315MAT01	ENGINEERING MATHEMATICS – III	L T P C 3 1 0 4

Course Objectives

- To develop z-transform techniques which analyze the discrete time signals.
- To solve certain linear differential equations using the Laplace transform technique which has applications in control theory and circuit theory.
- To introduce Fourier series analysis which is central to many applications in engineering.
- To understand the boundary value problems and to obtain the solution using partial differential equations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are aperiodic.

UNIT I Z – TRANSFORM **9+3**

z-transform - Elementary properties and applications - Inverse z-transform – Convolution theorem (statement and applications only) - Initial and final value theorems (Statement and applications only) - Solution of difference equations by applying z-transform using partial fractions, residue theorem and convolution theorem methods only.

UNIT II LAPLACE TRANSFORM **9+3**

Laplace transform – Conditions for existence –Basic properties (without proof) – Laplace Transform of elementary functions, derivatives and integrals, unit step function and impulse functions, periodic functions. Definition of Inverse Laplace transform – Convolution theorem (Statement and applications only) – Initial and final value theorems (Statement and applications only) – Solution of linear ordinary differential equations of second order with constant coefficients using Laplace transform techniques.

UNIT III FOURIER SERIES **9+3**

Dirichlet's conditions – General Fourier series – Change of scale - Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

UNIT IV BOUNDARY VALUE PROBLEMS **9+3**

Classification of Partial Differential Equations – Method of separation of Variables – Solutions of one dimensional wave equation and One-dimensional heat equations –Applications using Fourier series solutions in Cartesian coordinates - Steady state solution of two-dimensional heat equation.

UNIT V FOURIER TRANSFORM **9+3**

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Fourier Transform of simple functions – Convolution theorem applications – Parseval's identity applications.

Total Hours 60

Course Outcomes

CO1: Gaining the concept of analysis of linear discrete system using Z-transform approach.

CO2: Applying Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.

CO3: Describing an oscillating function which appear in a variety of physical problems by Fourier series helps them to understand its basic nature deeply.

CO4: Acquiring the knowledge to construct partial differential equations for various physical and engineering real time problems and obtaining solution using Fourier series methods.

CO5: Understanding the effect of Fourier transform techniques and their applications.

Text Books

1 B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd edition , 2016.

Reference Books

1 T.Veerarajan,"Engineering Mathematics-III", Tata McGraw-Hill Publishing company, New Delhi,2015.
2 V.Prameelakaladharan and G.Balaji ,"Engineering Mathematics-III", Amrutha marketing, Chennai,2016.
3 P.Kandasamy, K.Thilagavathy, K.Gunavathy, " Engineering Mathematics-III", S.Chand Publishers,2015.

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Gaining the concept of analysis of linear discrete system using Z-transform approach.	3	1		3	2	3	1	3						1	
Co2 Applying Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.	3	1		3	2	3	1	3						1	
Co3 Describing an oscillating function which appear in a variety of physical problems by Fourier series helps them to understand its basic nature deeply.	1											1	3	2	1
Co4 Acquiring the knowledge to construct partial differential equations for various physical and engineering real time problems and obtaining solution using Fourier series methods.	3	1		3	3		2							1	
Co5 Understanding the effect of Fourier transform techniques and their applications.	3	1		2	3		1	2						1	

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315ECT03	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING IN C++	L T P C 3 0 0 3

Course Objectives

- Comprehend the Fundamentals of Object Oriented Programming in C++.
- Use Object Oriented Programming to Solve Real Time Problems.
- Learn the Linear Data Structures like Lists, Stacks and Queues
- Get Familiar about the Non Linear Data Structures
- Develop the Ability to use Sorting and Searching Algorithms Efficiently.

UNIT I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9

Evolution of Programming Paradigms - Structured vs. Object Oriented Development - Elements of Object Oriented Programming - Merits and Demerits - Classes and Objects - Function Components: Passing Data to Functions - Parameter Passing - Default Arguments - Inline Functions - Function Overloading - Friend Function - Constructors: Parameterized constructors - Copy Constructors - Destructors - Array of Objects - this Pointer.

UNIT II INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING 9

Operator Overloading: Unary Operator Overloading - Binary Operator Overloading - Data Conversion : Conversion between Basic Data Types - Inheritance - Types of Inheritance - Virtual Functions - Pure Virtual Function - Abstract Classes - Templates: Function Template - Class Template - Exception Handling: Exception Handling Model - Exception Handling Constructs - Handling Uncaught Exception.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types - The List ADT - The Stack ADT - The Queue ADT - Priority Queues - Binary Heap - Binomial Queues.

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees: Binary Trees - Binary Search Tree - AVL Trees - Tree Traversals - B-Trees – Graphs: Topological Sort - Graph Traversal: Depth First Search - Breadth First Search - Shortest Path Algorithm: Dijkstra's Algorithm - Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm.

UNIT V SORTING AND SEARCHING 9

Insertion Sort - Shell Sort - Heap Sort - Merge Sort - Quick Sort - Selection Sort - Bucket Sort - External Sorting - Linear Search - Binary Search.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Gain the basic knowledge on Object Oriented Programming.
CO2: Develop Applications, and Implement Features of Object Oriented Programming to Solve Real World Problems.
CO3: Implement various Abstract Data Types to Solve Real Times Problems by using Linear Data Structures.
CO4: Apply the different Non-Linear Data Structures to Problem Solutions.
CO5: Analyze and Implement various Sorting and Searching Algorithms.

Text Books

1 K. R. Venugopal, Rajkumar Buyya, "MASTERING C++" 2E, Tata McGraw Hill, New Delhi, 2013.
2 Mark Allen Weiss, DATA STRUCTURES AND ALGORITHM ANALYSIS IN C++", 4/E Pearson Education, 2013.
3 Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++", Computer Scince Press, New York, 2007

Reference Books

1 Rohit Khurana, "Data Structures and Object Oriented Programming WITH c++ ", First Edition, Vikas Publishing House Pvt Ltd, 2012.
2 Bhushan Trivedi, "PROGRAMMING WITH ANSI C++, A Step-By-Step Approach", Oxford University Press, 2010.
3 Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.

4 Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Gain the basic knowledge on Object Oriented Programming.												1	3	2	1
Co2 Develop Applications, and Implement Features of Object Oriented Programming to Solve Real World Problems.												1	3	2	1
Co3 Implement various Abstract Data Types to Solve Real Times Problems by using Linear Data Structures.	3	1		3	2	3	1	1		1				1	
Co4 Apply the different Non-Linear Data Structures to Problem Solutions.	2	1		2	2		1	3						1	
Co5 Analyze and Implement various Sorting and Searching Algorithms.	3	1		3	2		1	2						1	

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315ECT04	DIGITAL ELECTRONICS	L T P C 3 0 0 3

Course Objectives

- Minimize the Boolean expression and identify the various operations of Logic gates
- Design and analyze of various combinational circuits
- Design various sequential circuits like counters, registers, etc
- Understand the concept of memories and programmable logic devices.
- Design and analyze synchronous and asynchronous sequential circuits

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES 9

Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem -Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method of minimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR- Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates.

UNIT II COMBINATIONAL CIRCUITS 9

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators - code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS 9

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter –Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers– Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV MEMORY DEVICES 9

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memorycycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Implementation of combinational logic circuits using ROM, Introduction to Flash Memory.

UNIT V SYNCHRONOUS AND AYNCHRONOUS SEQUENTIAL CIRCUITS 9

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of hazard Free Switching circuits.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Solve and implement various Boolean expression with minimized logic gates
CO2: Implement the various combinational circuits for real time applications
CO3: Design and analyze various sequential circuits like counters, registers, etc
CO4: Demonstrate the concept of memories and programmable logic devices.
CO5: Implement synchronous and asynchronous sequential circuits

Text Books

1 M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

2 S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt.

Ltd, New Delhi, 2006

Reference Books

1 John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006

2 John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.

3 Charles H.Roth. Fundamentals of Logic Design, Thomson Learning, 2003.

4 Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.

5 William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.

6 Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003.

7 Donald D.Givone, Digital Principles and Design, TMH, 2003

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Solve and implement various Boolean expression with minimized logic gates	3	1		3	2		1	2						1	
Co2 Implement the various combinational circuits for real time applications	2	3		3	2		3	2				1		1	
Co3 Design and analyze various sequential circuits like counters, registers, etc	3	1		3	2	3	1	1		1				1	
Co4 Demonstrate the concept of memories and programmable logic devices.	2	3		3	2		3	2				1		1	
Co5 Implement synchronous and asynchronous sequential circuits	2	3		3	2		3	2				1		1	

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315ECT05	Analog Electronics-I	L T P C 3 0 0 3

Course Objectives

- Understand DC loadline and various biasing technique and compensation technique for transistors
- Analyze small signal and large signal model for BJT
- Analyze small signal model for FET and MOSFET
- Define Rectifiers and power supplies concepts
- Analyze high and low frequency model of BJT and MOSFET

UNIT I BIASING OF DISCRETE BJT,JFET AND MOSFET 9

D C Load line, Operating Point, Various biasing methods for BJT- Design – Stability – Bias Compensation, Thermal Stability, Design of Biasing for JFET, Design of biasing for MOSFET.

UNIT II BJT AMPLIFIERS 9

Small signal Analysis of Common Emitter-AC Loadline, Voltage swing limitations, Common collector and common base amplifiers – Differential amplifiers- CMRR- Darlington Amplifier –Bootstrap technique Cascaded stages - Cascode Amplifier.

Large Signal Amplifiers - Classification - Class A/B/AB/C - single ended and Push-pull configuration - - Complementary-symmetry power amplifiers-Power dissipation, output power and conversion efficiencies, Harmonic Distortion.

UNIT III JFET AND MOSFET AMPLIFIERS 9

Small signal analysis of JFT amplifiers Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, BiMOS Cascode amplifier.

UNIT IV RECTIFIERS AND POWER SUPPLIES 9

Half wave and Full wave Rectifiers - Ripple factor, Regulation, Rectification efficiency, TUF - Filters - L, C and Pi type filters - Ripple factor and regulation - Voltage Regulators - Series and Shunt Voltage Regulators.

UNIT V FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS 9

Low frequency and Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency – $f\alpha$ and $f\beta$ unity gain and Determination of bandwidth of single stage and multistage amplifiers.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Recognize various biasing technique and compensation technique for transistors
CO2: Design small signal and large signal amplifiers using BJT for various application
CO3: Design small signal amplifiers using FET and MOSFET
CO4: Design Rectifiers and power supplies for various applications
CO5: Design high and low frequency amplifiers and to calculate Bandwidth

Text Books

1 Millman J and Halkias .C., Integrated Electronics, TMH, 2007.
2 Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 2nd Edition, TMH, 2007
3 Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd Edition,Tata Mc Graw Hill, 2009.

Reference Books

1 Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
2 David A. Bell, Electronic Devices & Circuits, 4th Ediion, PHI, 2007
3 Floyd, Electronic Devices, Sixth Edition, Pearson Education, 2002.
4 I.J. Nagrath, Electronic Devices and Circuits, PHI, 2007.
5 Anwar A. Khan and Kanchan K. Dey, A First Course on Electronics, PHI, 2006.
6 B.P. Singh andRekha Singh, Electronic Devices and Integrated Circuits, Pearson Education, 2006.

7 Rashid M, Microelectronics Circuits, Thomson Learning, 2007.

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Recognize various biasing technique and compensation technique for transistors	1		3									1	3	2	1
Co2 Design small signal and large signal amplifiers using BJT for various application	3	1		3	3		2	3						1	
Co3 Design small signal amplifiers using FET and MOSFET	3	1		2	3		1	2						1	
Co4 Design Rectifiers and power supplies for various applications	3	1		2	3		1	2						1	
Co5 Design high and low frequency amplifiers and to calculate Bandwidth	2	1		2	3	1		2	1	1					

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315ECP07 **DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING IN C++ LAB** **L T P C 0 0 4 2**

Course Objectives

- Understand the basic and Advanced Concepts of C++.
- Identify and Practice the Object Oriented Programming Concepts and Techniques
- Implement the different Linear Data Structures
- Manipulate Non-Linear Data Structures.
- Implement Sorting and Searching Algorithms.

