UNIT V

Optical Amplifiers

Optical amplifiers - EDFA, Raman amplifier. Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers, WDM and DWDM systems. Principles of WDM networks.

TEXT BOOKS

1. J. Kaisar, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. Rajiv Ramaswami, Kumar N. Sivarajan, Optical Networks: A Practical Perspective (The Morgan Kaufmann Series in Networking), Second Edition, 20 Oct 2001
3. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

REFERENCES

1. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
2. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997 F.C.
3. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).
4. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
5. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979

COURSE OUTCOMES

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors
4. Analyze system performance of optical communication systems
5. Design optical networks and understand non-linear effects in optical fibers.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					
CO2		✓		✓						✓		
CO3			✓		✓						✓	
CO4					✓	✓						✓
CO5				✓				✓				

ECPESCN	DIGITAL IMAGE AND VIDEO PROCESSING	L	T	P	C
		3	0	0	2

COURSE OBJECTIVE

- To comprehend the image processing fundamentals and enhancement techniques in spatial and frequency domain.
- To understand the various image processing techniques.
- To study the various image segmentation and morphology operations.
- To comprehend the basics of video processing and video coding**.**

UNIT I

Fundamentals of Image processing and Image Transforms

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms

UNIT II

Image Processing Techniques

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters,Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain,image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation

UNIT III

Wavelets and Multi-resolution image processing

Uncertainty principles of Fourier Transform, Time frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

UNIT IV

Basic Steps of Video Processing

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation ,Photometric Image formation, sampling of video signals, filtering operations

UNIT V

2-D Motion Estimation

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOKS

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2. S. Jayaraman, S. Esakkirajan and T.Veerakumar ," Digital Image Processing", Tata McGraw-Hill Education ,2009.

REFERENCES

1. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication",1st edition , PHI.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding.
4. Analyze the various image segmentation and morphology operations.
5. Work behind the basics of video processing and video coding**.**

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓				✓							
CO2	✓							✓		✓		
CO3	✓		✓									
CO4		✓				✓						
CO5	✓			✓	✓		✓					✓

ECPESCN	MIXED SIGNAL DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand discrete-time signal processing, analog integrated continuous- time and discrete-time (switched-capacitor) filters
- To have the knowledge of ADCs, DACs, Mixed-Signal layout and Interconnects
- To provide students knowledge and experience for mixed-signal IC design
- To develop the necessary framework and tools to analyze and design such systems

UNIT I

Basics

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

UNIT II

Switched-capacitor filters

Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

UNIT III

Data Converters

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

UNIT IV

Signalling Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

UNIT V

Frequency Synthesizers and PLL

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

TEXT BOOKS

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.

REFERENCES

1. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
2. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.

3. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
4. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Understand analog and discrete-time signal processing
2. Design analog integrated continuous- time and discrete-time (switched-capacitor) filters
3. Understand the practical situations where mixed signal analysis is required
4. Analyze and handle the inter-conversions between signals
5. Design systems involving mixed signals.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓	✓	✓				✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓			✓	✓			
CO4	✓	✓		✓	✓			✓	✓			
CO5	✓	✓	✓		✓			✓	✓	✓	✓	

ECPESCN	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide the basis for new computing paradigms that challenges many of the classical approaches to developing distributed and networking systems
- To learn the different types of MAC protocols
- To understand the architecture and protocols of wireless sensor networks
- To learn the architecture and its design constraints

UNIT I

Basics

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

UNIT II

MANETs

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

UNIT III

WSN Protocols

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT IV

WSN Design

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

UNIT V

WSN Operating Systems

Single-Node architecture, Hardware components and design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

TEXT BOOKS

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004

REFERENCES

1. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
2. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

COURSE OUTCOMES

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

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Be familiar with different types of routing protocols
5. Explore new protocols for WSN

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓			✓	✓				✓	✓
CO2	✓	✓		✓			✓	✓				
CO3	✓	✓		✓			✓	✓	✓			
CO4	✓		✓		✓		✓		✓			✓
CO5	✓		✓	✓						✓		

ECPESCN	HIGH SPEED ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce transmission line basics and various parameters that affects the performance of High speed circuits.
- To give exposure on analysis and design of RF circuits and components.
- To introduce various techniques for fabricating printed circuit board and assembling printed circuit board.

UNIT I

Basics

Transmission line theory (basics) crosstalk and non-ideal effects; signal integrity: impact of packages,vias, traces, connectors; non-ideal return current paths,high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise.Noise Analysis: Sources, Noise Figure, Gain compression – Harmonic distortion – Intermodulation – Cross-modulation – Dynamic range.

UNIT II

Passive and Active components

Passive components: RF behaviour of Resistor, Inductor and Capacitor; Active RF components: RF diodes, BJT, MOSFET, High electron mobility transistor– Modelling Diodes and Transistors at Radio frequencies.

UNIT III

RF Amplifiers

RF Amplifier Design – Stability – Low Noise Amplifiers – Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations – Cross-over distortion Efficiency RF power output stages.

UNIT IV

RF Mixers and Oscillators

Mixers –Up conversion, down conversion – Conversion gain and spurious response. Oscillators, PLL, Transceiver architectures.

UNIT V

Printed Circuit Board

Printed Circuit Board: Anatomy – CAD tools for PCB design – Standard fabrication – Microvia Boards. Board Assembly: Surface Mount Technology – Through Hole Technology – Process Control and Design challenges.

TEXT BOOKS

1. Thomas H. Lee, “Design of CMOS Radio-Frequency Integrated Circuits”, Cambridge University Press, 1998(2013 Reprint), ISBN: 9780521639224.
2. Stephen H. Hall, Garrett W. Hall, James A. McCall “High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices”, Wiley-IEEE Press, 2000.
3. Reinhold Ludwig,Pavel Bretchko,” RF Circuit Design: Theory and Applications”, Pearson Edition ,2000,ISBN:9788131702437.

REFERENCES

1. Chris Bowick, "RF Circuit Design", Elsevier, U.S./India, 2007(2nd Edition), ISBN: 9780750685184
2. Behzad Razavi, "RF Microelectronics", Pearson India, 2014(2nd Edition), ISBN: 9789332518636.

COURSE OUTCOME

After completing this course, the student will be able to:

1. Understand various factors to be considered while designing high speed circuits.
2. Understand the behaviour of Passive and active components at Radiofrequencies.
3. Design RF amplifiers for various applications.
4. Demonstrate the working of RF Oscillators and Mixers.
5. Demonstrate various techniques for fabricating and assembling PCB.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓	✓								✓
CO2	✓	✓					✓					
CO3	✓	✓	✓	✓	✓				✓			
CO4	✓	✓									✓	
CO5	✓		✓	✓	✓			✓		✓		

ECPESCN	**NANO ELECTRONICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To learn and understand basic concepts of Nano electronics.
- To know the techniques of fabrication and measurement.
- To gain knowledge about Nanostructure devices and logic devices.

UNIT I

Introduction to Nano Electronics

Introduction to nanotechnology, meso structures,Basics of Quantum Mechanics: Schrodinger equation, density of States, particle in a box Concepts, degeneracy, band theory of Solids. KronigPenny Model. Brillouin Zones - Semiconductors- Crystal lattices: Bonding in crystals- Electron energy bands- Semiconductor heterostructures- Lattice-matched and pseudomorphic heterostructures- Inorganic-organic heterostructures- Carbon nanomaterial: nanotubes and fullerenes

UNIT II

Fabrication and Measurement Techniques

Shrink-down approaches,Growth, fabrication, and measurement techniques fornanostructures-Nanolitho
graphy, etching, and other means for fabrication of nanostructures an d Nano devices- Techniques for characterization of nanostructures- Spontaneous formation and ordering of nanostructures- Clusters and Nano crystals- Methods of nanotube growth- Chemical and biological methods for Nano scale fabrication-Fabrication of Nano-electromechanical systems

UNIT III

Properties

Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects-Magneto electronics – Magnetism and Magneto transport in Layered Structures-Organic Molecules – Electronic Structures & Properties

UNIT IV

Nano Structure Devices

Introduction, CMOS Scaling, The Nano scale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Electron transport in semiconductors and nanostructures- Time and length scales of the electrons in solids- Statistics of the electrons in solids and nanostructures- Density of states of electrons in nanostructures- Electrons in traditional low-dimensional structures- Single-electron-transfer devices- Potential-effect transistors- Light-emitting diodes and lasers.

UNIT V

Applications

Introduction to Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Grapheme, atomistic simulation -Electronic devices for Logic Applications - Superconductor Digital Electronics - Molecular Electronics.

TEXT BOOKS

1. G.W. Hanson, Fundamentals of Nano electronics, Pearson, 2009.
2. W. Ranier, Nano electronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

REFERENCES

1. K.E. Drexler, Nano systems, Wiley, 1992.
2. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
3. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Able to set up and solve the Schrödinger equation for different types of potentials in one dimension as well as in 2 or 3 dimensions for specific cases.

2. Understand various aspects of nano-technology and the processes involved in making nano components and material.
3. Understand the Nano electronic systems and building blocks such as: low-dimensional semiconductors, heterostructures, carbon nanotubes, quantum dots, nanowires etc.
4. To use matrix methods for solving transport problems such as tunneling, resonant tunneling and know the concept of quantized conductance.
5. The student should be experimentally familiarized with the present research front in Nano electronics and to be able to critically assess future trends.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				✓
CO2	✓	✓		✓				✓				
CO3	✓							✓				
CO4	✓	✓		✓				✓				
CO5	✓		✓					✓			✓	✓

ECPESCN	SCIENTIFIC COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the significance of computing methods, their strengths and application areas.
- Perform the computations on various data using appropriate computation tools.