LIST OF EXPERIMENTS

C++ PROGRAMS:

1. Passing Default Arguments.
2. Inline Function and Friend Function.
3. Constructor and Destructor.
4. Array of Objects.
5. Function Overloading and Operator Overloading
6. Data Conversion.
7. Inheritance.
8. Virtual Functions and Templates.

DATA STRUCTURE USING C++:

9. Implementation of Linked List, Stack, and Queue.
10. Implementation of Binary Search Tree.
11. Implementation of AVL Tree.
12. Implementation of Shortest Path Algorithm
13. Implementation of Minimum Spanning Tree
14. Implementation of Sorting Algorithms.
15. Implementation of Searching Algorithms.

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Implement basic and advanced concepts of Object Oriented Programming using C++

CO2: Apply Good Programming Design methods for Program Development using Object Oriented Concepts.

CO3: Develop C++ programs for manipulating Stacks, Queues, Linked Lists.

CO4: Apply the different Non-Linear Data Structures for Implementing Solutions to Practical Problems.

CO5: Analyze and Implement various Searching and Sorting Algorithms.

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Implement basic and advanced concepts of Object Oriented Programming using C++	2	1		2	2		1	3						1	
Co2 Apply Good Programming Design methods for Program Development using Object Oriented Concepts.	2	3		3	2		3	2				1		1	
Co3 Develop C++ programs for manipulating Stacks, Queues, Linked Lists.	3	1		3	2	3	1	1		1				1	
Co4 Apply the different Non-Linear Data Structures for Implementing Solutions to Practical Problems.	3	1		3	2	3	1	1		1				1	
Co5 Analyze and Implement various Searching and Sorting Algorithms.	2	1		2	2		1	3						1	

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315ECP08	Digital Electronics Laboratory	L T P C 0 0 4 2

Course Objectives

- Identify the various functions of digital IC's.
- Design and Implement Magnitude comparator using MSI device
- Design and Implement Parity generator and checker using MSI device
- Design and analyse the various combinational circuits using MSI device.
- Design and analyse various sequential circuits using MSI device

LIST OF EXPERIMENTS

1. Design and implementation of Half/Full-Adder and subtractor using basic Gates
2. Design and implementation of code converters using logic gates
   BCD to excess-3 code and vice versa
   Binary to gray and vice-versa
3. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC 7483
4. Design and implementation of 2 bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
5. Design and implementation of 16 /even parity generator and checker using IC74180.
6. Design and implementation of Multiplexer and De- odd multiplexer using logic gates and study of IC74150 and IC 74154
7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147
8. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters using MSI circuits.
9. Design and implementation of 3-bit synchronous up-counter, down-counter using MSI circuits.
10. Study of RAM as a Storage Device

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Apply Digital ICs for various applications.

CO2: Apply the Magnitude comparator using MSI device

CO3: Apply the operation of Parity generator and checker using MSI device

CO4: Implement the various combinational circuits using MSI device.

CO5: Implement and analyse various sequential circuits using MSI device

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Apply Digital ICs for various applications.	2	1		2	2		1	3						1	
Co2 Apply the Magnitude comparator using MSI device	2	1		2	2		1	3						1	
Co3 Apply the operation of Parity generator and checker using MSI device	2	1		2	2		1	3						1	
Co4 Implement the various combinational circuits using MSI device.	2	1		2	2		1	3						1	

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co5 Implement and analyse various sequential circuits using MSI device	**3**	**1**		**3**	**3**		**2**	**3**						**1**	

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315ECP09	Analog Electronics-I Laboratory	L T P C 0 0 4 2

Course Objectives

- Analyze the different parameters of power supply circuits.
- Design amplifier circuit for various biasing technique
- Design Darlington amplifiers
- Design differential amplifiers
- Design of Power amplifiers

LIST OF EXPERIMENTS

LIST OF EXPERIMENTS

1 a).Power Supply circuit - Half wave rectifier with simple capacitor filter.

b). Power Supply circuit - Full wave rectifier with simple capacitor filter.

2. Fixed Bias amplifier circuit using BJT.

3 Design and construct BJT Common Emitter Amplifier using voltage divider bias.

4 Design and construct BJT Common Collector Amplifier using voltage divider bias.

5 Design and Construct Darlington Amplifier using BJT.

6 Source follower with Bootstrapped gate resistance.

7 Differential amplifier using BJT.

8 Design of Class A Power Amplifier.

9 Class B Complementary symmetry power amplifiers.

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Design power supply circuits for various application
CO2: Calculate the gain of the amplifier
CO3: Measure the Bandwidth of Darlington amplifiers
CO4: Measure the CMRR value for differential amplifiers
CO5: Calculate the gain of the power amplifier

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Design power supply circuits for various application		1	3	1			1		3	3	2				
Co2 Calculate the gain of the amplifier		2		3	2		2	3				1		1	
Co3 Measure the Bandwidth of Darlington amplifiers		2		3	2	3	1	1		1				1	
Co4 Measure the CMRR value for differential amplifiers		2		3	2	3	1	1		1				1	

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co5 Calculate the gain of the power amplifier		**2**		**3**	**2**	**3**	**1**	**1**		**1**				**1**	

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415PRT01	PROBABILITY AND RANDOM PROCESSES	L T P C
		3 1 0 4

Course Objectives

- To impart the knowledge of basic probabilistic theory.
- To learn one dimensional discrete and continuous probability distributions occurring in natural phenomena.
- To extend the probability theory to two dimensional random variable and to study the statistical measures.
- To study the classification and analysis of few discrete random process.
- To be able to analyze the response of random inputs to linear time invariant systems.

UNIT I PROBABILITY AND RANDOM VARIABLE 9+3

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

UNIT II PROBABILITY DISTRIBUTION 9+3

Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions and their properties - Functions of a random variable-simple applications.

UNIT III TWO-DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Central limit theorem (Statement and applications only for independent and identically distributed random variables).

UNIT IV RANDOM PROCESSES 9+3

Classification – Stationary process – Poisson process - Markov process - Discrete parameter Markov chain – Chapman-Kolmogorov equations – Random telegraph process-Application problems for each process.

UNIT V CORRELATION AND SPECTRAL DENSITIES 9+3

Auto-correlation functions, Cross-correlation functions , Power spectral density, Cross spectral density – Properties(Statements and Applications only) – Wiener-Khintchine relations (Statement and Applications only).

Total Hours 60

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Imbibe the knowledge of basic probability improves the quality of interpretation and decision making in real time problems of uncertainty.

CO2: Learn the concept of two dimensional random variables helps to understand and analyse the statistical measures which describe an outcome of a random experiment.

CO3: Understand and characterizing the random variable phenomenon which evolve with respect to time in a probabilistic approach.

CO4: Gain the concept of the linear system with random inputs.

Text Books

1 Ibe, O.C.,"Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007.

Reference Books

1 Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill edition, New Delhi, 2014.

2 Peebles, P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th edition, New Delhi, 2005.

3 Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishing company Limited, New Delhi, 2014.

4 Kandasamy. P.,Thilagavathy, K.,&Gunavathi.K., "Probability, Statistics and random processes"., S.Chand & Company Ltd., New Delhi, 2014.

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Imbibe the knowledge of basic probability improves the quality of interpretation and decision making in real time problems of uncertainty.		2		3	2		2	3				1		1	
Co2 Learn the concept of two dimensional random variables helps to understand and analyse the statistical measures which describe an outcome of a random experiment.		2		3	2	3	1	1		1				1	
Co3 Understand and characterizing the random variable phenomenon which evolve with respect to time in a probabilistic approach.		2		3	2	3	1	1		1				1	
Co4 Gain the concept of the linear system with random inputs.	3	1		3	3		2	3		0				1	

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415ECT02	SIGNALS AND SYSTEMS	L T P C 3 1 0 4

Course Objectives

- Demonstrate an understanding of the fundamental properties and representation of discrete and continuous time signals.
- Do Spectral analysis of CT periodic and aperiodic signals using CT Fourier and Laplace methods.
- Analyse and Characterization of total response, impulse response and frequency response of LTI CT systems.
- Use Discrete Time Fourier Transforms and Z transform to analyze discrete time signals.
- Analyse and Characterization of total response, impulse response and frequency response of LTI DT systems.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS **9+3**

Continuous Time signals (CT signals), Discrete Time signals (DT signals) - Step, Ramp, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, Energy and power, even and odd, Deterministic and Random signals, Transformation on Independent variables -CT systems and DT systems, Properties of Systems – Linearity, Causality, Time Invariance, Stability, Invertibility and LTI Systems.

UNIT II ANALYSIS OF CT SIGNALS **9+3**

Fourier Series Analysis, Spectrum of CT Signals, Continuous Time Fourier Transform and Laplace Transform in Signal Analysis, Properties of Fourier Transform, Laplace Transform-Properties-ROC, Parseval's Theorem, Sampling Theorem and Aliasing.

UNIT III LTI-CT SYSTEMS **9+3**

Differential equations-Total Response- Fourier Transform & Laplace Transform, Impulse response, Convolution Integral, Frequency response.

UNIT IV ANALYSIS OF DT SIGNALS **9+3**

Spectrum of DT Signals, Discrete Time Fourier Transform (DTFT), Z-Transform in signal analysis, Z-transform-Properties-ROC and Inverse Z Transform-Partial Fraction-Long Division.

UNIT V LTI-DT SYSTEMS **9+3**

Difference equations, Total Response-Z- Transform, Impulse response, Convolution sum, Frequency response

Total Hours 60

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Categorize the properties and representation of discrete and continuous time signals.
CO2: Analyze the continuous time signal using Fourier and Laplace transform.
CO3: Determine total response, impulse response and frequency response of LTI-CT systems
CO4: Analyze the discrete time signals using Discrete Time Fourier Transforms and Z transform
CO5: Determine total response, impulse response and frequency response of LTI-DT systems

Text Books

1 AlanV.Oppenheim, Alan S.Willsky with S.Hamid Nawab, Signals & Systems, 2nd edn., Pearson Education, 2015
2 M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH 2003.

Reference Books

1 Lathi.B.P,Signals Systems and Communication, B S Publications, Hyderabad, 2001.
2 Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley, 1999
3 K.Lindner, "Signals and Systems", McGraw Hill International, 1999
4 Michael J Roberts, "Fundamentals of Signals and systems" Tata McGraw Hill, 2007.

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Categorize the properties and representation of discrete and continuous time signals.	3	1		3	2	3	1	1		1				1	
Co2 Analyze the continuous time signal using Fourier and Laplace transform.		2		3	2	3	1	1		1				1	
Co3 Determine total response, impulse response and frequency response of LTI-CT systems		2		3	2	3	1	1		1				1	
Co4 Analyze the discrete time signals using Discrete Time Fourier Transforms and Z transform		2		3	2	3	2	1		1				1	
Co5 Determine total response, impulse response and frequency response of LTI-DT systems		2		3	2	3	1	1		1				1	

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415ECT03	LINEAR INTEGRATED CIRCUITS	L T P C
		3 0 0 3

Course Objectives

- Describe the Operational Amplifier and its characteristics
- Learn the linear and non-linear applications of operational amplifiers
- Define the theoretical concept and applications of PLL
- Understand the Concept of distinct types of A-D and D-A converters
- Describe the operational principle of voltage regulators and Special function ICs

UNIT I OPERATIONAL AMPLIFIER CHARACTERISTICS 9

OPERATIONAL AMPLIFIER CHARACTERISTICS: Internal circuit diagram of IC741, characteristics of an ideal operational amplifier, op-amp with negative feedback, , General operational amplifier stages open loop gain, input offset voltage, input bias current, input offset current, total output offset voltage, frequency response of op-amp, stability, slew rate and methods of improving slew rate.

CIRCUIT CONFIGURATION FOR LINEAR IC'S: Current mirror and current sources, Current sources as active loads, Voltage Sources, Voltage References.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Application of Op-Amp: Inverting and Non-Inverting amplifiers, voltage follower, summing amplifier, Differential amplifier, Instrumentation amplifiers, Differentiator, Integrator, Voltage to Current converter and Current to Voltage converter, Sine wave Oscillators, comparator and Schmitt trigger, Precision rectifier, Log and Antilog amplifiers, Clipper and Clamper, Sample and hold circuit.

Active Filters: Design of Low Pass and High Pass filters, Band pass Butterworth filters

UNIT III PHASED LOCKED LOOP & ITS APPLICATIONS 9

PLL -principle of operation, building blocks of PLL, Characteristics, Derivation of expression of Lock & Capture range, IC 566-Voltage controlled oscillator, Monolithic PLL IC 565- Functional block diagram, Applications of PLL: AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV A-D AND D-A CONVERTERS 9

A/D conversion: Ramp converters, Flash type, Successive Approximation, Dual slope converters, Parallel A/D converters, Tracking A/D converters, Single Slope type, A/D converters using Voltage-to-Time Conversion - Over-sampling A/D Converters.

D/A conversion: D/A conversion fundamentals, weighted resistor summing D/A Converter, R-2R Ladder D/A converter.

UNIT V VOLTAGE REGULATORS& SPECIAL FUNCTION ICs 9

IC Voltage regulators-IC LM7805-Line Regulation - Load Regulation -Adjustable Output Voltage Regulator, Switched Mode Power Supply, IC L8038 -Function generator-Functional Block Diagram, Timer IC 555- Functional Block Diagram, Applications-Frequency to Voltage and Voltage to Frequency converters

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1:	Explain the principle of operational amplifier and its characteristics
CO2:	Demonstrate the various applications of operational amplifier
CO3:	Generalize the theory of phased lock loop and its characteristics
CO4:	Examine the concept of A-D and D-A converters using operational amplifier
CO5:	Summarize how operational amplifier can be modeled as voltage regulator and Special function IC

Text Books

1. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, Tata McGraw-Hill, 2007.
2. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
3. S.Salivahanan & V.S. Kanchana Bhaskaran, Linear Integrated Circuits, TMH, 2008.
4. Gayakwad A R,"Op-Amps and Linear Integrated circuits," Pearson Education, NewDelhi, Fourth Edition, 2004 Prentice Hall of India, New Delhi.

Reference Books

1. B.S.Sonde, System design using Integrated Circuits, New Age Pub, 2nd Edition,2001

2 Gray and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley International, 2005.
3 J.Michael Jacob, Applications and Design with Analog Integrated Circuits, Prentice Hall of India, 1996.
4 William D.Stanley, Operational Amplifiers with Linear Integrated Circuits, Pearson Education, 2004.
5 Botkar K.R., "Integrated Circuits ", Khanna Publishers, 1996.
6 Caughlier and Driscoll, "Operational amplifiers and Linear Integrated circuits", Prentice Hall, 1989.
7 Millman J. and Halkias C.C., "Integrated Electronics ", McGraw Hill, 2001.

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Explain the principle of operational amplifier and its characteristics		2		3	2	3	1	1		1				1	
Co2 Demonstrate the various applications of operational amplifier		2		3	2	3	1	1		1				1	
Co3 Generalize the theory of phased lock loop and its characteristics	3	1		3	2		2		1					1	
Co4 Examine the concept of A-D and D-A converters using operational amplifier	3	1		3	2		2		1		1			1	
Co5 Summarize how operational amplifier can be modeled as voltage regulator and Special function IC	3	1		3	2		2		1		1			1	

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415ECT04	Analog Electronics – II	L T P C
		3 0 0 3

Course Objectives

- Investigate the various classification of feedback amplifiers for single and multi stage modes
- Analyse of different categories of tuned amplifiers
- Learn the concept of sustained oscillation for different types of oscillators
- Illustrate the concept of clampers, multivibrators and wave shaping circuits
- Discuss the features of ramp generators, sine wave converters and time base generators

UNIT I FEEDBACK AMPLIFIERS **9**

Concept of feedback- topological classification-voltage series, voltage shunt, current series, current shunt - effect of feedback on gain, stability, distortion, band width, input and output impedances – practical feedback amplifier circuits and their analysis –multistage feedback amplifier.

UNIT II TUNED AMPLIFIERS **9**

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers -Analysis of single tuned amplifier - double tuned amplifier –Transformed Coupled amplifier effect of cascading single tuned and double tuned amplifiers on bandwidth - Stagger tuned amplifiers - large signal tuned amplifiers - Class C tuned amplifier - Efficiency and applications of Class C tuned amplifier - Stability of tuned amplifiers, Neutralization.

UNIT III OSCILLATORS **9**

Barkhausen criterion for sustained oscillations - RC oscillators – RC phase shift oscillator-Ring Oscillators and Wein bridge oscillator- resonant circuit oscillators –LC oscillators– Hartley and Colpitts oscillators – crystal oscillators and frequency stability.

UNIT IV WAVE SHAPING CIRCUITS AND MULTIVIBRATORS **9**

Low pass RC circuit – integrator - High pass RC circuit – differentiator- Clamper circuits – positive, negative and biased clampers -Voltage doubler, tripler and quadrupler circuits. Multivibrators – design of transistor astable, monostable and bistable multivibrators using transistors– Schmitt trigger circuit.

UNIT V TIME BASE GENERATORS **9**

General features of time base signals – RC ramp generator – constant current ramp generator, UJT saw tooth generator – Bootstrap ramp generator – Miller integrator ramp generator – triangular waveform generator – pulse generator circuit– function generator – sine wave converter-Current time base generators

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Design the various types of feedback amplifiers for single and multi stage modes
CO2: Identify the various types of tuned amplifiers
CO3: Interpret the operation of oscillators for different real time applications
CO4: Demonstrate the concept of clampers, multivibrators and wave shaping circuits
CO5: Manipulate the features of ramp generators, sine wave converters and time base generators

Text Books

1 Millman and Halkias, "Integrated Electronics", Tata McGraw Hill International Edition, 2002.
2 David A. Bell, "Solid State Pulse circuits", PHI Learning Private Ltd, Fourth Edition, 2007

Reference Books

1 David A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, Fourth Edition, 2007
2 R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI Learning Pvt. Ltd, Ninth Edition, 2008
3 Sedra / Smith, Micro Electronic Circuits Oxford University Press, 2004.
4 Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 2nd Edition, TMH, 2007

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Design the various types of feedback amplifiers for single and multi stage modes	3	1		3	2		2		1					1	
Co2 Identify the various types of tuned amplifiers	3	1		3	2		2		1		1			1	
Co3 Interpret the operation of oscillators for different real time applications	3	1		3	2		2		1					1	
Co4 Demonstrate the concept of clampers, multivibrators and wave shaping circuits	3	1		3	2	3	1	3						1	
Co5 Manipulate the features of ramp generators, sine wave converters and time base generators	3	1		3	2	3	1	3						1	

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415ECP07	LINEAR INTEGRATED CIRCUITS LABORATORY	L T P C 0 0 4 2

Course Objectives

- Demonstrate an understanding the Characteristics of op-amp
- Construct the op-amp circuits for various applications
- Demonstrate wave shaping circuits using op-amp
- Study of power supplies and its regulation
- Simulate op-amp circuits for various applications by using Multisim tool

LIST OF EXPERIMENTS

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active lowpass, Highpass and bandpass filters.
5. Astable & Monostable multivibrators using op-amp.
6. Schmitt Trigger using op-amp.
7. Phase shift and Wien bridge oscillators using op-amp.
8. Astable and monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier.
10. Study of Voltage Regulator ICs.
11. Study of SMPS.

SIMULATION USING MULTISIM

1. Instrumentation amplifier
2. Active low pass, High pass and band pass filters.
3. Astable & Monostable multivibrators using op-amp.
4. Schmitt Trigger using op-amp.
5. Phase shift and Wien bridge oscillators using op-amp.

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Determine the Characteristics of op-amp
CO2: Modify the op-amp circuits for various applications
CO3: Extrapolate wave shaping circuits using op-amp
CO4: Describe the power supplies and its regulation
CO5: Design op-amp circuits for various applications by using Multisim tool

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Determine the Characteristics of op-amp	3	1		3	2	3	1	3						1	
Co2 Modify the op-amp circuits for various applications	3	1		3	2	3	1	3						1	
Co3 Extrapolate wave shaping circuits using op-amp	3	1		3	2	3	1	3						1	

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co4 Describe the power supplies and its regulation	3	1		3	2	3	1	3						1	
Co5 Design op-amp circuits for various applications by using Multisim tool	3	1		3	2	1								1	

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415ECP08	ANALOG ELECTRONICS - II LABORATORY	L T P C 0 0 4 2

Course Objectives

- Demonstrate an understanding of Negative feedback amplifiers using discrete BJT
- Demonstrate an understanding of oscillator using discrete BJT
- Design of Wave Shaping Circuits using discrete BJT
- Construct the multivibrators using discrete BJT
- Simulate Negative feedback amplifiers, Multivibrators, Boot strap ramp generator and Miller Integrator Ramp generator using Multisim tool

LIST OF EXPERIMENTS

1. Negative feedback amplifiers: Voltage Series and Voltage Shunt feedback amplifiers
2. Tuned class C amplifier
3. RC Phase shift oscillator, Wien Bridge Oscillator
4. Hartley Oscillator, Colpitts Oscillator
5. Wave Shaping Circuits : Integrators, Differentiators, Clippers and Clampers
6. Multivibrators: Astable, Monostable and Bistable
7. Miller Integrator Ramp Generator

SIMULATION USING MULTISIM

1. Negative feedback amplifiers: Current Series and Current Shunt feedback amplifiers
2. Voltage Doubler and Tripler
3. Multivibrators: Astable, Monostable ,Bistable and Schmitt trigger
4. Boot Strap Ramp Generator
5. UJT Sawtooth Generator

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Measure the frequency response of Negative feedback amplifiers using discrete BJT
CO2: Design an oscillator circuits using discrete BJT
CO3: Construct the Wave Shaping Circuits using discrete BJT
CO4: Demonstrate the multivibrators using discrete BJT
CO5: Design Negative feedback amplifiers, Multivibrators, Boot strap ramp generator and Miller Integrator Ramp generator using Multisim tool

Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Measure the frequency response of Negative feedback amplifiers using discrete BJT		2										1	3	2	2
Co2 Design an oscillator circuits using discrete BJT		2		3	2	3	1	3						1	
Co3 Construct the Wave Shaping Circuits using discrete BJT		2		3	2	3	1	3						1	
Co4 Demonstrate the multivibrators using discrete BJT	3	1		3	2	3	1	3						1	
Co5 Design Negative feedback amplifiers, Multivibrators, Boot strap	3	1		2	3	2	1							1	

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Course Outcome	PSO 1	PSO 2	PSO 3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
ramp generator and Miller Integrator Ramp generator using Multisim tool															

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415ECE01	INDUSTRIAL ELECTRONICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Discuss the behavior of SCR and TRIAC circuits
- Analyze of voltage regulators using SCR for various speed control applications
- Study the principle of Industrial Heating and thermal losses under RF
- Classify the Industrial Timing Circuits and its components
- Learn the PLC programming skills for industrial automation applications .

UNIT I THYRISTORS 9

SCR – SCR behaviour and rating – Phase control of SCR – Turn-off of SCR – SCR with resistive load and inductive load – Rectifiers with back EMF load – TRIAC – TRIAC circuits – Phase control of SCR.