UNIT I

Introduction

Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic

Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

UNIT II

System of liner equations

Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares

Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

UNIT III

Eigenvalues and singular values

Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

UNIT IV

Nonlinear equations

Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization:One-Dimensional Optimization, Multidimensional Unconstrained Optimization,Nonlinear Least Squares

Interpolation

Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

UNIT V

Numerical Integration And Differentiation

Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods,Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication,Wavelets, Random Numbers and Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

TEXT BOOKS

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery,"Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008

REFERENCES

1. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed.,2006
2. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods.
2. Analyze the strengths of the computing methods.
3. Discuss the platform and design the application areas.
4. Perform the computations on various data using appropriate computation tools.
5. Perform the computation on modern usage of tools.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓					✓		
CO2	✓	✓				✓			✓		✓	
CO3	✓		✓									
CO4				✓				✓				
CO5		✓			✓		✓					✓

ECPESCN	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To conceptualize the organization and architecture of Digital computer.
- To introduce the design procedures for data path and control path in computer system.
- To introduce the hierarchical memory system including cache memories and virtual memory in computers.
- To impart knowledge of I/O devices and standard I/O interfaces.
- To introduce the basics of pipelining and parallel processing techniques.

UNIT I

Basic Structure of Computers

Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations – Stacks and queues.

UNIT II

Arithmetic Unit

Signed number representation– Fixed Point Representation – Floating Point number representation – Fixed point arithmetic: Addition, Subtraction– Multiplication: Robertson algorithm, booth‘s algorithm –Division: Restoring and Non- Restoring division algorithm –Floating point arithmetic — ALU design (Combinational and Sequential).

UNIT III

Processing Unit and Pipelining concept

Fundamental concepts - Hardwired control - Micro programmed control- Nano Programming - Pipelining - Basic concepts - Data hazards - Instruction hazards - Superscalar operation.

UNIT IV

Memory Unit

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory - Memory Management requirements – Secondary storage.

UNIT V

System Organisation

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB) – Parallel processing architectures and challenges.

TEXT BOOKS

1. Behrooz Parhami, "Computer Architecture: From Microprocessors to Super Computers", Oxford,University Press India, 2012(1st Indian Edition).
2. Carl Hamachi, Zvonko Vranesic and Safwat Zaky, "Computer Organisation", McGraw Hill India, 2014(5th Edition).
3. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, Tata McGraw-Hill.

REFERENCES

1. William Stallings, "Computer Organisation and Architecture: Designing for Performance", Pearson India, 2016(10th Edition).
2. John P. Hayes, "Computer Architecture and Organisation", McGraw Hill India, 2012(3rd Edition).
3. David Patterson John Hennessy, "Computer Organisation and Design (MIPS Edition): The Hardware/Software Interface", Elsevier (Morgan Kaufmann) U.S./India, 2013(5th Edition).

COURSE OUTCOMES

1. Demonstrate the understanding of functional units of computer, bus structure and addressing mode.
2. Apply algorithms to design arithmetic unit of a processor.
3. Demonstrate the working of single cycle and pipelined CPU.
4. Acquired knowledge on various memory types and memory management techniques.
5. Understand the concept of I/O organization and parallel processing techniques.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓									✓	
CO2	✓	✓	✓	✓				✓				
CO3	✓	✓	✓			✓			✓			✓
CO4	✓	✓			✓		✓			✓		
CO5	✓	✓		✓								

ECPESCN	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To give an exposure to the various fixed point and floating point DSP architectures
- To understand the techniques to interface sensors and I/O circuits
- To implement applications using these processors.

UNIT I

Fundamentals of Programmable DSP's

Review of Fixed-Point and Floating Point Numbers - Fixed-Point and Floating Point Arithmetic-Multiplier and Multiplier accumulator – Modified Bus Structures and Memory Access in PDSP's – Multiple Access Memory – Multi Port Memory – VLIW Architecture – Pieplining – Special Addressing Modes in PDSP's – On Chip Peripherals.

UNIT II

TMS320C54X Processor

Introduction - Architecture of 54X, 54X Buses, Internal Memory Organisation, Central Processing Unit - Data Addressing, Instruction Set, Pipeline Operation, Code Compressor Studio - Application Programs.

UNIT III

DSP56XXX Processor

Freescale DSP56XXX Architecture and Programming - Introduction, Core Architecture Overview, Data Arithmetic Logic Unit, Address Generation Unit, Program Control Unit, PLL and Clock Generator, Debugging Support, Instruction Cache, External Memory Interface, DMA Controller, Operating Modes and Memory Spaces, Instruction Set, Benchmark Programs.

UNIT IV

Filtering Using DSP56XXX

FFT and Filter Implementation using DSP56XXX - Implementation of FFT : Radix- 2 Fast Fourier Transforms – Block Floating Point Scaling – Optimized Radix-2 DIT FFT- Leakage- Implementation of Digital Filters: Single and Double Precision FIR Filters – IIR Filters – Multirate Filters.

UNIT V

TMS320C6X Processor

TMS320C6x Architecture:CPU Operation – Pipelined CPU- VelociTI – C64x DSP- Software tools: EVM – DSK Target C6x board – Assembly File – Memory Management- Compiler Utility- Code Initialization – Code Composer Studio – Interrupt Data Processing.

TEXT BOOKS

1. Randy Yates, "Technical Reference Fixed-Point Arithmetic: An Introduction", Digital Signal Labs, 2013.
2. Jean-Michel Muller,NicolasBrisebarre,Florent de Dinechin,Claude-Pierre Jeannerod Vincent Lef˙ever,GuillaumeMelquiond, Nathalie Revol,DamienStehl´e,Serge Torres "Handbook of Floating-Point Arithmetic", Birkhauser Boston, 2010.

REFERENCES

1. B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2011.
2. Nasser Kehtarnavaz and Mansour Keramat, "DSP System design using the TMS320C600 Prentice hall 2000.
3. Digital Signal Processing Applications using the ADSP – 2100 Family, Volume 1
    a. Analog devices, DSP Division Prentice Hall, 1992.
4. Mohammed El-Sharkawy,Digital Signal Processing Applications With Motorola's
    a. DSP56002 Processor,Prentice Hall, 1997|
5. Sophocles J.Orfanidis, " Introduction to signal processing " , Prentice Hall, 1996.

COURSE OUTCOMES

At the end of the course student will be able to

1. Learn the architecture details of fixed point DSPs.
2. Learn the architecture details of floating point DSPs.
3. Infer about the control instructions, interrupts, pipeline operations, memory and buses.
4. Illustrate the features of on-chip peripheral devices and its interfacing with real time application devices.
5. Learn to implement the signal processing algorithms and applications in DSPs.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓			✓		
CO2	✓								✓			
CO3		✓				✓					✓	
CO4			✓		✓			✓				
CO5	✓			✓								✓

ECPESCN	**MOBILE ADHOC NETWORKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- Students will get an introduction to Ad Hoc wireless network
- To study the introduction of protocols
- To understand the architecture of MANET
- Enable the students to know techniques involved to support mobility
- To motivate the students to do research on Issues of Ad hoc Networking

UNIT I

Introduction

Introduction to Ad Hoc Networks – Definition, Characteristics, Features, Applications of Ad Hoc Networks-Challenges and Advantages- Characteristics of Wireless Channel-Ad Hoc Mobility Models- Entity and Group-IEEE Standards: 802.11a, 802.11b, 802.11g, 802.15.

UNIT II

Routing Basics

Function of Network Layer-MAC Protocols-Design Issues, Goals and Classification- Routing Algorithms-Contention Based Protocols, Reservation Based Protocols- Distance Vector and Link State Routing Concepts- Hierarchical Routing.

UNIT III

Ad Hoc Network Protocols

Designing A Routing Protocol for Ad Hoc Wireless Networks-Goals and Classification of Routing Protocols-Proactive Vs Reactive Routing-Ad Hoc on Demand Distance Vector Routing (AODV)-Destination Sequenced Distance Vector Routing (DSDV)-Hybrid Routing Algorithm-TORA-Multicast Routing Algorithms - Power-Energy Aware Routing Algorithm- QOS Aware Routing.

UNIT IV

End -To - End Delivery and Security

Transport Layer: Issues in Designing- Transport Layer Classification, Ad Hoc Transport Protocols. Security Issues in Ad Hoc Networks: Issues and Challenges, Network Security Attacks, Secure Routing Protocols-MANET Simulation Tools.

UNIT V

Cross Layer Design and Quality of Service

Need for Cross Layer Design, Cross Layer Optimization, Parameter Optimization Techniques-QOS Routing Protocol-Predictive and Location Based QOS Routing Protocol- on Demand QOS Routing Protocol- Integration of Ad Hoc With Mobile IP Networks Research Issues of Adhoc Networking.

TEXT BOOK

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, Second edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.
4. A survey of integrating IP mobility protocols and Mobile Ad hoc networks, Fekri M. Abduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, v 9.no.1

5. V.T.Raisinhani and S.Iyer "Cross layer design optimization in wireless protocol stacks"Comp. communication, vol 27 no. 8, 2004.
6. V.T.Raisinhani and S.Iyer,"ÉCLAIR; An Efficient Cross-Layer Architecture for wireless protocol stacks",World Wireless cong., San francisco,CA,May 2004.
7. V.Kawadia and P.P.Kumar,"A cautionary perspective on Cross-Layer design,"IEEE Wireless commn.,vol 12, no 1,2005.

COURSE OUTCOMES

The student will be able to

1. Describe the fundamental Characteristics, Features and Applications of MANETs.
2. Analyze the performance of various routing protocols and its Goals and Classification
3. Ability to understand the routing mechanism of Proactive and Reactive Routing
4. Students will understand the concept of cross layer design
5. Select the suitable routing protocol to be used based on the requirements

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓		✓				✓		
CO2	✓	✓	✓	✓						✓		
CO3	✓	✓	✓			✓		✓				
CO4	✓			✓		✓						
CO5					✓		✓					✓

ECPESCN	**INTRODUCTION TO MEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To enable the student to understand the basic principles of sensors and actuators, materials and fabrication aspects of MEMS and Microsystems.
- To make the student familiar with the mechanical and the electrostatic design and the associated system issues.

To introduce the student to the different MEMS applications, the design basics, the design tools and the performance issues.

UNIT I

Fundamentals

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication.

UNIT II

Review of Basic MEMS fabrication modules

Silicon as material, deposition techniques, lithography, doping, etching, silicon micromachining, wafer bonding, LIGA process, special materials like polymers and ceramics for microsystems

UNIT III

Micromachining

Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

UNIT IV

Mechanics of solids in MEMS/NEMS

Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

UNIT V

MEMS Application Case studies

Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

TEXT BOOKS

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.

REFERENCES

1. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
2. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
3. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

COURSE OUTCOMES

Upon completing the course, the student should have

1. Appreciate the underlying introduction to MEMS.
2. Ability to comprehend and appreciate the significance and role of this course in the present basic MEMS fabrication modules.
3. The student would be able to demonstrate an understanding of the different aspects of Micromachining.

4. Given the user requirements and the functionality the student would be in a position to apply his knowledge for identifying a suitable mechanics of solids in MEMS/NEMS.
5. The student would be capable of applying his knowledge and design MEMS application tools.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓										
CO2		✓			✓					✓	✓	
CO3			✓			✓	✓					
CO4		✓			✓				✓			
CO5		✓	✓					✓				✓

ECPESCN	CELLULAR MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To make students familiar with fundamentals of mobile communication systems.
- To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.
- To identify the requirements of mobile communication as compared to static communication.
- To identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G and beyond mobile communication systems.
- As a prerequisite for the course in Wireless LANs.

UNIT I

Introduction

Basic cellular system-Uniqueness of mobile radio environment- operation of cellular system-Cell site antennae and mobile antennae-Multipart fading-Delay spread-Coherence bandwidth-Models for predicting path loss-Cell coverage for signals and traffic-Real time co-channel interference-Non co-channel interference

UNIT II

Cellular System

Global system for mobile communication-Advanced mobile phone service-Digital cellular system-Cordless telephoning- Practical cellular mobile system. GSM Network and signaling-GSM short message services- International roaming-Administration and maintenance of GSM operation-Mobile number Portability-VOIP service for mobile networks.

UNIT III

Mobility Management

Frequency allocation-Cell splitting-Operational techniques and technologies-Mobile telephone switching office-Hand off- Hand off detection-Roaming management-Channel assignment techniques-Radio line transfer-Network signaling-Inter system hand off and authentication-PACS network signaling

UNIT IV

Wireless Application Protocol

WAP model-WAP gate way-WAP protocol-WAP UAPROF and Caching-Wireless barrier for WAP-WAP developer tool kits-Mobile station applications-Execution environment.

UNIT V

Mobile Communication Systems (Block diagram treatment)

Data links-Microwave antennas-Digital mobile telephony-Spread spectrum system to combat multipath-Radio paging-Trunk radio systems-Cordless Communication-Personal communication networks-Communication satellite systems-Third generation mobile services-Wireless enterprise networks.

TEXT BOOKS

1. Yi-Bing Lin and Imrich chlantae., "Wireless and Mobile Network Architecture" John wiley, 2001
2. Lee W.C.Y.., "Mobile Cellular Telecommunication Systems" Mc Graw Hill International Edition, 1990

REFERENCES

1. Kanch Pallavan,Prahant krishnamoorthy., "Principles of Wireless Networks" Pearson Education Publication, 2001
2. Rappaport., "Wireless and Mobile Communication", Pearson Education, 2001
3. Stephen W.Gibson., "Cellular mobile Radio Telephones" Prentice Hall Inc, Englewood cliffs, New Jersey 07632, 1987
4. Jakes W.C.., "Microwave mobile communication" Wiley, NewYork, 1975.
5. Paul Bedell.,"Mobile Communication Wireless crash course" TMH-2001.

COURSE OUTCOMES

At the end of the course, Student will be able to

1. Describe the evolution and History of Wireless Technology.
2. Define Wireless and Radio.
3. Determine the downlink and uplink frequencies for AMPS channel 326 on A Side channels.
4. List the use of at least two advantages of Digital encoding for cellular telephone systems.
5. Explain the function of Mobile station roaming number.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓									✓		
CO2							✓	✓				✓
CO3	✓		✓		✓				✓	✓		
CO4				✓	✓	✓				✓	✓	
CO5	✓	✓				✓		✓	✓		✓	

ECPESCN	DIGITAL DESIGN THROUGH VERILOG	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the constructs and conventions of the Verilog HDL programming language and various modelling styles supported by the language.
- To distinguish between the various modelling styles like structural, register-transfer (data flow), and algorithmic (behavioral) and make use of various levels of abstraction for modelling simple digital systems.
- To develop advanced required skill set in the verilog programming language to foster the needs of the industry.

UNIT I

Introduction

VLSI/ASIC design flow –Role of HDL – Verilog as HDL – Emergence of HDLs– Capabilities of Verilog HDL– Levels of Design Description, Hierarchical Modelling Concepts – Verilog CONSTRUCTS AND CONVENTIONS: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars, Vectors and Arrays, Memories, Expressions, Operands and Operators, Parameters, System Tasks, Compiler Directives –Modules and Ports–Modelling Styles.

UNIT II

Gate Level Modelling

Introduction, Gate Types – AND/OR Gates, BUF/NOT Gates, Tri-state Gates, Array of Instances of Gate Primitives, Net Delays and Gate Delays, Rise, Fall and Turn-off Delays, Min/Typ/Max Values, Delay Examples, Strengths and Contention Resolution, Verilog Design Examples Using Gate Level Modelling.

UNIT III

Data Flow and Switch level Modelling:

Data Flow Modelling: Introduction, Continuous Assignments, Delays, Expressions, Operands and Operators, Operator Types, Verilog Design Examples Using Data Flow Modelling.

Switch Level Modelling: Introduction, Switch-Modelling Elements – MOS Switches, CMOS Switches, Bidirectional Switches, Power and Ground, Resistive Switches, Delay Specification on Switches, Verilog Design Examples Using Switch Level Modelling.

UNIT IV

Behavioral Modeling

Introduction, Structures Procedures – Initial and Always Statements, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks, Generate Blocks, Procedural Continuous Assignments, Test Benches, Verilog Design Examples Using Behavioral Modeling.

UNIT V

Tasks, Functions and User Defined Primitives (UDPs)

Differences between Tasks and Functions, Declaration and Invocation, Examples, UDP Basics, Combinational UDPs, Sequential UDPS.

TEXT BOOKS

1. Samir Palnitkar – Verilog HDL – Pearson, U.S. / PHI, India – 2015(2nd Edition).
2. Vaibbhav Taraate – Digital Logic Design Using Verilog: Coding and RTL Synthesis – Springer, India – 2016.
3. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004..

REFERENCES

1. Joseph Cavanagh – Digital Design Verilog HDL and Fundamentals – CRC Press, U.K./India – 2008.
2. Zainalabedin Navabi – Verilog Digital System Design – McGraw Hill, India – 2008.
3. Charles Roth, Lizy K. John, Byeong Kil Lee – Digital Systems Design using Verilog – Cengage Learning, India – 2016(1st Edition).
4. Michael D. Ciletti – Advanced Digital Design with the Verilog HDL – Pearson, India – 2011(2nd Edition).

COURSE OUTCOMES

At the end of the course, students will

1. Describe the role of hardware description language (HDL) in design flows for FPGA and ASIC with a historical development of the Verilog HDL.
2. Understand basic constructs and conventions of the Verilog HDL
3. Develop program codes in different modelling styles to relaize combinational and sequential logic
4. Understand the concepts of Funcions,tasks and use it effectively in realizing digital circuits.
5. Interpret and Implement designs using the advanced features of Verilog HDL and be able to write code effectively.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								
CO2	✓									✓		
CO3	✓	✓	✓		✓			✓				
CO4	✓	✓	✓				✓					
CO5	✓	✓	✓									✓

OPEN ELECTIVES

EOESCN	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Artificial Intelligence, Various types of production systems, characteristics of production systems.
- Neural Networks, architecture, functions and various algorithms involved.
- Fuzzy Logic, Various fuzzy systems and their functions.
- Genetic algorithms, its applications.

UNIT I

Artificial Neural Networks

Motivation for the development of neural networks- biological neural networks- artificial neural networks – Fundamental Concepts - weights - biases and thresholds - common activation functions. McCulloch-pitts neuron: Architecture, algorithm - Hebb Net- Architecture - algorithm - Perceptron – Architecture- algorithm- applications- Linear separability - Perceptron learning rule convergence theorem - Delta rule.

UNIT II

Neural Network Architecture and Algorithms

Backpropagation Neural Net: Standard backpropogation - architecture - algorithm - number of hidden layers - Discrete Hopfield neural net- architecture - algorithm – Competitive Neural Networks -Fixed-weight competitive nets – Kohonen self-organizing Maps – Adaptive Resonance Theory- Basic architecture - Algorithm - Introduction to Neuro controllers - Case Studies.