UNIT II VOLTAGE AND MOTOR SPEED REGULATORS 9

Voltage compensator – Solid state DC voltage regulation – DC shunt motor – Armature control and field control of motor speed – Electronic control of DC motor – Speed regulator action – Full wave motor speed regulation by one SCR

UNIT III INDUSTRIAL HEATING 9

Induction heating – Principles- Theory – Merits – Applications – High frequency power source for induction heating Dielectric heating – Theory – Electrodes used in dielectric heating – Method of coupling of electrodes to RF generator – Thermal losses in dielectric heating

UNIT IV INDUSTRIAL TIMING CIRCUITS 9

Constituents of industrial timing circuits – Timers – Classification of timers – Thermal timers – Electromechanical timers – Electronic timers – Classification of electronic timers – Digital timing element – Digital counters – SCR delay timer – IC electronic timer.

UNIT V PROGRAMMABLE LOGIC CONTROLLERS 9

Number system and codes – Basics of PLC programming – Timer and counter instructions – Data manipulation instructions – Shift register and sequence instructions.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Explain the behavior of SCR and TRIAC circuits
CO2: Design the voltage regulators using SCR and various speed control methods
CO3: Identify the thermal losses and Manipulate the Industrial Heating under RF
CO4: Recognize the various Industrial Timing Circuits
CO5: Develop the PLC programming for industrial applications

TEXT BOOKS

1. Frank D. Petruzella, Industrial Electronics, McGraw Hill International Editions, 1996
2. G.K. Mithal, Ravi Mithal, Industrial Electronics, Khanna Publishers, Delhi, 1995
3. George M. Chute, Robert D. Chute, Electronics in Industry, McGraw Hill International Edition

REFERENCE BOOKS

1. M. H. Rashid, "power Electronics Circuits, Devices and Application", PHI, 3rd edition, 2004.

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Explain the behavior of SCR and TRIAC circuits	2	3	2	1								1	3	1	
Co2	Design the voltage regulators using SCR and various speed control methods	3	2	1									1	3	1	
Co3	Identify the thermal losses and Manipulate the Industrial Heating under RF	3	2	1									1	3	1	
Co4	Recognize the various Industrial Timing Circuits	3	2	1									1	3	1	
Co5	Develop the PLC programming for industrial applications	3	2	1									1	3	1	

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415ECE02	CONSUMER ELECTRONICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Learn the concepts of audio system and processing.
- Study the operation of Television system and DTH.
- Infer the knowledge in Telecommunication systems.
- Identify the various commercial electronic applications.
- Identify the various domestic electronic applications

UNIT I AUDIO SYSTEM **9**

Home Audio systems ,Microphones, Head Phones and Hearing Aids, Loud Speakers, Loud Speaker Systems, Optical Recording and reproduction systems – CDs, DVDs, Blue ray technology, iPods, MP4 players and accessories.

UNIT II TELEVISION SYSTEM **9**

Elements of TV Communication System, Scanning, Composite Video signal, Need for synchronizing and blanking pulses, Picture Tubes, Construction and working of Camera Tubes, Block diagram of TV Receiver, TFT- LCD and Plasma TV fundamentals, Block diagram and principles of working of cable TV and DTH.

UNIT III TELECOMMUNICATION SYSTEMS **9**

Basics of Telephone system, Radio system – VHF and UHF – Types of mobile phones- Caller ID Telephone, Intercoms, Cordless Telephones, Cellular mobile systems.

UNIT IV ELECTRONICS **9**

Automatic Teller Machines, Facsimile machines, Digital Diaries, Safety and security systems, Bar Coders – Bar codes, scanner and decoder.

UNIT V HOME ELECTRONICS **9**

Digital Camera system, Microwave ovens, Washing Machines, Air Conditioners and Refrigerators,Dish washers and Set Top Box.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Explain the concepts of audio system and processing
CO2: Describe the operation of Television system and DTH
CO3: Demonstrate the functions Telecommunication systems
CO4: Show the various commercial electronic applications
CO5: Show the various domestic electronic applications

TEXT BOOKS

1. S.P.Bali, Consumer Electronics, Pearson Education, 2005.
2. R.R.Gulati ,Monochrome and Color Television New Age International Publisher,2001

REFERENCE BOOKS

1. C.A. Schuler and W.L. .Mc Namee, Modern Industrial Electronics, McGraw Hill, 2002.
2. D.J. Shanefield, Industrial Electronics for Engineers, Chemists and Technicians, Jaico Publishing House, 2007.

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
Co1	Explain the concepts of audio system and processing	3	2	1									1	3	1	
Co2	Describe the operation of Television system and DTH	3	2	1									1	3	1	
Co3	Demonstrate the functions Telecommunication systems	3	2	3	1	3							1	3	1	
Co4	Show the various commercial electronic applications	3	2	1									1	3	1	
Co5	Show the various domestic electronic applications	3	2	1									1	3	1	

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415ECE03	GREEN ELECTRONICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Discuss about the knowledge on the theories, eco-design concepts, methods for designing a range of sustainable green electronic products with the recommended standards and regulations.
- Address relevant issues on Green Electronic products and materials for electronic design
- Study the applications of green electronic systems
- Acquire comprehensive and in-depth knowledge of reliability of green electronics systems
- Learn the importance of green nanotechnology

UNIT I INTRODUCTION TO GREEN ELECTRONICS AND ENVIRONMENTAL REGULATIONS 9

Environmental concerns of the modern society-Overview of electronics industry and their relevant regulations in India, European Union and other key countries-Restriction of Hazardous substances (RoHS)-Waste Electrical and electronic equipment (WEEE)-Energy using Product (EuP) and Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH).

UNIT II FABRICATION OF GREEN PWB & GREEN FINISHES FOR IC COMPONENTS 9

Introduction - Impact of Assembly Processes-Impact of Electronic Design-PWB construction-Material Screening- Green Finishes for IC components- Lead frame finish Evolution-Component finish requirements-Tin Based finishes for IC Components-PPF Component finishes-Comparison-Tin Whiskers- X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products-Recycling

UNIT III GREEN ELECTRONIC SYSTEMS AND APPLICATIONS 9

Introduction- OLED- General Characteristics -Structure- Hopping and recombination-Emission Spectrum-Doping-Encapsulation-Optical Cavity-Wave guiding properties-Conductivity-Life Time-Electro-Optical Characteristics-Emission-Emission Intensity-VI Characteristics-OPV -Device Structures-Working principle-OLED TV- Features.

UNIT IV RELIABILITY OF GREEN ELECTRONIC SYSTEMS 9

Reliability-Reliability measures-Weibull Distribution-Lead free Solder interconnections-Lead free solders-Tin/Lead baseline-properties-test environments-Lead free solderable finishes-PCB reliability issues-Connector issues.

UNIT V GREEN NANOTECHNOLOGY 9

Introduction-Importance of Nanotechnology to Green Electronics- manufacture of Nanomaterials-Application areas in Electronics-Nanoapplication examples-Nano Solders.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to :

CO1: Recognize the importance of various environmental regulations in different major countries around the world and the need for compliance with these regulations.
CO2: Describe the process, designtechniques, manufacturing of green electronics systems and assessment of the environmental hazards and suggest ways to reduce them.
CO3: Apply the principles and practices of green electronics in selected consumer products.
CO4: Analyze the reliability of green electronic systems
CO5: Describe the significance of green electronics to nanotechnology domain

TEXT BOOKS

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1. Goldberg L.H., Green Electronics / Green Bottom Line, Environmentally Responsible Engineering, 1st Edition Newnes 2000 ISBN 0-7506-9993-0
2. Shina, Sammy G. Green Electronics Design and Manufacturing. New York: McGraw-Hill Professional, 2008.
3. Wimmer, Wolfgang et.al. Ecodesign Implementation: A Systematic Guidance on Integrating Environmental Consideration into Product Development. Berlin: Springer, 2014.

REFERENCE BOOKS

1. John H. Lau (2003). Electronics manufacturing: with lead-free, halogen-free, and conductive-adhesive materials. New York: McGraw-Hill. 1v
2. WEEE : http://ec.europa.eu/environment/waste/weee/index_en.htm
3. REACH : http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Recognize the importance of various environmental regulations in different major countries around the world and the need for compliance with these regulations.						3	2	3	2		3		3	1	
Co2	Describe the process, design techniques, manufacturing of green electronics systems and assessment of the environmental hazards and suggest ways to reduce them.	3	2	1									1	3	1	
Co3	Apply the principles and practices of green electronics in selected consumer products.	3	2	3	1	3							1	3	1	
Co4	Analyze the reliability of green electronic systems	3	2	1									1	3	1	
Co5	Describe the significance of green electronics to nanotechnology domain	3	2	1									1	3	1	

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415ECE04	OPTOELECTRONIC DEVICES	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Discuss the Polarization, Interference and diffraction of light
- Infer the operation of LASER and various display devices
- Discuss the various optical detection devices like photo detector, thermal detector, photo diodes etc..,
- Extend the application of optoelectronic devices as different optical modulator
- Infer the knowledge in opto-electronics integrated circuits and guided wave devices

UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

Wave nature of light- Polarization- Interference- Diffraction- Light Source- review of Quantum Mechanical concept- Review of Solid State Physics- Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II DISPLAY DEVICES AND LASERS 9

Introduction- Photo Luminescence- Cathode Luminescence- Electro Luminescence- Injection Luminescence- LED- Plasma Display- Liquid Crystal Displays- Numeric Displays- Laser Emission- Absorption- Radiation- Population Inversion- Optical Feedback- Threshold condition- Laser Modes- Classes of Lasers- Mode Locking- laser applications.

UNIT III OPTICAL DETECTION DEVICES 9

Photo detector- Thermal detector- Photo Devices- Photo Conductors- Photo diodes- Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR 9

Introduction- Analog and Digital Modulation- Electro-optic modulators- Magneto Optic Devices- Acousto – Opticdevices- Optical- Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9

Introduction- hybrid and Monolithic Integration- Application of Opto Electronic Integrated Circuits- Integrated transmitters and receivers- Guided wave devices.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Explain the Polarization, Interference and diffraction of light
CO2: Demonstrate the operation of LASER and various display devices
CO3: Describe the various optical detection devices like photo detector, thermal detector, photo diodes etc..,
CO4: Extrapolate the application of optoelectronic devices as different optical modulator
CO5: Explain the opto-electronics integrated circuits and guided wave devices

TEXT BOOKS

1. J- Wilson and J-Haukes- "Opto Electronics – An Introduction"- Pearson/Prentice Hall of India Pvt- Ltd-- New Delhi- 2007
2. Bhattacharya "Semiconductor Opto Electronic Devices"- Pearson/Prentice Hall of India Pvt-- Ltd-- New Delhi- 2006

REFERENCE BOOKS

1. Jasprit Singh- "Opto Electronics – As Introduction to materials and devices" McGraw-Hill International Edition- 1998.
2. Joachim Piprek, Semiconductor Optoelectronic Devices, Elsavier-2003
3. S. O. Kasap, SafaKasap, Optoelectronics and Photonics: Principles and Practices,PHI-2001

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Explain the Polarization, Interference and diffraction of light	3	2	1									1	3	1	
Co2	Demonstrate the operation of LASER and various display devices	3	2	1									1	3	1	
Co3	Describe the various optical detection devices like photo detector, thermal detector, photo diodes etc..,	3	2	3	1	3							1	3	1	
Co4	Extrapolate the application of optoelectronic devices as different optical modulator	3	2	3	1	3							1	3	1	
Co5	Explain the opto-electronics integrated circuits and guided wave devices	3	2	1									1	3	1	

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415ECE05	PCB DESIGN	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Discuss the concepts of connectivity, components and manufacturing of PCB
- Infer the knowledge in various drawing and design rules in Layout planning and design of PCB
- Generalize the design rules for Analog and Digital circuits
- Discuss the concept of various image transfer techniques
- Conceive various plating and etching technique

UNIT I INTRODUCTION TO PRINTED CIRCUIT BOARDS 9

Connectivity in Electronic Equipment-Evolution of Printed Circuit Boards,Components of a Printed Circuit Board,Classification of Printed Circuit Boards,Manufacturing of Basic Printed Circuit Boards,Challenges in Modern PCB Design and Manufacture ,Major Market Drivers for the PCB Industry , PCBs with Embedded Components ,Standards on Printed Circuit Boards , Useful Standards .