UNIT III

Fuzzy Logic

Fuzzy sets - Properties of Classical and Fuzzy sets- Operations on Fuzzy sets- Fuzzy relations- Linguistic variables - Linguistic Hedges- Fuzzy statements- Assignment statements- Conditional statements- unconditional statements- Fuzzy rule base- Canonical rule formation- Decomposition of compound rules.

UNIT IV

Fuzzy Logic Controller

Fuzzy logic controller: Functional diagram - Fuzzification - Membership value assignments using intuition - Membership functions- Defuzzification: Max-Membership principle - centroid method - weighted average method - Inference Engine – Knowledge Base -Rule base -Case studies

UNIT V

Genetic Algorithm

Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Genetic Algorithm – encoding and decoding of variables – GA operators – reproductions – Cross over – mutation – fitness function –fitness scaling.

TEXT BOOKS

1. S.N. Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S, Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.
3. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory & Applications, PHI Publication.

REFERENCES

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications,TMH, First Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, First Edition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, Third Edition, 2012.
4. Martin T Hagen, Neural Network Design, Nelson Candad, Second Edition, 2008.

COURSE OUTCOMES

1. Learn about soft computing techniques and their applications.
2. Analyze various neural network architecture.
3. Define the fuzzy systems
4. Analyze the genetic algorithms and their applications.
5. Genetic algorithms, its applications

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓										✓	
CO2		✓		✓								
CO3			✓		✓			✓				
CO4					✓	✓						
CO5				✓				✓				

ECOESCN	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the principles of satellite and its architecture.
- To learn about the link establishment of satellite.
- To learn to access and different applications of satellite.

UNIT I

Introduction to Satellite Communication

Principles and architecture of satellite Communication, Brief history of Satellite systems, Advantages, disadvantages, applications and frequency bands used for satellite communication. Satellite Construction, Satellite obits, Telemetry, Tracking, command and monitoring (TTC & M), Attitude and orbit control system(AOCS), Communication sub-system, and power sub-systems.

UNIT II

Orbital Mechanics

Kepler's laws, Orbital equations, orbital parameters, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concepts of Solar day andSidereal day, Eclipse,sub satellite point, sun transit outage Launching procedures and Launch Vehicle.

UNIT III

Satellite Link Design

Basic Transmission theory, satellite uplink and downlink analysis, Calculation of System noise temperature for satellite receiver, noise power calculation, drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Propagation characteristics and frequency considerations.

UNIT IV

Access Techniques

Types - FDMA concepts - Inter modulation and back off - SPADE system , TDMA concept - Frame and burst structure , Satellite switched TDMA, CDMA concept - VS and SH CDMA system, Random multiple access techniques – Packet switching, Transmit- Receive Earth stations.

UNIT V

Satellite Services

Fixed satellite services - Broadcast satellite services - Satellite TV systems - Domestic satellite systems(INSAT,INTELSAT series), Mobile satellite services –GSM, Global positioning satellite systems, INMARSAT,VSAT, ATM over satellite, Role of future satellite networks.

TEXT BOOKS

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009

REFERENCES

1. Pritchend and Sciulli, "Satellite Communication Systems Engineering" PHI 1986.
2. Robert M.Gagliendi., "Satellite Communication" John wiley and sons, 1988.
3. RichhariaM.,"Satellite Communication System Design and Analysis" McGraw-Hill Professional; 2nd edition, 1999.
4. Agarwal B.N., "Design of Geo Synchronous Space craft" Prentice Hall, 1986.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, Solve numerical Problems related to orbital motion
3. Satellite-link budget, and design of link budget for the given Parameters and conditions.
4. Acquiring knowledge on Earth station technology and multiple access schemes.
5. Gather information on different services of satellite.

Mapping Course Outcomes(COs) with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12
CO1	✓											✓
CO2	✓	✓	✓	✓								
CO3	✓	✓	✓	✓		✓						
CO4	✓	✓	✓			✓						✓
CO5	✓		✓			✓						✓

ECOESCN	WAVELETS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Able to perform frequency domain analysis for signals.
- To understand the principles and property of various wavelets transform.
- To understand the Biorthogonal wavelet transforms.
- Apply wavelet transform for engineering application.

UNIT I

Signal Representation in Fourier Domain

Fourier series, Orthogonality, Orthonormality and the method of finding the Fourier coefficients Complex Fourier series, Orthogonality of complex exponential bases, Mathematical preliminaries for continuous and discrete Fourier transform, limitations of Fourier domain signal processing.

UNIT II

Introduction to Wavelet Transform

The origins of wavelets, Wavelets and other wavelet like transforms, History of waveletfrom Morlet to Daubechies via Mallat, Different communities and family of wavelets,Different families of wavelets within wavelet communities.

UNIT III

Continuous and Discrete Wavelet Transform

Wavelet transform-A first level introduction, Continuous time-frequency representationof signals, Discrete time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Properties of wavelets used in discrete wavelet transform Continuous versus discrete wavelet transform.

UNIT IV

Biorthogonal Wavelets

Biorthogonality in vector space, Introduction to Biorthogonal Wavelet Systems, Signal Representation using Biorthogonal Wavelet System, Concepts of Multi-Resolution Analysis (MRA) and Multi-rate signal processing.

UNIT V

Wavelet Packets

Wavelet Packet Analysis: Signal representation using Wavelet Packet Analysis, Selectionof best basis, Introduction of M-Band wavelet system, Signal representation using M-Bandwavelet systems. Applications of wavelets in signal and image processing and other related engineering fields.

TEXT BOOKS

1. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.
2. C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.
3. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995.
4. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.

REFERENCES BOOKS

1. K. P. Soman, K. I. Rmachandran, N. G. Resmi, “Insight into Wavelets: From Theory to Practice, (Third Edition)”, PHI Learning Pvt. Ltd., 2010.
2. A.N. Akansu and R.A. Haddad, “Multiresolution signal Decomposition:Transforms, Subbands and Wavelets”, Academic Press, Oranld, Florida, 1992.
3. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson Prentice Hall, 2007.
4. Raghuveer M.Rao and AjitS.Bopardikar, “Wavelet Transforms: Introduction to Theory & Applications”, PearsonEducation Asia, New Delhi, 2003.

COURSE OUTCOMES

1. Understand Fourier and wavelet transform with its terminology.
2. Apply the concept of wavelets to practical problems.
3. Mathematically analyze the systems or process the signals using appropriate wavelet functions.

4. Understand bi orthogonal wavelets and multirate signal.
5. Design certain classes of wavelets to specification and justify the basis of the Application of wavelet transforms to different fields.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							
CO2	✓			✓					✓			
CO3	✓	✓	✓				✓					
CO4	✓	✓	✓	✓								
CO5	✓	✓	✓								✓	

ECOESCN	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To get an overview of different types of power semiconductor devices and their characteristics
- To understand the operation, characteristics and performance parameters of AC-DC converters
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To understand operations of inverters
- To Provide some application oriented knowledge of power electronic devices

UNIT I

Power Semi-Conductor Devices

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatmentshould consist of structure- Characteristics- operation-ratings- protections and thermal considerations. Brief introduction to power devices viz. TRIAC- MOS controlled thyristor (MCT)-Power Integrated Circuit (PIC) (Smart Power)- Triggering/Driver- commutation and snubber circuitsfor thyristor- power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

UNTI II

AC to DC Converters

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R- RL-and RLE and level loads. Analysis of load voltage and input current-Derivations of load form factor and ripple factor- Effect of source impedance- Input current Fourier series analysis of input current to derive input supply power factor-displacement factor and harmonic factor.

UNIT III

DC to DC Converters

Choppers: Quadrant operations of Type A- Type B- Type C- Type D and type E choppers- Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper-Multiphase Chopper

UNIT IV

Inverters

Single-phase inverters: Principle of operation of full bridge square wave- quasi-square wave- PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters- Single phase current source inverter Switching Power Supplies: Analysis of fly back, forward converters for SMPS- Resonant converters-need, concept of soft switching- switching trajectory and SOAR- Load resonant converter – series loaded half bridge DC-DC converter.

UNIT V

Power Electronic Applications

Applications: Power line disturbances- EMI/EMC- power conditioners. Block diagram and configuration of UPS- salient features of UPS, selection of battery and charger ratings- sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

TEXT BOOKS

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.

REFERENCES

1. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
2. V.R.Moorthi, “Power Electronics”, Oxford University Press.
3. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
4. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

COURSE OUTCOMES

Students will be able to

1. Design power devices
2. Analyze various load characteristics of AC-DC converter
3. Analyze various load characteristics of DC-AC converter
4. Effectively handle inverters utility in the circuit
5. Have an thorough exploration about power electric applications

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓										
CO2			✓		✓							
CO3	✓	✓	✓						✓			
CO4	✓											
CO5							✓				✓	

ECOESCN	RADAR AND NAVIGATIONAL AIDS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the principles of RADAR, Equations and its concepts
- To learn about the different types of RADAR on different applications.
- To Understand the systems of Navigation Aids

UNIT I

Basic concepts and Radar Equations

Introduction to RADAR, Basic Radar block diagram and operation, simple form of Radar equation - Bi- Static Radar equation, Radar Frequencies, Applications of Radar. Detection of Signals in Noise, Receiver Noise and Signal to noise ratio, Radar cross section of targets, pulse repetition frequency and range ambiguities, Radar system losses.

UNIT II

CW, FMCW and MTI Radar

Doppler Effect – Simple CW Doppler Radar block diagram and operation, basic principles and operation of Frequency Modulated CW Radar (FMCW).

MTI Radar Block diagram – Delay line cancellers – Multiple or Staggered Pulse repetition frequency - Digital MTI Processing, Pulse Doppler Radar.

UNIT III

Tracking Radar

Tracking Radar and its types -Sequential lobing - block diagram of Conical-scan tracking radar. Monopulse Tracking Radar – Amplitude comparison monopulse tracking – Phase comparison monopulse tracking.

UNIT IV

Radar Clutter and Basic Navigational Radar system

Introduction to Radar Clutter – Types – surface clutter radar equations, Angel Echoes. Introduction – Four Methods of Navigation - Radio direction Finding – Loop Antenna - Adhoc directional finder- Automatic directional finders- VHF Omni directional Range (VOR).

UNIT V

Advanced Navigational system

Hyperbolic system of Navigation – Loran (Long Range Navigation) and Decca navigation system- DME (Distance Measurement Equipment) and TACAN (TACtical Air Navigation). Omega Navigation system - Satellite navigation system – Navstar Global positioning system.

TEXT BOOKS

1. Merrill I. Skolnik, “Introduction to Radar Systems”, 3rd Edition, TMH, 2003.
2. Nadav Levanon,”radar Principles”,Wiley Interscience, 2015.

REFERENCES BOOKS

1. Nagaraja, N.S. “Elements of Electronic Navigation”, TMH, 1996.
2. Peyton Z. Peebles. “Radar Principles”, John Wiley inc., 2004.
3. Sachin Gupta,”Fundamentals of Radar and Navigation” Katson books, 2012.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Acquire knowledge in the basics of RADAR and it applications.
2. Have a knowledge about different types of RADAR and techniques used.
3. Understand the problem to reduce the interference and natural effects.
4. Know the Basic of Navigational Aids.
5. Different types of Navigation System.

Mapping Course Outcomes(COs) with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓	✓	✓			✓				✓	
CO3	✓	✓	✓	✓		✓		✓				
CO4	✓		✓			✓				✓		✓
CO5	✓		✓			✓			✓			✓

ECOESCN	NETWORK AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

UNIT I

Introduction

Computer Security - Security Services, Security Mechanisms, Types of Attacks, Policy-Types of Policies- Cryptography - Plain text and Cipher Text, Substitution techniques- Transposition techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

UNIT II

Symmetric Key Algorithms

Algorithms types and modes, Overview of Symmetric key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES), Differential and linear cryptanalysis, hash functions.

UNIT III

Public Key Cryptosystems

Brief history of Asymmetric Key Cryptography, Overview of Asymmetric Key Cryptography, RSA algorithm, Knapsack Algorithm, Elliptic curve cryptography, ElGamal, key management, Diffie Hellman key exchange and generation, Digital Signatures and authentication protocols-DSS.

UNIT IV

Security Practice and System Security

Authentication Service ,Certificate-based, Biometric Authentication– Kerberos, X.509 Authentication services - E-mail, security –PGP, IP security - Web security-SSL and TLS, SET. System security-Intruder, Intrusion detection system – Virus and related threats –Countermeasures – Firewalls design principles – Trusted systems.

UNIT V

Wireless Network Security

Security in Wireless Environment, Mobile Network Environment, Limitations, Attacks and security issues in mobile environment, WLAN- Security of 802.11 Wireless LANs, Security Requirements and Threats, Security in 2G Systems- GSM Security, I-Mode. Security in 3G-3G Wireless Communication systems, 3GPP Objectives, 3G Security Architecture, Authentication and Key Agreement in 3GPP, Confidentiality and Data Integrity.

TEXT BOOKS

1. William Stallings, “Cryptography and Network Security”, 8th Edition, Pearson Education, 2009.
2. Behrouz Forouzan, “Cryptography and Network Security”, Tata McGraw Hill, 2008.

REFERENCES

1. AtulKahate, “Cryptography and Network Security”, Tata McGraw Hill, 2006.
2. Doughas R.Stinson, “Cryptography-Theory and Practice,” CRC Press, 1995.
3. Wolfgang Osterhage, “Wireless Security”, CRC Press, 2011.
4. Mark Stamp, “Information Security Principles and Practice” Wiley, Second Edition, 2011.
5. Matt Bishop, “Computer Security: Art and Science”, Second Edition, Pearson Education, 2012.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

1. Implement basic security algorithms required by any computing system
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
3. Analyze the possible security attacks in complex real time systems and their
4. effective countermeasures
5. Analyze security threats related to wireless network.
6. Design a simple secure cryptosystem for an application.

Mapping with Programme Outcomes(Pos)												
Course Outcomes (Cos)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓				✓					
CO2	✓	✓							✓		✓	
CO3	✓	✓		✓	✓		✓			✓		✓
CO4	✓	✓	✓				✓					
CO5		✓			✓	✓						

ECOESCN	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- Gives the idea of evolution of cloud computing
- Provides knowledge about its services available today
- Helps to the design and development of simple cloud service.
- Focused on some key challenges and issues around cloud computing.

UNIT I

Introduction

Cloud-Definition, Benefits, Usage Scenarios, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business Models Around Clouds – Major Players in Cloud Computing - Issues in Clouds - Eucalyptus - Nimbus - Open Nebula, Cloud Sim.

UNIT II

Cloud Services

Types of Cloud Services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as Services. Service Providers - Google, Amazon, Microsoft Azure, IBM, Sales Force.

UNIT III

Collaborating Using Cloud Services

Email Communication over the Cloud - CRM Management - Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.

UNIT IV

Virtualization for Cloud

Need For Virtualization – Pros And Cons of Virtualization – Types of Virtualization –System Vm, Process VM, Virtual Machine Monitor – Virtual Machine Properties - Interpretation And Binary Translation, HLL VM - Hypervisors – Xen, KVM , Vmware, Virtual Box, Hyper-V.

UNIT V

Security, Standards and Applications

Security in Clouds: Cloud Security Challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed Management Task Force – Standards for Application Developers – Standards for Messaging – Standards For Security, End User Access to Cloud Computing, Mobile Internet Devices and The Cloud.

TEXT BOOKS

1. John Rittinghouse & James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Que Publishing, August 2008.

REFERENCES

1. David E.Y. Sarna Implementing and Developing Cloud Application, CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing : A Practical Approach, Tata McGraw-Hill 2010.
4. Haley Beard, Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited,July 2008.
5. G.J.Popek, R.P. Goldberg, Formal requirements for virtualizable third generation Architectures, Communications of the ACM, No.7 Vol.17, July 1974.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

1. Understand clearly about the introduction of cloud computing
2. Acquired knowledge about its services
3. Design and development of simple cloud service.
4. Implement Practical applications using cloud
5. Gain knowledge on some key challenges and issues around cloud computing.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓											✓
CO2	✓								✓			✓
CO3	✓	✓	✓		✓			✓	✓	✓		
CO4	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
CO5	✓		✓			✓		✓	✓		✓	

ECOESCN	MODERN COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Students will get an introduction about ISDN layers and its protocol,
- To comprehend the concepts of SS7,Frame relay and Broadband ISDN,
- To understand the concepts of ATM network and architecture,
- To learn the modern Mobile communication system.

UNIT I

ISDN Overview and Physical Layer

A conceptual view of ISDN - ISDN standards - service capabilities –- . ISDN interfaces and function : transmission structure - user network interface configuration - ISDN protocol architecture - ISDN connection - terminal adaptation - addressing - interworking. ISDN physical layer: basic user network interface - primary user role network interface.

UNIT II

ISDN Datalayer and Network Layer

ISDN data layer: LapD, Terminal adaption - bearer channel link control using I.465/v.120. ISDN network layer: Basic call control- ISDN supplementary services. Signaling system 7: SS7 architecture, signaling data link level - signaling network link level - signaling connection control part - ISDN user part.

UNIT III

Frame Relay and Broadband ISDN

Frame Relay Protocols architecture -call control-traffic and congestion control-BISDN: Standards-Services-Architecture-Protocol reference models-B-ISDN layers.

UNIT IV

ATM Network Concepts and Architecture

ATM cell and its structure –Transmission of ATM cells- ATM architecture, ATM Signaling –ATM switching –ATM interfaces- ATM traffic and congestion control, ATM operation, administration and maintenance.

UNIT V

Mobile Communication Systems

GSM - Network aspects - Radio aspects - Security aspects – IS-95-CDMA-WCDMA-UMTS-LTE- Low speed circuit switched data in digital cellular networks - High speed circuit switched data in GSM - Packet switched data in digital cellular networks - Data services over DECT, CT2 and PACS - GPRS.

TEXT BOOKS

1. Stallings W., "ISDN and B.ISDN" Macmillan, 1995..
2. Raj Pandya, "Mobile and Personal Communication System and Services", IEEE Press, 2001.

REFERENCES

1. Winch R,G.," Telecommunication transmission systems", McGraw Hill, 1996.
2. Rhee M.Y., "Cryptography and Secure Communications", McGraw Hill,1994.

COURSE OUTCOMES

At the end of this course the students will have wide knowledge on

1. ISDN layers and its protocol,
2. Signaling system 7
3. Frame relay and BISDN,
4. ATM Networks and architecture,
5. Mobile communication systems.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓			✓						
CO2	✓	✓			✓	✓				✓		
CO3	✓					✓			✓			
CO4			✓					✓				
CO5		✓										✓

ECOESCN	MULTIMEDIA COMPRESSION TECHNIQUE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of these codes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

UNIT I

Introduction

Overview of information theory, redundancy - Taxonomy of compression techniques -Overview of source coding, source models, Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, scalar quantization, vector quantization, rate distortion theory, structure quantizers - Evaluation techniques-error analysis and methodologies.