UNIT II LAYOUT PLANNING AND DESIGN 9

Reading Drawings and Diagrams,General PCB Design Considerations,Mechanical Design Considerations,Electrical Design Considerations,Conductor Patterns,Component Placement Rules,Fabrication and Assembly Considerations,Environmental Factors,Cooling Requirements and Packaging Density,Layout Design,Layout Design Checklist.

UNIT III DESIGN CONSIDERATIONS FOR SPECIAL CIRCUITS 9

Design Rules for Analog Circuits,Design Rules for Digital Circuits,Design Rules for High Frequency Circuits,Design Rules for Fast Pulse Circuits,Design Rules for PCBs for Microwave Circuits,

UNIT IV IMAGE TRANSFER TECHNIQUES 9

Laminate Surface Preparation,Screen Printing,Pattern Transferring Techniques,Printing Inks,Printing Process,Photo Printing,Laser Direct Imaging

UNIT V PLATING AND ETCHING 9

PLATING: Electroplating,Plating Techniques,General Problems in Plating,General Plating Defects,Special Plating Techniques.

ETCHING:Etching Solutions,Etching Arrangements,Etching Parameters, Equipment and Techniques

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Explain the concepts of connectivity, components and manufacturing of PCB
CO2: Manipulate various drawing and design rules in Layout planning and design of PCB
CO3: Extrapolate the design rules for Analog and Digital circuits
CO4: Describe the concept of various image transfer techniques
CO5: Identify the defects in Plating and Etching process

TEXT BOOKS

1. Raghbir Singh Khandpur, Printed circuit boards _ design_ fabrication_ assembly and testing-McGraw-Hill (2006).

REFERENCE BOOKS

1. Walter C. Bosshart, Printed Circuit Boards: Design and Technology, McGraw-Hill Inc. US (2008).

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Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Explain the concepts of connectivity, components and manufacturing of PCB	3	2	3	1	3							1	3	1	
Co2	Manipulate various drawing and design rules in Layout planning and design of PCB	3	2	1									1	3	1	
Co3	Extrapolate the design rules for Analog and Digital circuits	3	2	3	1	3							1	3	1	
Co4	Describe the concept of various image transfer techniques									1	3	1	2	1		3
Co5	Identify the defects in Plating and Etching process	3	3		2								1	3	1	

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415ECE06	SOLID STATE DEVICES	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Learn the crystal structures of elements used for fabrication of semiconductor devices.
- Infer the concept of fermi levels, movement of charge carriers, Diffusion current and Drift current.
- Study the characteristics, operations of various MOSFET
- Analyze various opto-electronics devices
- Infer the operation of different high power devices like tunnel diodes, IMPATT, TRAPATT etc

UNIT I CRYSTAL PROPERTIES AND GROWTH OF SEMICONDUCTORS 9

Semiconductor materials - Periodic Structures - Crystal Lattices - Cubic lattices - Planes and Directions - Diamond lattice - Bulk Crystal Growth - Starting Materials - Growth of Single Crystal Ingots - Wafers - Doping - Epitaxial Growth - Lattice Matching in Epitaxial Growth - Vapor - Phase Epitaxy - Atoms and Electrons - Introduction to Physical Models - Experimental Observations - Photoelectric Effect - Atomic spectra - Bohr model - Quantum Mechanics - Probability and Uncertainty Principle - Schrodinger Wave Equation - Potential Well Equation - Potential well Problem - Tunneling.

UNIT II ENERGY BANDS AND CHARGE CARRIERS IN SEMICONDUCTORS AND JUNCTIONS 9

Energy bands in Solids, Energy Bands in Metals, Semiconductors, and Insulators - Direct and Indirect Semiconductors - Variation of Energy Bands with Alloy Composition - Charge Carriers in Semiconductors - Electrons and Holes - Electrons and Holes in Quantum Wells - Carrier Concentrations - Fermi Level - Electron and Hole Concentrations at Equilibrium - Temperature Dependence of Carrier Concentrations - Compensation and Space Charge Neutrality - Drift of Carrier in Electric and Magnetic Fields conductivity and Mobility - Drift and Resistance - Effects of Temperature and Doping on Mobility - High field effects - Hall Effect - invariance of Fermi level at equilibrium - Fabrication of p-n junctions, Metal semiconductor junctions.

UNIT III METAL OXIDE SEMICONDUCTOR FET 9

GaAS MESFET - High Electron Mobility Transistor - Short channel Effects - Metal Insulator Semiconductor FET - Basic Operation and Fabrication - Effects of Real Surfaces - Threshold Voltage - MOS capacitance Measurements - current - Voltage Characteristics of MOS Gate Oxides - MOS Field Effect Transistor - Output characteristics - Transfer characteristics - Short channel MOSFET V-I characteristics - Control of Threshold Voltage - Substrate Bias Effects - Sub threshold characteristics - Equivalent Circuit for MOSFET - MOSFET Scaling and Hot Electron Effects - Drain - Induced Barrier Lowering - short channel and Narrow Width Effect - Gate Induced Drain Leakage.

UNIT IV OPTOELECTRONIC DEVICES 9

Photodiodes - Current and Voltage in illuminated Junction - Solar Cells - Photo detectors - Noise and Bandwidth of Photo detectors - Light Emitting Diodes - Light Emitting Materials - Fiber Optic Communications Multilayer Heterojunctions for LEDs - Lasers - Semiconductor lasers - Population Inversion at a Junction Emission Spectra for p-n junction - Basic Semiconductor lasers - Materials for Semiconductor lasers.

UNIT V HIGH FREQUENCY AND HIGH POWER DEVICES 9

Tunnel Diodes, IMPATT Diode, operation of TRAPATT and BARITT Diodes, Gunn Diode - transferred - electron mechanism, formation and drift of space charge domains, p-n-p-n Diode, Semiconductor Controlled Rectifier, Insulated Gate Bipolar Transistor

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES

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Upon Completion of this course, students will be able to :

CO1: Describe the crystal structures of elements used for fabrication of semiconductor devices.

CO2: Explain the concept of fermi levels, movement of charge carriers, Diffusion current and Drift current.

CO3: Describe the characteristics, operations of various MOSFET

CO4: Identify the various opto-electronics devices

CO5: Demonstrate the operation of different high power devices like tunnel diodes, IMPATT, TRAPATT etc

TEXT BOOKS

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

REFERENCE BOOKS

1. YannisTsividis, Operation & Mode line of MOS Transistor, 2nd Edition, Oxford University Press, 1999
2. Donald A. Neaman, Semiconductor Physics and Devices, 3rd Edition, TMH, 2002.
3. D.K. Bhattacharya &Rajinish Sharma, Solid State Electronic Devices, Oxford University Press, 2007

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Describe the crystal structures of elements used for fabrication of semiconductor devices.	2	3		1	2							1	3	1	
Co2	Explain the concept of fermi levels, movement of charge carriers, Diffusion current and Drift current.	2	3		1	2							1	3	1	
Co3	Describe the characteristics, operations of various MOSFET	3	2		3	2				1			1	2	3	
Co4	Identify the various opto-electronics devices	2	3		1	2							1		3	
Co5	Demonstrate the operation of different high power devices like tunnel diodes, IMPATT, TRAPATT etc.	3	2		3	2				1			1		3	

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515ECT02	DIGITAL SIGNAL PROCESSING	L T P C 3 1 0 4

COURSE OBJECTIVES:

- Compute FFT of a discrete time signal.
- Design the various FIR filter techniques.
- Design the various IIR filter techniques.
- Analyze the finite word length effects in signal processing.
- Devise the fundamentals of digital signal processors.

UNIT I FAST FOURIER TRANSFORM AND CONVOLUTION 9+3

Introduction to DFT – Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –sectioned convolution- overlap add method- overlap save method.

UNIT II FINITE IMPULSE RESPONSE DIGITAL FILTERS 9+3

Linear phase filters-Frequency response of linear phase FIR filters-Fourier series method of designing FIR filters-Windowing techniques for design of linear phase FIR filters: Rectangular- Hamming- Hanning-Blackman windows. Gibbs phenomenon –principle of frequency sampling technique- Realization - FIR filters-Direct form,Cascade ,Linear phase FIR realization.

UNIT III INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9+3

Review of design of analogue Butterworth and Chebyshev Filters- Frequency transformation in analog domain – Design of IIR digital filters using impulse invariance technique –bilinear transformation – pre warping –Frequency transformation in digital domain – IIR Filter Realization - Direct form I, Direct form II, cascade and parallel.

UNIT IV FINITE WORD LENGTH EFFECTS 9+3

Quantization noise – truncation and rounding error-derivation for quantization noise power – Binary fixed point and floating point number representations – Comparison – input quantization error-coefficient quantization error –Product quantization error-limit cycle oscillations-dead band- Overflow error-signal scaling.

UNIT V DIGITAL SIGNAL PROCESSOR -TMS320C54X 9+3

Introduction-Architecture of C54X – 'C54X buses-Internal memory organization-Central Processing unit-Arithmetic Logic unit-Barrel Shifter-Multiplier/Adder unit-Compare, select and store unit-On-chip Peripherals-External Bus Interface - Overview of instruction set –Arithmetic instructions-Data Transfer instructions-Logical instructions

TOTAL HOURS:60 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Calculate the FFT of a discrete time signal.
CO2: Demonstrate various FIR filter techniques.
CO3: Demonstrate various IIR filter techniques.
CO4: Summarize finite word length effects in signal processing.
CO5: Explain the fundamentals of Digital signal processor.

TEXT BOOKS

1. John G Proakis- Dimtris G Manolakis- Digital Signal Processing Principles-Algorithms and Application- Pearson/PHI- 4th Edition- 2007-
2. S.K.Mitra- "Digital Signal Processing- A Computer based approach"- TataMcGraw-Hill- 1998- New Delhi.
3. B.Venkataramani& M-Bhaskar- Digital Signal Processor Architecture-Programming and Application- TMH 2002

REFERENCE BOOKS:

1. Allan V.Openheim, Ronald W.Sehafer& John R.Buck-"Discrete Time Signal Processing",Third edition-Pearson/Prentice Hall,2014
2. Johny R-Johnson: Introduction to Digital Signal Processing- Prentice Hall- 1984
3. Emmanuel I feachor "Digital Signal Processing: A Practical Approach", 2/E -Prentice Hall
4. Li Tan " Digital Signal Processing" Elsevier-2008

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Calculate the FFT of a discrete time signal.	3	2		1	2							1	3	1	
Co2	Demonstrate various FIR filter techniques.	3	2		1	2							1	2	1	
Co3	Demonstrate various IIR filter techniques.	3	2		1	2							1	3	1	
Co4	Summarize finite word length effects in signal processing.	2	2		1	3							1	2	1	
Co5	Explain the fundamentals of Digital signal processor.									1	3	1	2		1	2

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515ECT03 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Summarize the architecture and assembly language programming of microprocessors
- Defend the architecture and assembly language programming of microcontrollers
- Demonstrate the concept of interrupts and interfacing with various peripherals.
- Integrate the features of a microcontroller and its timer applications.
- Justify the architectural features of PIC with 8051 microcontroller

UNIT I 8085 MICROPROCESSOR 9

8085 Architecture – Instruction set – Addressing modes–Timing diagrams – Assembly language programming – Interrupts

UNIT II 8086 MICROPROCESSOR AND PERIPHERAL INTERFACING 9

Intel 8086 Internal Architecture – 8086 Addressing modes- Instruction set- 8086 Assembly language Programming-Interrupts - Architecture: Serial I/O (8251)- parallel I/O (8255) –Keyboard and Display controller (8279).

UNIT III 8051 MICROCONTROLLER 9

8051 Internal Architecture - Ports and circuits- External memory –instruction set – Addressing modes – Assembly language programming –-Timer / counter – Serial Communication – Interrupt .