UNIT II

Text Compression

Huffman coding - Arithmetic coding – Shannon - Fano coding and dictionary techniques - LZW family algorithms - Entropy measures of performance - Quality measures.

UNIT III

Audio Compression

Audio compression techniques-frequency domain and filtering-basic sub band coding-application to speech coding-G.722-application to audio coding-

MPEG audio, progressive encoding for audio - Silence compression, Speech compression techniques - Vocoders.

UNIT IV

Image Compression

Predictive techniques - PCM, DPCM, DM, Transform coding, Introduction to JPEG, JPEG-2000, JBIG standards, Study EZW, SPIHT algorithm.

UNIT V

Video Compression

Video signal representation - Video compression techniques-MPEG, Motion estimation techniques- Overview of Wavelet based compression and DVI technology, Motion video compression - PLV performance - DVI real time compression.

TEXT BOOKS

1. SayoodKhaleed, "Introduction to data compression", Morgan Kauffman, London, 2006.
2. Gibson J D, Berger T, Lookabaugh T, D. Lindbergh, and R. L. Baker," Digital Compression for Multimedia: Principles and Standards", Morgan Kaufmann, 1998,

REFERENCES

1. Watkinson J, "Compression in video and audio", Focal press, London,1995.
2. Mark Nelson, "Data compression book", BPB Publishers, New Delhi, 1998.
3. Jan Vozer, "Video Compression for Multimedia", AP professor, NewYork, 1995.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

1. Describe various multimedia compression parameters.
2. Describe compression and decompression techniques for text.
3. Analyze various compression techniques available for Image.
4. Discuss in detail about various audio and video compression techniques.
5. Apply the compression concepts in multimedia communication

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓					✓						✓
CO2	✓		✓							✓		
CO3	✓	✓	✓	✓	✓				✓		✓	
CO4	✓	✓	✓		✓			✓	✓		✓	
CO5	✓	✓	✓	✓	✓			✓	✓		✓	

ECOESCN	ADVANCED MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

UNIT I

High Performance CISC Architecture – Pentium

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

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

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- STDI/O Libraries – Peripheral Interface – Application of ARM Processor - Caches – Memory protection Units – Memory Management units – Future ARM Technologies.

UNIT IV

Motorola 68HC11 Microcontrollers

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

UNIT V

PIC Microcontroller

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

TEXT BOOKS

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.
2. Steve Furber, "ARM System –On –Chip architecture", Addision Wesley, 2000.

REFERENCES

1. Daniel Tabak, "Advanced Microprocessors", Mc Graw Hill. Inc., 1995
2. James L. Antonakos, "The Pentium Microprocessor", Pearson Education, 1997.
3. Gene H.Miller, "Micro Computer Engineering", Pearson Education, 2003.
4. John B.Peatman, "Design with PIC Microcontroller", Prentice Hall, 1997.

5. James L.Antonakos, "An Introduction to the Intel family of Microprocessors", Pearson Education,1999.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the architecture and programming of High performance CISC processor (Pentium)
2. Understand the architecture and programming of High performance RISC processor (ARM).
3. Digital Signal Processing application development in ARM processor.
4. Obtain programming and interfacing knowledge in Motorola 68HC11 Microcontrollers.
5. Attain programming and interfacing knowledge in PIC Microcontrollers.

Mapping Course Outcomes (COs) with Programme Outcomes (POs)												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓			✓	✓	✓	✓	✓
CO2	✓	✓			✓			✓	✓	✓	✓	✓
CO3	✓	✓			✓			✓	✓			✓
CO4	✓	✓	✓	✓	✓			✓	✓			✓
CO5	✓	✓			✓	✓	✓	✓	✓			✓

HONOURS ELECTIVE

ECHESCN	TRANSMISSION LINES AND WAVE GUIDES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce basic concepts of transmission lines
- To learn the characteristics of low and radio frequency lines
- To study various impedance matching devices
- To learn Smith chart and its applications in transmission line problems
- To design passive filters attenuators, and equalizers
- To study waveguide theories

UNIT I

Transmission Line Theory

Electrically short and long line concepts with distributed constants – Transmission line equation – Infinitive line. Transmission , reflection coefficient and standing wave ratio. Input and transfer impedance - Open and Short circuited lines – Reflection factor and reflection loss.

UNIT II

Low Frequency Transmission Lines

Characteristics, distortion, condition for distortion less transmission – Loading – Lumped and distributed loading - Measurement of USWR, wave length, characteristic impedance , propagation constant and primary constants.

UNIT III

Radio Frequency Transmission Lines

Characteristics, parameter of open wire line and co-axial lines at radio frequencies – Standing waves, input impedances of a line terminated with a complex load – Transmission line as resonant circuit and reactive elements. Skin depth and promily effect – Equivalent T and TT models. Impedance matching quarter wave transformer – Single and double stub matching – circle diagram, smith chart and its uses.

UNIT IV

Circular and Rectangular Wave Guides

Wave between parallel planes – TE, TM and TEM waves and characteristics – Attenuation in parallel plane guide for TE, TM and TEM, waves – Wave impedance and characteristics impedances – Excitation methods for various modes for rectangular and circular wave guides – Impossibility of TEM, waves in wave guides – TE and TM waves in rectangular and circular wave guides – Transmission line analogy for wave guides – Attenuation factor and Q-factor of wave guides.

UNIT V

Wave Guides Elements

Introduction to microwave communication – Basic micro wave system and its components – Wave guide T junction – Slide screen tuners – Slotted line – Bench attenuator – Matched termination – Directional coupler – Phase shifters – Isolators – Circulators – Power measurement by Bolometer method – Measurements of frequency , guide wave length, VSWR – Insertion loss – Q of cavity.

TEXT BOOKS

1. Ryder JD., "Networks Lines and Fields" PHI NewDelhi, 2nd Edition 2002.
2. Jordan "Electromagnetic Waves and Radiating Systems", Second Edition, Darling Kindersley (India) Pvt Ltd., 2006.

REFERENCES

1. Umesh Sinha, "Transmission Lines and Networks", Satya prakashan Publishers, 2005
2. Ramo.S. and J.R. Whinnery "Fields and Waves in Communication Electronics",3rd Edition, John Wiley,1994.
3. David K. Cheing, "Field and Wave Electromagnetics" Second Edition, Pearson Education 2002

COURSE OUTCOMES

Upon completion of the course the students will be able to

1. Understand the fundamentals of transmission lines
2. Understand loading concepts in cables
3. Explain the need for impedance matching in radio frequency lines
4. Analyze and design various network elements(filters, attenuators and equalizers)
5. Explain propagation of EM waves in rectangular and circular waveguides.

Mapping with Programme Outcomes(POs)												
Course Outcomes (COs)	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓		✓	✓	✓	✓
CO2	✓	✓		✓		✓		✓				
CO3	✓	✓	✓		✓				✓		✓	
CO4	✓	✓	✓	✓				✓	✓	✓		
CO5	✓	✓	✓		✓							

ECHESCN	CMOS ANALOG IC DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce MOSFET physics and various MOS models..
- To introduce various sub-circuits used in analog ICs
- 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

Analog IC Design Flow–MOS transistor– I-V characteristics– MOS transconductane and output resistance –MOSFET capacitance– Large-Signal and Small-Signal Models of MOS transistor –Short channel MOS model –Subthreshold MOS model.

UNIT II

CMOS Sub circuits

MOS Switch – MOS Diode/Active Resistor – Current Sinks and Sources – Current Mirrors – Current and Voltage References – Temperature-Independent References.

UNIT III

CMOS Amplifiers

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage – Frequency response of CS and CG stages – Noise in CS, CG, Cascode and Source follower stages –Single ended and differential operation- Basic Differential pair- Common mode response-Differential pair with MOS loads - Gilbert Cell– Noise in Differential pairs

UNIT IV

CMOS Operational Amplifiers

CMOS Operational Amplifiers: Two-Stage Op Amps: gain boosting, common mode feedback, input range limitation, slew rate, power-supply rejection ratio – Noise in Two-Stage Op Amps–Multipole Systems, Phase Margin, Frequency Compensation, Compensation of Two-Stage Op amp.

UNIT V

Switched Capacitor Circuits and PLLs

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

TEXT BOOKS

1. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press India, 2013 (3rd Indian Edition), ISBN: 9780198097389.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill India, 2016(33rd Reprint), ISBN: 9780070529038.

REFERENCES

1. R. Jacob Baker, "CMOS Circuit Design Layout and Simulation", Wiley/IEEE Press India/U.S., 2009 (Reprint)
2. Tertulien Ndjountche, "CMOS Analog Integrated Circuits: High-Speed and Power-Efficient Design", CRC Press (Taylor & Francis) U.K./India, 2011, ISBN: 9781439854914.
3. Gray, Hurst, Lewis, Meyer, "Analysis and Design of Analog Integrated Circuits (ISV)", Wiley U.S.,2010(5th Edition), ISBN: 9788126521487

COURSE OUTCOMES

At the end of the course, students will

1. Demonstrate an understanding of characteristics and working of MOS Transistors.
2. Design and analyse various analog CMOS Sub circuits.
3. Realize the various configurations of CMOS amplifiers and explain their frequency response and noise characteristics.
4. Analyze the performance of Two stage Op-amp and explain compensation techniques used in Op-amp.
5. Construct Switched capacitor circuits and PLLs.

ECHESCN	DATA STRUCTURES AND C++	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the methodical way of solving complex problems
- To understand the different methods of organizing large amounts of data
- To efficiently implement graphical programs
- To learn and develop skills in C++ programming

UNIT I

Linear Data Structures

Introduction to data structures, Primitive and non-primitive data structures, Arrays in C -types, Structures in C, Stack-implementation, operations, Queues-operations-Lists-Linked list-types, Applications.

UNIT II

Non Linear Data Structures

Tree - Binary tree-representation - Tree traversal techniques- Graph-representation, traversal-Sorting- Selection Sorting, Insertion sorting, Merge sorting, Radix sorting, Searching -techniques - Hashing.

UNIT III

Object Oriented Programming

Object Oriented Programming concepts- Objects- classes – methods and message passing, encapsulation, abstraction, inheritance, polymorphism and dynamic binding-characteristics of OOPS-benefits of object orientation. Introduction to C++ and data types-Operators in C++.

UNIT IV

Objects and Classes

Objects and class -defining a class –defining member functions-Private and public member function–accessing class members, creating objects, object as function arguments- Array fundamentals - array within a class - array of objects. Constructors and destructors- Function overloading - Inline function - Virtual function.

UNIT V

File and Graphics Operations

Operator overloading – overloading unary, binary and relational operators-type conversion, Inheritance- derived class and base class-visibility mode-public, private and protected–various forms of inheritance. C++ graphics - text mode graphics functions- graphics mode graphics functions - colors –drawing shapes- Address and pointers-Files and streams.

TEXT BOOKS

1. John R.Hubbard, "Programming with C++", Tata McGraw Hill, New Delhi, 1988.
2. Aho Alfred, V., E. Hopperoft John, D. UIlman Jeffrey, “Data Structures and Algorithms”, Addison Wesley, 1987.

REFERENCES

1. Jean - Paul Tremblay and PaulSorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill, 1988.
2. R.F.Gilberg, B.A.Forouzan, “Data structures”, Second Edition, Thomson India Edition, 2005
3. Michael T. Goodrich, “Data Structures and Algorithm Analysis in C++”, Wiley student edition, 2007.
4. Sahni, “Data Structures Using C++”, The McGraw-Hill, 2006.
5. E. Balagurusamy, “Object Oriented Programming with C++”, 4th Edition, Tata Mc Graw Hill.

COURSE OUTCOMES

At the end of the course, Student will be able to

1. Understand basic data structures such as arrays, linked lists, stacks and queues in C.
2. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data in C and C++.
3. Able to use object oriented programming language like C++ and associated libraries to develop object oriented programs.
4. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
5. Choose appropriate data structure as applied to specified problem definition.

ECHESCN	SPEECH AND AUDIO PROCESSING	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

The objective of this subject is to make the student learn and understand

- Speech signal representations.
- Models for speech production system.
- Models for speech perception system.
- Fundamentals of speech coding.
- Fundamentals of speech recognition
- Fundamentals of text-to-speech synthesis

UNIT I

Introduction

Introduction-Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT II

Linear Prediction of Speech

Basic concepts of linear prediction; Linear Prediction Analysis of non stationary signals, prediction gain, examples; Levinson-Durbin algorithm; Long term and short term linear prediction models; Moving average prediction.

UNIT III

Speech Quantization

Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers, Vector quantization – Distortion Measures,codebook design, codebook types. Scalar Quantization of LPC-Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

UNIT IV

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

UNIT V

Coding Standards

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards **.**

TEXT BOOKS

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students" Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu,WileyInter science, 2003.

REFERENCES

1. Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Second Editionby Dan Ellis, Nelson Morgan, Ben Gold Publisher: Wiley-Interscience Release Date: August 2011 ISBN: 9780470195369.
2. Speech and Audio Processing by Dr. shaila B.Apte Wiley Edition 2012.
3. Discrete-Time Processing of Speech Signals by John R. Jr Deller, John H. L. Hansen, John G. Proakis, Wiley, 2000 - Technology & Engineering.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to

1. Mathematically model the speech signal.
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.
4. Properties of speech production and perception system.
5. Fundamental algorithms for speech synthesis, coding and recognition.

ECHESCN	ADAPTIVE SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To introduce some practical aspects of signal processing, and in particular adaptive systems.
- To gain knowledge in Current applications for adaptive systems which include in the field of communications, radar, sonar, seismology, navigation systems and biomedical engineering.
- To understand the basic principles of adaptation
- To cover various adaptive signal processing algorithms (e.g., the LMS algorithm) and many applications, such as adaptive noise cancellation, interference canceling, system identification, etc.

UNIT I

Basic Concepts

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

UNIT II

LMS Algorithm

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued. The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment. Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

UNIT III

Signal Space Concepts

Signal space concepts - Introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

UNIT IV

Vector space

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

UNIT V

Recursive Least Squares

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

TEXT BOOKS

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

REFERENCES

1. Adaptive Signal Processing: Next Generation Solutions by Tülay Adali and Simon Haykin,Wiley publications, 2010.
2. Adaptive Filters, by Ali H. Sayed, Wiley, NJ, 2008.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Examine and derive the FIR Wiener filter
2. Apply the RLS algorithm.
3. Recognise the prediction filter formulation and applications
4. Solve the Wiener filter weights for the prediction filter using the Levinson-Durbin algorithm
5. Use Matlab to implement the Wiener filter, Least Squares, LMS and RLS algorithms, and apply to selected applications.

ECPESCN	MOBILE COMMUNICATION AND NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the basics of mobile communication networks and its generation.
- To understand the concepts of advanced network concepts.
- To study the basics of various receiver characteristics.

UNIT I

Cellular Concepts

Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, System capacity, wireless standards: Overview of 2G and 3G cellular standards.

UNIT II

Signal propagation

Propagation mechanism-reflection, refraction, diffraction and scattering, large scale signal propagation,fading channels- multipath and small scale fading-Doppler shift, narrowband and wideband fading models, delay spread, coherence bandwidth and coherence time, frequency selective fading, slow and fast fading, capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal, base station antennas and arrays.

UNIT III

Multiple access schemes

FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

UNIT IV

Receiver structure

Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

UNIT V

MIMO and space time signal processing

Spatial multiplexing, diversity/multiplexing Tradeoff. Performance measures-Outage, average SNR, average symbol/bit error rate. System Examples-GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

TEXT BOOKS

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.

REFERENCES

1. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
2. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance.
4. Understand the Equalization Techniques and Receiver types.
5. Understand the diversity Techniques and System Examples.

MINOR ENGINEERING

ECMISCN	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Students will try to learn:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

UNIT I

Introduction to Semiconductor Physics

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors.

UNIT II

P-N junction

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-Vcharacteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode.

UNIT III

Bipolar Junction Transistor

Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics.

UNIT IV

MOSFET and Optoelectronic devices

MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell.

UNIT V

Integrated circuits

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

TEXT BOOKS

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices,"7th edition, Pearson, 2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.

REFERENCES

1. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
2. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics
2. Understand the current voltage characteristics of semiconductor devices
3. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
4. Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.
5. Design and analyze of electronic circuits.

ECMISCN	COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To give an exposure of different types of analog modulation techniques and their significances in communication systems.
- To familiarize the students about digital modulation techniques in communication systems.
- To introduce the concepts of Pulse Code Modulation techniques and multiple access techniques used in communication systems for enhancing the number of users.
- To focus on various media for digital communication and future data communication.

UNIT I

Linear Modulation / Demodulation

Need for modulation - Amplitude modulation - Power spectrum - Power relation - Different types of modulation - Double sideband suppressed carrier. (DSB/SC), Single sideband suppressed carrier (SSB) and Vestigial sideband (VSB) generation. AM transmitters - Block diagram - Amplitude demodulation - Detection of DSB, SSB signals - Receiver characteristics - Super heterodyne reception - Automatic volume control.

UNIT II

Angle Modulation

Principle of frequency and phase modulation - Generation of FM and PM signals - Direct and indirect methods - FM transmitters - Block diagram – Pre-emphasis circuit - Frequency demodulation - Detection of FM and PM signals - Automatic frequency control - De-emphasis circuit.

UNIT III

Pulse Modulation

Analog and digital communication systems and techniques: Pulse modulation systems - Sampling theorem - Pulse amplitude modulation - Channel bandwidth - Detection of PAM signals - Cross talk in PAM signals - Pulse time modulation - Generation of PDM and PPM - Conversion of PDM to PPM - Detection of PTM signals - Cross talk in PTM signals.

UNIT IV

Pulse Code Modulation Systems

Quantization - Compounding - Pulse code modulation - Sampling and digitizing - Aliasing - Sample and hold circuit - Practical implementation of sampling and digitizing - Equalization - Multiplexing - Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) - Data communications - Serial synchronous, asynchronous communication protocol - Hardware USARTS - Software USART.

UNIT V

Wireless Communication Systems

Evolution of generations (1G, 2G, 2.5, 3G, 4G and beyond 4G), - GSM and CDMA systems-cellular structure-frequency reuse-Handoff-Bluetooth and UWB network-Wi-Fi and Wi-Max. (Quantitative treatment only)

TEXT BOOKS

1. Herbert Taub, Donald L. Schiling&GautamSaha “Principles of Communication Systems”, Tata McGraw Hill Education Pvt. Ltd., Third Edition, 2008.
2. Bernard Davis & George Kennedy, “Electronic Communication Systems”, Tata McGraw Hill Education Pvt. Ltd., Fifth Edition, 2011.

REFERENCES

1. K.N. HariBhat& Ganesh Rao, “Analog Communications”, Pearson Publications, 2nd Edition, 2008.
2. Anokh Singh, “Principles of Communication Engineering”, 6th Reprint, S. Chand & Company Ltd., 2006.
3. Sanjay Sharma, “Analog and Digital Communication”, S.K. Kataria and Sons Publications, 2013.