UNIT IV 8051 REAL WORLD INTERFACING 9

8051 Interfacing: Keyboard, LCD, Stepper Motors, Interfacing to external memory and 8255.

UNIT V INTRODUCTION TO PIC16F8XX MICROCONTROLLER 9

PIC16F8XX Flash microcontrollers: Pin diagram of 16F8XX, Architectural features, I/O Ports, & Timers, Interrupts, Memory organizations

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: Recognize the basic microprocessor architecture and its concepts.
CO2: Outline the concepts of peripheral interfacing mechanisms.
CO3: Design various assembly language programming using microprocessors and microcontroller.
CO4: Extend the real world interfacing with microcontroller
CO5: Extrapolate the architecture of PIC microcontroller and its addressing modes .

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing, New Delhi, 2013
2. JohnUffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002
3. Mohammed Ali Mazidi and Janice GillispieMazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.
4. John B.Peatman, Design with PIC Microcontrollers, Pearson Education Asia, 2002.

REFERENCE BOOKS

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000
2. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Co1	Recognize the basic microprocessor architecture and its concepts.	3	3		2	3							1	3	1	
Co2	Outline the concepts of	1			1		3	3	2						1	3

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Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	peripheral interfacing mechanisms.															
Co3	Design various assembly language programming using microprocessors and microcontroller.	2	3	1		2	1	1						2	1	
Co4	Extend the real world interfacing with microcontroller	3	2	3	1	1		1					1	3	1	
Co5	Extrapolate the architecture of PIC microcontroller and its addressing modes .	2	3		1	2							1		2	

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515ECT04	COMPUTER COMMUNICATIONAND NETWORKS	L T P C 3 0 0 3

Course Objectives

- Demonstrate the concept of various parameters in application layer
- Understand various protocols in transport layer like stop and wait go-back-N,TCP etc
- Discuss the various network layers and IP standards IPV4, IPV6
- Demonstrate various multiple access protocols point to point protocols and 802.11 standards
- Understand concepts in network security layers like cryptography, firewall,intrusion detection system and elements of QoS

UNIT I APPLICATION LAYER 9

Introduction-Services-client server programming - Delay, Loss and Throughput in Packet-Switched Networks-Protocol Layers and Their Service Models- Networks Under Attack- -Principles of Network Applications-The Web and HTTP-File Transfer: FTP -Electronic Mail in the Internet- DNS—The Internet's Directory Service-Peer-to-Peer Applications.

UNIT II TRANSPORT LAYER 9

Introduction and Transport Layer Services -Simple-stop and wait-Go-back N protocols -Multiplexing and Demultiplexing-Connectionless Transport: UDP-Principles of Reliable Data Transfer-Connection Oriented Transport: TCP-Principles of Congestion Control.

UNIT III THE NETWORK LAYER 9

Introduction-Virtual Circuit and Datagram Networks- Inside a Router- The Internet Protocol (IP): Forwarding and Addressing in the Internet-Routing Algorithms Routing in the Internet-Broadcast andMulticast Routing-IPV4,IPV6,ICMP-IPV6 addressing

UNIT IV DATALINK LAYER AND LOCAL AREA NETWORKS 9

Link Layer: Introduction and Services-Error-Detection and -Correction Techniques-Multiple Access Protocols-Link Layer Addressing-Ethernet-Link-Layers Switches- The Point-to-Point Protocol-Link Virtualization: A Network as a Link Layer- WiFi: 802.11 Wireless LANs.

UNIT V NETWORK SECURITY AND MANAGEMENT 9

Principles of Cryptography- Message Integrity- End-Point Authentication- Securing Email-SecuringTCP Connections: SSL-Network-Layer Security: IPsec- Securing Wireless LANs- Operational Security: Firewalls and Intrusion Detection Systems elements of QOS

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Implement the concept of various parameters in application layer

CO2: Understand various protocols in transport layer like stop and wait go-back-N,TCP etc

CO3: Configure the various network layers and IP standards IPV4, IPV6

CO4: Implement various multiple access protocols point to point protocols and 802.11 standards

CO1: Understand concepts in network security layers like cryptography, firewall,intrusion detection system and elements of QoS

Text Books

1 Andrew S.Tannenbaum-"Computer Networks"- PHI/Pearson – 4/E,2011

2 Behrouz.A.Forouzan- "Data communication and Networking"- Tata McGraw-Hill- 4/E-2013

3 James .F.Kurose & Keith W Ross "Computer Networking: A Top down approach "- Pearson education- *4 /E 2013.*

Reference Books

1 Alberto Leon Garcia, Communication Networks, 2nd Edition TMH, 2004.

2 Dougles comer 'Computer networks with Internet applications" Pearson edition 2005.

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Course Outcome	PSO1	PSO2	PSO3	PO1 a	PO2 b	PO3 c	PO4 d	PO5 e	PO6 f	PO7 g	PO8 h	PO9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Implement the concept of various parameters in application layer	3	1		3	2		1	2						1	
Co2 Understand various protocols in transport layer like stop and wait go-back-N,TCP etc	2	3		3	2		3	2				1		1	
Co3 Configure the various network layers and IP standards IPV4, IPV6	3	1		3	2	3	1	1		1				1	
Co4 Implement various multiple access protocols pointto point protocols and 802.11 standards	2	3		3	2		3	2				1		1	
CoS Understand concepts in network security layers like cryptography, firewall, intrusion detection system and elements of QoS	2	3		3	2		3	2				1		1	

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515ECP07 **DIGITAL SIGNAL PROCESSING LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- Demonstrate the signal processing techniques in time domain using MATLAB.
- Analyze the signals in frequency domain using MATLAB.
- Design Simulink model for signal generation.
- Interpret the Audio signals using MATLAB.
- Manipulate the signal processing techniques using TMS320C5X DSP Processor

LIST OF EXPERIMENTS

USING MATLAB

1. Generation of Discrete time Signals.
2. Verification of Sampling Theorem.
3. Computation of FFT and IFFT.
4. Computation of Linear convolution .
5. Computation of Circular convolution .
6. Fast Convolution techniques.
7. Design of FIR filters (window design).
8. Design of IIR filters (Butterworth &Chebychev).
9. Record, Read and play audio signal(.WAV file).
10. Modelling pulse generator, signal generator, signal builder using MATLAB/SIMULINK.

USING TMS320C54X PROCESSOR

1. Generation of Discrete time Signals
2. Linear Convolution
3. Implementation of a FIR filter
4. Implementation of an IIR filter

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1:Implement the signal processing techniques in time domain using MATLAB
CO2:Compute the signals in frequency domain using MATLAB.
CO3:Produce Simulink model for signal generation.
CO4:Manipulate the Audio signals using MATLAB.
CO5:Analyze the signal processing techniques using TMS320C5X DSP Processor.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Implement the signal processing techniques in time domain using MATLAB	3	3		2	3							1	3	1	
Co2	Compute the signals in frequency domain using MATLAB.	3	2	3	2	1		1					1	3	1	
Co3	Produce Simulink model for signal generation.	3	2	3	1	1		1					1	3	1	
Co4	Manipulate the Audio signals using MATLAB.	3	2	3	1	1		1					1	3	1	
Co5	Analyze the signal processing techniques using TMS320C5X DSP Processor.	3	2	3	1	1		1					1	3	1	

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515ECP08	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L T P C 0 0 4 2

COURSE OBJECTIVES:

- Develop the code in assembly language programming.
- Interpret the Assembly code using 8085, 8086 processors and 8051 controllers.
- Test the developed code using 8085, 8086 processors and 8051 controllers.
- Demonstrate the interface peripherals with microprocessor and micro controller
- Apply the interfacing in the real world applications

I. 8085 based Experiments

1. 8-bit /16 bit-Arithmetic operations using 8085.
2. Searching of a Largest and smallest number in an array using 8085.
3. Sorting of an array using 8085
4. Conversion of Hexadecimal to ASCII code using 8085
5. Design of Simple ALU using 8085.

II. 8086 based Experiments

6. 16-bit Arithmetic operations using 8086
7. Searching of a Largest and smallest number in an array using 8086
8. String manipulation using 8086.
9. Generation of Fibonacci series using 8086

III. 8051 based experiments

10. 8-bit arithmetic operations using 8051 microcontroller
11. Design of simple ALU using 8051 microcontroller.

IV. Interfacing experiments with 8085/8086/8051

12. Traffic light controller
13. Stepper motor interfacing
14. 8279 keyboard/display controller
15. ADC and DAC interfacing

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: Generate the code for arithmetic operations in assembly language
CO2: Generalize the developed code using 8085, 8086 processors and 8051 controllers
CO3: Identify the bugs in the assembly code using 8085, 8086 processors and 8051 controllers
CO4: Reorganize the Interfacing peripherals with microprocessor and microcontroller
CO5: Propose the new design for real world applications

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Generate the code for arithmetic operations in assembly language	3	2	3	2	1		1					1		2	
Co2	Generalize the developed code using 8085, 8086 processors and 8051 controllers	3	2	3	1	1		1					1		2	
Co3	Identify the bugs in the assembly code using 8085, 8086 processors and 8051 controllers	3	2	3	1	1		1					1		2	
Co4	Reorganize the Interfacing peripherals with microprocessor and microcontroller	3	2		2		1						1	3	1	
Co5	Propose the new design for real world applications.	3	2		2		1		1				1	3	1	

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515ECP09 **COMPUTER NETWORKS LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- Demonstrate Error Detecting Codes, IP subnet, LAN protocols
- Understand CSMA/CD Protocol, Token ring and Token Bus protocols
- Understand various protocols in transport layer like stop and wait go-back-N, TCP etc
- Demonstrate various routing algorithms like Distance vector and link state routing algorithm
- Learn NS2 simulators for Network Application.

LIST OF EXPERIMENTS

1. Implementation of Error Detecting Codes (CRC)/Error Correction Techniques
2. Implementation of IP subnet
3. Ethernet LAN protocol
4. Write A Code Simulating Ping And Trace Route Commands
5. Token bus and token ring protocols: To create scenario and study the performance of token bus and token ring protocols through .
6. Wireless LAN protocols: To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
7. Implementation and study of stop and wait protocol.
8. Implementation and study of Go-back-N and selective reject protocols.
9. Implementation of distance vector routing algorithm.
10. Implementation of Link state routing algorithm.
11. Implementation of Data encryption and decryption.
12. STUDY OF NS2 & SIMULATION OF CONGESTION CONTROL ALGORITHM USING NS2
    *Open Source Software Tools like Ethereal /Wire shark Opnet IT Guru, Network Simulator 2, GLOMOSIM. Router Simulator may be used for Simulation.

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1:Implement Error Detecting Codes, IP subnet, LAN protocols
CO2:Understand CSMA/CD Protocol, Token ring and Token Bus protocols
CO3:Understand various protocols in transport layer like stop and wait go-back-N, TCP etc
CO4:Implement various routing algorithms like Distance vector and link state routing algorithm
CO5:Simulate various algorithm in NS2 software

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Implement Error Detecting Codes, IP subnet, LAN protocols	3	2		2		1		1				1	3	1	
Co2	Understand CSMA/CD Protocol, Token ring and Token Bus protocols	3	2		2		1						1	3	1	
Co3	Understand various protocols in transport layer like stop and wait go-back-N, TCP etc	3	2		2		1		1				1	3	1	
Co4	Implement various routing algorithms like Distance vector and link state routing algorithm	3	2		2		1						1	3	1	
Co5	Simulate various algorithm in NS2 software	3	2	3	1	3							1	3	1	

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615ECT02	VLSI Design	L T P C 3 0 0 3

Course Objectives

- Understand the basic CMOS circuits.
- Learn the fabrication of the CMOS using several process.
- Know the concepts of designing VHDL.
- Design the inverter and logic gates using the CMOS technology.
- Learn the basic debugging process in digital circuits.

UNIT I MOS TECHNOLOGY **9**

Chip Design Hierarchy- IC Layers –Photolithography and Pattern Transfers- Basic MOS Transistors- CMOS Fabrication – Submicron CMOS Process – Mask and Layout – CMOS Design Rules: Lambda based layout.