4. Bernard Sklar&Pabitra Kumar Ray, "Digital Communications - Fundamentals and Applications", Pearson Publications, Second Edition, 2010.

COURSE OUTCOMES

1. Provide idea about modulation and demodulation techniques employed in communication systems.
2. Explain the concepts of pulse modulation systems and multiple access techniques used in communication field applications.
3. Understand the various broadband communication systems and recent advancements in communication systems.
4. To analyze the concepts of Pulse Code Modulation techniques and multiple access techniques used in communication systems for enhancing the number of users.
5. To focus on various media for digital communication and future data communication.

ECMISCN	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The student is expected to have the knowledge about

- Working of operational amplifiers and various applications of op-amp such as Multivibrators, Oscillators and filters.
- The theory of ADC and DAC and the concepts of waveform generation and some special Function ICs.
- Micro fabrication techniques of optical integrated circuits and optical wave guides, opto electronic integrated circuits.

UNIT I

Introduction to Linear IC'S

Integrated circuits – monolithic integrated circuits – active and passive components of IC - fabrication of monolithic IC's -ideal op-amp - practical op-amp - Various stages of an operational amplifier - simplified schematic circuit of op-amp 741 – op-amp characteristics - offset current and offset voltage - frequency response of an op-amp - noise analysis - slew rate.

UNIT II

Applications of Op – Amp

DC amplifier – AC amplifier - Inverting and Non-inverting Amplifiers - Summing, scaling and Averaging amplifiers - Logarithmic Amplifiers - antilog amplifier - Instrumentation Amplifiers - Differential Amplifiers -Voltage to Current Converters - Current to Voltage Converters – Integrators – Differentiators.

UNIT III

Active Filters & Oscillators

Active filters - Butterworth filters: First order and Second Order Low-Pass filters -First order and Second Order High-Pass filters – Band-Pass filters: wide band-pass filters - narrow band-pass filters – Band-reject filters: wide band-reject filters and narrow band-reject filters - Oscillators: Oscillator Principles, Oscillator types - phase shift Oscillator - Wien Bridge Oscillator - voltage–controlled oscillator.

UNIT IV

Comparators and Converters

Basic Comparator: Comparator characteristics - Zero Crossing Detector – Schmitt Trigger – high speed and precision type comparators - window Detector – Voltage to Frequency converter - Frequency to Voltage converter - D/A converters - A/D Converters - Clippers and Clampers – positive and negative clippers – small-signal and half-wave rectifier – positive and negative clampers - Peak Detector – sample and hold circuit.

UNIT V

Waveform Generators and Other Linear IC'S

Square wave generator – triangular wave generator - saw tooth wave generator – Switched capacitor filter - The 555 Timer –555 Timer as an astable, bistable, monostable multivibrators– power amplifiers - voltage regulators - Three Terminal fixed and adjustable Regulators - switching regulators - Operation of the basic PLL - Monolithic PLL – 565 PLL Applications.

TEXT BOOKS

1. Gayakwad R.A. "Op amp and Linear Integrated circuits", Second Edition,PHI.1988.
2. Roychoudhury and shail Jain "Linear integrated circuits" Wiley Eastern 1991.

REFERENCES

1. Jacob millman and Arvin Grabel, "Micro electronics" (2nd edition), McGraw Hill - 1987.
2. Gray and Meyer, "Analysis and design of analog IC's", Wiley International - 1996.
3. Paul R. Gray, Paul J. Hurst, Robert G. Meyer, Stephen H. Lewis, "Analysis and design of analog integrated circuits", 4th education

COURSE OUTCOMES

Upon completion of the course the students will

1. Gain knowledge of IC fabrication
2. Have an in depth knowledge of applications of op – amps
3. Design different types of active filters and oscillators and acquire knowledge about comparators and converters
4. Generate Sinusoidal and non-sinusoidal waveforms using op – amp circuits.
5. Analyse special function ICs like 555 Timer.

ECMISCN	COMPUTER NETWORKS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To understand the concept of network architecture and protocols
- To understand the division of network functionalities into layers.
- To be familiar with the components required to build different types of networks.
- To be exposed to the required functionality at each layer
- To learn the flow control and congestion control algorithms

UNIT I

Introduction to computer networks and the Internet

Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

UNIT II

Switching in networks

Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing.

UNIT III

Transport layer

Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

UNIT IV

Congestion Control and Resource Allocation

Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

UNIT V

Network layer

Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

TEXT BOOKS

1. J.F. Kurose and K. W. Ross,"Computer Networking – A top down approach featuring the Internet", Pearson Education, 7th Edition, 2016.
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach"Elsevier Morgan Kaufmann Publisher, 5th Edition, 2011.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall,1992.
4. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education, 2002.

REFERENCES

1. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edn, 2012.
2. Andrew Tanenbaum, "Computer networks", Prentice Hall, 5th edition, 2016.
3. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall, 6th 2014.
4. William Stallings, "Data and computer communications", Prentice Hall, 10th edition, 2013.

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to:

1. Understand the concepts of networking thoroughly.
2. Design a network for a particular application.
3. Analyze the performance of the network.
4. Analyze about the layered architecture.
5. Able to provide solutions to various issues in routing and congestion.

ECMISCN	TELECOMMUNICATION SWITCHING AND NETWORKS	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES

- To introduce the concepts of Frequency and Time division multiplexing.
- To introduce digital multiplexing and digital hierarchy namely SONET / SDH
- To introduce the concepts of space switching, time switching and combination switching, example of a switch namely No.4 ESS Toll switch.
- To introduce the need for network synchronization and study synchronization issues. To outline network control and management issues.

UNIT I

Multiplexing

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings, SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats, SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switched Ring, Bidirectional Line-Switched Ring.

UNIT II

Digital Switching

Switching Functions, Space Division Switching, Time Division Switching, two dimensional switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SS7 signaling.

UNIT III

Network Synchronization Control and Management Timing

Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT IV

Digital Subscriber Access ISDN

ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

UNIT V

Traffic Analysis

Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

TEXT BOOKS

1. J. Bellamy, "Digital Telephony", John Wiley, Third Edition 2007.
2. JE Flood, "Telecommunications Switching, Traffic and Networks", IET,1997.

REFERENCES

1. R.A.Thomson, "Telephone switching Systems", Artech House Publishers, 2000.
2. W. Stalling, "Data and Computer Communications", Prentice Hall, Tenth Edition,2014.
3. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, "Fundamentals of Telecommunication Networks", Wiley Interscience, 1994.
4. W.D. Reeve, "Subscriber Loop Signaling and Transmission Hand book", IEEE Press (Telecomm Handbook Series), 1995.
5. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 2015.

COURSE OUTCOMES

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

1. To understand the concepts of Frequency and Time division multiplexing.
2. To analyze digital multiplexing and digital hierarchy namely SONET / SDH
3. To discuss the concepts of space switching, time switching and combination switching, example of a switch namely No.4 ESS Toll switch.
4. To explain the statistical modeling of telephone traffic, blocking system characteristics and queuing system characteristics.
5. To examine blocking probability holding service time distributions for in speech and data networks.

ECMISCN	WIRELESS COMMUNICATION	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE

- To acquire knowledge of Wireless channels and parameters
- To impart knowledge on mobile communication and cellular system architecture
- To understand various Modulation Techniques used in wireless communication.
- To create exposure to multipath mitigation techniques and wireless standards

UNIT I

Wireless Channels

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 and 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

Fundamentals of Cellular Communication

Multiple access technique - FDMA, TDMA and CDMA - Operation of Cellular Systems - Frequency Reuse - Channel Assignment Strategies - Interference and System Capacity - Co-Channel Interference - Adjacent Channel Interference - Trunking and Grade of Service - Improving Coverage and Capacity in Cellular Systems - Cell Splitting - Sectoring - Repeaters for range extension - A Micro cell zone concept.

UNIT III

Modulation Techniques

Introduction to Modulation Techniques, Modulation and Demodulation - Quadrature Phase Shift Keying, Π / 4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, Power Spectrum and Error Performance In Fading Channels, OFDM Principle – Cyclic Prefix, PAPR, Inter Carrier Interference.

UNIT IV

Multipath Mitigation Techniques

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

UNIT V

Mobile Communication Systems

Overview of AMPS - DECT - CT2 - PACS - PHS - International Mobile Telecommunication 2000 - GSM Architecture - USSD - GPRS - EDGE - IS95, CDMA 2000 - WCDMA - UMTS - HSPDA - Bluetooth - WIFI - WIMAX - Introduction to LTE.

TEXT BOOKS

1. Rappaport., "Wireless and Mobile Communication", Pearson Education, 2009.
2. Yi-Bing Lin and Imrichchlantae.,"Wireless and Mobile Network Architecture" John Wiley & Sons, 2008

REFERENCES

1. ITI SahaMisra., "Wireless Communications and Networks : 3G and Beyond", Tata McGraw – Hill Edition,2013.
2. K. Fazel and S. Kaiser, "Multicarrier and Spread Spectrum Systems", Wiley, 2003.
3. D. Tse and P. Vishwanath, -"Fundamentals of Wireless Communication", Cambridge University Press, 2005.
4. Lee W.C.Y., "Mobile Cellular Telecommunication Systems" McGraw Hill International Edition,1990.
5. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2010.
6. Ramjee Prasad," OFDM for Wireless Communications Systems", Artech House,2004

COURSE OUTCOMES

At the end of the course student will

1. Characterize Wireless Channels
2. Explain the basic concepts of Cellular Systems.
3. Design and Implement various Modulation schemes for fading channels
4. Compare Multipath Mitigation techniques and analyze their performance
5. Acquire knowledge on Various Wireless Standards.