UNIT II MOS TRANSISTOR **9**

NMOS and PMOS transistors, Threshold voltage - Body effect - Design equations - Second ordereffects. MOS models and small signal AC characteristics - CMOS-DC and transient characteristics.

UNIT III INVERTER AND LOGIC GATES **9**

NAND and NOR Gates – Complex Logic Gates(AOI and OAI logic) –Tri state circuits – Large FETs- Transmission Gate and Pass Transistor Logic- NMOS and CMOS Inverters, Stick diagram, Inverterratio, Driving large capacitance loads, Static CMOS design, dynamic CMOS design.

UNIT IV BASICS OF TESTING AND FAULT MODELING **9**

Introduction to testing - Faults in Digital Circuits – Modeling of faults – Logical Fault Models –Fault detection – Fault Location – Fault dominance – Design for testability – Boundary scan.

UNIT V VHDL **9**

VHDL Program Structure- concurrent code – sequential code - Variables- Signals and Constants- VHDL Operators -VHDL Description of Combinational Networks: Adders ,Subtractor– VHDL Model for Multiplexer- Modeling Flip Flop using VHDL Processes —Modeling a sequential Machine.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Discuss the different design hierarchy of the CMOS circuits.
CO2: Determine of the various characteristics of the MOS transistor.
CO3: Design the inverter and logic gates using the CMOS technology.
CO4: Perform the testing and fault modeling in any design.
CO5: Write Programs based on the VHDL structure

Text Books

1 John P Uyemura- "Chip Design for Submicron VLSI:CMOS layout and simulation" ThomsonIndia Edition-2006.

2 Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson EducationASIA, 2nd edition, 2000.

Reference Books

1 Eugene D.Fabricius, Introduction to VLSI Design McGraw Hill International Editions,1990

2 M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems and Testable Design",Jaico Publishing House,2002.

3 Charles H Roth-"Digital System Design Using VHDL"- Thomson business Information India Pvt Ltd-2006 .

4 Kamran Eshraghian- Douglas A PucknellSholehEshraghian "Essentials of VLSI Circuits and Systems"- Prentice Hall of India Pvt Ltd- 2006 Wayne Wolf," Modern VLSI Design – System On Chip", PHI 2006, 3e, New Delhi.

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Course Outcome	PSO1	PSO2	PSO3	PO 1 a	PO 2 b	PO 3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO 8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Discuss the different design hierarchy of the CMOScircuits.	3	1		3	2	3	1	3						1	
Co2 Determine of the various characteristics of the MOS transistor.	3	1		3	2	1								1	
Co3 Design the inverter and logic gates using the CMOS technology.		2										1	3	2	2
Co4 Perform the testing and fault modeling in any design.		2		3	2	3	1	3						1	
Co5 Write Programs based onthe VHDL structure		2		3	2	3	1	3						1	

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615ECT03	DIGITAL COMMUNICATION	L T P C 3 1 0 4

Course Objectives

- Discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- Estimate the power spectrum of the signal
- Learn baseband pulse transmission, which deals with the transmission of pulse- amplitude modulated signals in their baseband form.
- Understand the error control coding which encompasses techniques for theencoding and decoding of digital data streams for their reliable transmission over noisy channels.
- Understand the digital spread spectrum modulation.

UNIT I SAMPLING AND WAVEFORM CODING **9+3**

Sampling - Band pass sampling- PAM- PCM -Uniform and Non- Uniform Quantization- Quantizationerror- DM and Adaptive Delta Modulation-DPCM- TDM Principles-Digital Multiplexer.

UNIT II BANDLIMITED SIGNALLING **9+3**

Power Spectra of PAM signals-Matched filters- Inter Symbol Interference- Ideal Nyquist channel- Raised Cosine Channels- Correlative Coding- Eye patterns- Adaptive Equalization for Data Transmission.

UNIT III PASS BAND DATA TRANSMISSION **9+3**

Pass band Transmission Model-Correlation receivers- Generation- Detection- Signal Space diagram-Bit error probability and power spectra of -BPSK-DPSK- QPSK- QAM - FSK and MSK schemes- Performance comparisons- carrier and bit synchronization

UNIT IV ERROR CONTROL CODING **9+3**

Linear block codes- Cyclic codes- Convolutional Codes: Coding Gain and Viterbi decoding ofConvolutional Codes- Trellis coded modulation.

UNIT V SPREAD SPECTRUM SYSTEMS **9+3**

Pseudo Noise sequences- generation-principles of DSSS-Correlation properties- m-sequence and Gold sequence- FHSS- processing gain- jamming margin.

Total Hours 60

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Demonstrate of sampling and waveform coding related to digital hierarchy.
CO2: Implement the band limited signaling in the various digital transmissions.
CO3: Analyze the BER for the different digital modulations.
CO4: Apply the concept of error control coding to detect and correct the error indigital data transmission.
CO5: Understand the concept of spread spectrum modulation to obtain securecommunication.

Text Books

1 Simon Haykins- "Digital Communications"- John Wiley, 4/E- 2007.

2 H. Taub, D.L.Schilling, G. Saha- "Principles of Communication Systems"- 3/ETata McGraw HillPublishing Company- New Delhi- 2008

Reference Books

1 John.G.Proakis "Digital Communication"- McGraw Hill – 3/E - 2008.

2 B.Sklar " Digital communications"2/E Prentice Hall-2001

3 K.N.Chari., D.GaneshRao-"Digital Communications"- 2/E- Sanguine Technical Publishers- Bangalore- 2005

Course Outcome	PSO1	PSO2	PSO3	PO1 a	PO2 b	PO3 c	PO4 d	PO5 e	PO6 f	PO7 G	PO8 h	PO9 i	PO 10 j	PO 11 k	PO 12 l
Co1Demonstrate of sampling and waveform coding related to digital hierarchy.	3	1		3	2	3	1	3						1	
Co2 Implement the band limited signaling in the variousdigital transmissions.	3	1		2	3	2	1							1	
Co3 Analyze the BER for the different digital modulations.	3	1		3	2	3	1	3						1	
Co4 Apply the concept of error control coding to detect and correct the error in digital data transmission.	3	1		2	3		1							1	
Co5Understand the concept ofspread spectrum modulation toobtain secure communication.	3	1		3			2				2			1	

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615ECT04	ANTENNA AND WAVE PROPAGATION	L T P C 3 0 0 3

Course Objectives

- Provide insight of the radiation phenomenon.
- Understand the concepts of antenna arrays.
- Analyze the radiation characteristics of special antennas.
- Design and analyze the various parameters for aperture antennas.
- Understand the various types of propagation at different frequencies.

UNIT I FUNDAMENTALS OF RADIATION 9

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiationfrom oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

UNIT II APERTURE AND SLOT ANTENNAS 9

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas ,Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis

UNIT III ANTENNA ARRAYS 9

N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays,Adaptive array, Basic principle of antenna Synthesis-Binomial array

UNIT IV SPECIAL ANTENNAS 9

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR

UNIT V PROPAGATION OF RADIO WAVES 9

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept, Sky wave propagation – Virtualheight, Critical frequency , Maximum Usable Frequency – Skip distance, Fading , Multi hop propagation

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Identify the various antenna modules for Radio frequency communicationsystems.

CO2: Identify the various antenna arrays patterns

CO3: Compute the various radiation patterns for special antennas.

CO4: Utilize the concept of aperture and slot antennas in desired application

CO5: Explain the various types of wave propagation.

Text Books

1 John D Kraus," Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2005.

Reference Books

1 Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" PrenticeHall of India, 2006

2 R.E.Collin,"Antennas and Radiowave Propagation", Mc Graw Hill 1985.

3 Constantine.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006.

4 Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition New Age International Publishers, 2006.

5 S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007.

6 Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.

7 H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint,Springer Publications, 2007.

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Course Outcome	PSO1	PSO2	PSO3	PO1 a	PO2 b	PO3 c	PO4 d	PO5 e	PO6 f	PO7 g	PO8 h	PO9 i	PO 10 j	PO 11 k	PO 12 l
Co1Identify the various antenna modules for Radiofrequency communication systems.	3	1		3	2	1								1	
Co2 Identify the various antenna arrays patterns	3	1		2	3	2	1							1	
Co3 Compute the various radiation patterns for special antennas.	3	1		3	2	1								1	
Co4 Utilize the concept of aperture and slot antennas in desired application	3	1		3	2	1								1	
Co5Explain the various typesof wave propagation.	3	1		3	2	1								1	

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615ECP08	VLSI Design Laboratory	L T P C 0 0 4 2

Course Objectives

- Develop VHDL programs for various sequential and combinational logiccircuits.
- Design the CMOS circuits using SPICE.

LIST OF EXPERIMENTS

I- Design and simulation of Combinational Logic Circuit using VHDL

1. Adder,subtractor
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Multiplier

II- Design and simulation of Sequential logic circuit using VHDL

5. Flip Flops
6. Counter
7. Shift registers
8. Frequency Divider

III- CMOS Circuit design using SPICE (DC and Transient Analysis)

9. CMOS Inverter
10. CMOS NAND and NOR Gates
11. CMOS D Latch

IV- FPGA Implementation

12. 4 bit Adder, 4 Bit Multiplier.
13. Real Time Clock

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Design and simulate various sequential and combinational logic circuits withVHDL programs.

CO2: Design and implement the different adders and multipliers using FPGA kit.

CO3: Design CMOS circuits for the DC and transient analysis.

Course Outcome	PSO1	PSO2	PSO3	PO1 a	PO2 b	PO3 c	PO 4 d	PO 5 e	PO 6 f	PO 7 g	PO8 h	PO 9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Design and simulate various sequential and combinational logic circuitswith VHDL programs.		3		2	3		1	2						1	
Co2 Design and implement the different adders and multipliers using FPGA kit.	3	1		3	2		1	2						1	
Co3 Design CMOS circuits forthe DC and transient analysis.												1	3	2	1

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615ECP09 **Analog and Digital CommunicationSystems Laboratory** **L T P C**
0 0 4 2

Course Objectives

- Know about the difference between modulation and demodulation techniquespractically.
- Design and implementing the phase locked loop circuits.
- Study the characteristics of the different detectors in analog and digitalcommunication techniques.

LIST OF EXPERIMENTS

1. Amplitude Modulation and demodulation
2. Frequency Modulation and FSK Generation
3. Balanced modulator
4. Pre-emphasis & de-emphasis
5. Phase locked loop and applications
6. PWM Generation and detection
7. AM detector and AGC Characteristics
8. FM detector
9. PAM and verification of sampling theorem
10. Pulse Code Modulation Encoder and Decoder
11. Delta modulation and demodulation
12. Digital Modulation Techniques

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Analyze the PLL characteristics and its applications.

CO2: Understand the difference between the modulation and demodulationtechniques.

CO3: Implement various detection process of analog and digital communication.

Course Outcome	PSO1	PSO2	PSO3	PO1 a	PO2 b	PO3 c	PO4 d	PO5 e	PO6 f	PO7 g	PO8 h	PO9 i	PO 10 j	PO 11 k	PO 12 l
Co1 Analyze the PLL characteristics and its applications.												1	3	2	1
Co2 Understand the difference between the modulation and demodulation techniques.												1	3	2	1
Co3 Implement various detection process of analog and digital communication.	3	1		3	2	3	1	1		1				1	

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615ECE01 **DIGITAL IMAGE PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the fundamentals of image processing
- Understand the basic image transforms.
- Compare different Image enhancement and restoration techniques
- Describe the various image segmentation and representation process
- Understand the Image compression process

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Elements of digital image processing systems- Elements of visual perception- psycho visual model-brightness- contrast- hue- saturation- mach band effect-Color Image fundamentals- RGB- HSI models- Image sampling- Quantization- dither- Two dimensional mathematical preliminaries

UNIT II IMAGE TRANSFORMS **9**

1D DFT- 2D transforms – DFT- DCT- Discrete Sine, Walsh- Hadamard , Slant , Haar Wavelet Transform

UNIT III IMAGE ENHANCEMENT AND RESTORATION **9**

Spatial domain enhancement: gray level transformations - Histogram modification and specification techniques- Image averaging- Directional Smoothing- Median- Geometric mean- Harmonic mean- Contra harmonic and Yp mean filters- Homomorphic filtering- Color image enhancement. Image Restoration – degradation model- Unconstrained and Constrained restoration- Inverse filtering: Removal of blur caused by uniform linear motion- Wiener filtering- Geometric transformations: Saptial transformations- Gray-Level interpolation .

UNIT IV IMAGE SEGMENTATION AND REPRESENTATION **9**

Point- line and edge detection- Edge linking-Hough Transform- Region based segmentation: Region splitting and merging. Image representation: chain codes – polygonal approximations – signatures – boundary segments – skeletons.

UNIT V IMAGE COMPRESSION **9**

Need for data compression- Error free compression: variable length coding, bit plane coding, LZW coding. Lossy compression: Transform coding, wavelet coding. Compression standards: binary image compression standard, still image compression standards, video compression standards.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

CO1: Compute the mathematical transforms for images.
CO2: Analyze Image by designing spatial and frequency domain filters.
CO3: Describe the concepts of image segmentation and pattern recognition and to develop an object recognition system.
CO4: List the various image segmentation and representation process
CO5: Explain the Image compression process

TEXT BOOKS

1. Rafael C- Gonzalez- Richard E-Woods- 'Digital Image Processing'- Pearson Education- Inc-- Third Edition- 2015
2. Anil K- Jain- 'Fundamentals of Digital Image Processing'- Pearson/Prentice Hall of India- 2002

REFERENCE BOOKS

1. Dr.S.Jayaraman, Digital Image Processing TMH New Delhi, 2009
2. David Salomon Data Compression – The Complete Reference- Springer Verlag New York Inc-- 2nd Edition- 2001

3. William K-Pratt- 'Digital Image Processing'- John Wiley- NewYork- 2002.
4. Kenneth R.Castleman-"Digital Image Processing"-Pearson-2003.

Course Outcome		PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
Co1	Compute the mathematical transforms for images.	3	2	3	2	2	1	1	1	1	1	2	1	3	2	1
Co2	Analyze Image by designing spatial and frequency domain filters.	3	2	3	1	3							1	3	1	
Co3	Describe the concepts of image segmentation and pattern recognition and to develop an object recognition system.	2	3	2	1								1	3	1	
Co4	List the various image segmentation and representation process	2	3	2	1								1	3	1	
Co5	Explain the Image compression process	3	2	1									1	3	1	

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615ECE03	DIGITAL SYSTEM DESIGN USING VHDL	L T P C 3 0 0 3

COURSE OBJECTIVES

- Understand the architecture and programming of Programmable Logic devices
- Implement and realize the SM charts.
- Design and program FPGA for digital system
- Design and program RISC microprocessor
- Develop program for Digital system design using VHDL

UNIT I Introduction To Programmable Logic Devices **9**

Programmable Logic Devices, Simple Programmable Logic Devices, Complex Programmable Logic Devices, Field Programmable Gate Arrays

UNIT II State Machine Charts **9**

State Machine Charts, Derivation of SM Charts, Realization of SM Charts

UNIT III Designing With Field Programmable Gate Array **9**

Function Implementation in FPGAs and Shannon Decomposition, Carry and Cascade Chains in FPGAs, Dedicated memories and Multipliers in FPGA, Cost of Programmability, FPGA Capacity: Maximum Gates vs. Usable Gates, Design translation, Mapping , Placement and Routing

UNIT IV Design of RISC Microprocessor **9**

RISC Philosophy, MIPS ISA, MIPS Instruction Encoding, implementation of MIPS Subset, VHDL model-Memory and Register

UNIT V VHDL **9**

VHDL function and Procedures, Attributes and overloaded Operators, Multivalued Logic and Signal resolution, IEEE 9-valued Logic System, SRAM model using IEEE, Model for SRAM ready write system

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to :

CO1: Write programs for programmable Logic devices
CO2: Implement and realization of SM charts
CO3: Implement and realize digital design in FPGA
CO4: Write program using RISC
CO5: Write Programs in VHDL

TEXT BOOKS

1. Principle of Digital System Design Using VHDL by Roth and John, Cengagelearning,Third edition,2016
2. "An Engineering Approach to Digital Design" by William I. Fletcher, PHI 10th Edition,2007

REFERENCE BOOKS

1. "Digital Design Principles and Practices" by John F. Wakerly, Person Publication 4thEdition,2009
2. "Fundamentals of Digital Logic with VHDL Design" by Stephen Brown and Zvonko, McGraw-Hill 3rdEdition,2009
3. ZainalabedinNavabi, VHDL, analysis and modeling of digital systems, McGraw-HillThird Edition 2011

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Write programs for programmable Logic devices	3	2	3	1	3							1	3	1	
Co2	Implement and realization of SM charts	3	2	1									1	3	1	
Co3	Implement and realize digital design in FPGA	3	2	1									1	3	1	
Co4	Write program using RISC						3	2	3	2		3		3	1	
Co5	Write Programs in VHDL	3	2	1									1	3	1	

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615ECE04 **INFORMATION THEORY AND CODING** L T P C
3 0 0 3

COURSE OBJECTIVES

- Understand the Concept of Information Entropy,
- Understand the various Source coding Technique
- Understand the various compression technique like Huffman coding, Tagged Image file
- Understand various data and voice coding methods like DPCM, LPC etc.,
- Understand the concept of Channel Capacity and Error control codes

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memoryless channels – channel capacity – channel coding Theorem – Channel capacity Theorem

UNIT II SOURCE CODING 9

Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels

UNIT III COMPRESSION TECHNIQUES 9

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards

UNIT IV DATA AND VOICE CODING 9

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT V ERROR CONTROL CODES 9

Linear Block codes – Syndrome Decoding – Mianimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

TOTAL HOURS:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to :

CO1: Acquire Knowledge in Information entropy, channel capacity
CO2: Apply various source coding techniques
CO3: Implement various compression techniques in relevant application
CO4: Acquire Knowledge in Error control codes
CO5: Apply various decoding techniques in Block codes and Convolutional codes

TEXT BOOKS

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley,2006
2. Digital communication, Simon Haykin, John Wiley, 2008

REFERENCE BOOKS

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3,45

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Acquire Knowledge in Information entropy, channel capacity	3	2	3	1	3							1	3	1	
Co2	Apply various source coding techniques	3	2	1									1	3	1	
Co3	Implement various compression techniques in relevant application	3	2	1									1	3	1	
Co4	Acquire Knowledge in Error control codes	3	2	1									1	3	1	
Co5	Apply various decoding techniques in Block codes and Convolutional codes	3	2	1									1	3	1	

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Department	Electronics and communication Engineering		Programme Name			B.E
Semester VII						
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECT01	PROFESSIONAL ETHICS AND HUMAN VALUES	3	0	0	3	50	50	100

Course objective	• To learn the morality, integrity, honesty and spirituality. • To learn the various theory which portray about the engineering ethics. • To understand the industrial standard and responsibility of engineers. • To learn the safety and rights of human in the working place. • To enable the professional to aware of the global issues in the technological society

Prerequisites:Nil

1	HUMAN VALUES	Total Hrs	8

. Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

2	ENGINEERING ETHICS	Total Hrs	9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry – moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

3	ENGINEERING AS SOCIAL EXPERIMENTATION	Total Hrs	9

. Engineering as experimentation - engineers as responsible experimenters - codes of ethics – industrial standards- a balanced outlook on law - the challenger case study

4	SAFETY- RESPONSIBILITIES AND RIGHTS	Total Hrs	10

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies- Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest – occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination-

5	GLOBAL ISSUES	Total Hrs	9

Multinational corporations - Environmental ethics - computer ethics – weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME- ASCE- IE- E-E- Institution of Engineers (IEI) India- Institution of Electronics and
Telecommunication engineers(IETE) India- etc-

Total hours to be taught	45

Text book (s) :

1	Mike Martin and Roland Schinzinger- "Ethics in Engineering"- Tata McGraw-Hill- - 1996-3 e
2	Govindarajan M- Natarajan S- Senthil Kumar V- S- "Engineering Ethics"- Prentice Hall of India- New Delhi- 2004.

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Reference(s) :	
1	R-S Nagarazan -"A textbook on Professional Ethics and Human Values" New Age International Publishers- New Delhi 2006.
2	Charles D- Fleddermann- "Engineering Ethics"- Pearson Education / Prentice Hall- New Jersey- 2004 (Indian Reprint).
3	Charles E Harris- Michael S- Protchard and Michael J Rabins- "Engineering Ethics – Concepts and Cases"- Wadsworth Thompson Learning- United States- 2000 (Indian Reprint now available).
4	John R Boatright- "Ethics and the Conduct of Business"- Pearson Education- New Delhi- 2003.

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECT02	EMBEDDED SYSTEMS	3	0	0	3	50	50	100
Course objective	• To learn the basic concepts and architecture of the embedded systems. • To learn the various concepts of the RTOS and OS. • To learn the various parameters of the hardware for interfacing. • To learn the various programming methods of embedded systems							
Prerequisites: Microprocessors and Microcontrollers								
1	**ARCHITECTURE OF EMBEDDED SYSTEMS**					Total Hrs		9
Definition of Embedded System - Embedded Systems Vs General Computing Systems - History of Embedded Systems - Categories of Embedded Systems-Specifications of Embedded systems- Recent trends in Embedded Systems-Hardware Architecture-Software Architecture-development/testing tools.								
2	REAL-TIME OPERATING SYSTEM CONCEPTS					Total Hrs		9
Desk Top OS versus RTOS - Architecture of the Kernel-task and task scheduler-Interrupt Service Routines- Semaphores-Mutex-Mailboxes-Message Queues-Event Registers-Pipes-Signals- Timers-Memory Management – Priority Inversion Problem								
3	HARDWARE PLATFORM					Total Hrs		9
PIC microcontroller- Architecture of PIC 16c6x/7x- FSR- Reset action-Oscillatory connection-Memory organization- Instructions- Addressing modes- I/O ports- Interrupts-Timers- ADC-Assembly language programming								
4	PROGRAMMING FOR EMBEDDED SYSTEMS					Total Hrs		9
Embedded Program – Role of Infinite loop – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor - Overview of Embedded C - Programming and Assembly – Register usage conventions - procedure call and return - parameter passing – retrieving parameters - temporary variables								
5	HARDWARE/SOFTWARE CO-SYNTHESIS					Total Hrs		9
The Co-Synthesis Problem - State-Transition Graph - Refinement and Controller Generation - Distributed System Co-Synthesis-study of an Embedded Systems for a Smart Card.								
Total hours to be taught								45
Text book (s) :								
1	K.V.K.K.Prasad "Embedded /Real-Time Systems:Concepts,Design and Programming"Dreamtech,Wiley 2003.							
2	Ajay V Deshmukh "Microcontroller Theory and Applications" Tata McGraw Hill 2005							

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Reference(s) :	
1	Raj Kamal "Embedded Systems Architecture Programming and Design" 2nd Edition TMH,2008.
2	David E Simon "An Embedded Software Primer" Pearson Education 2003
3	Daniel.W. Lewis, "Fundamentals of Embedded Software" Pearson Education- 2001
4	Peatman "Designing with PIC Micro Controller", Pearson 2003.
5	Introduction to Embedded system – ShibuK.V.McGraw Hill.
6	Michael Barr, "Programming Embedded systems in C & C++" Oreily, 2003.

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECT03	OPTICAL COMMUNICATION	3	0	0	3	50	50	100
Course objective	• To learn the basic concepts of the optical transmission links. • To learn the different losses and degradation of the signals in the optical transmission. • To understand about the different laser sources and their effects. • To learn the specification and operation of various optical receivers. • To learn the about digital transmission systems with optical fibers							
Prerequisites:								

1	OPTICAL FIBERS – STRUCTURE	Total Hrs	9
. Evolution of Fiber Optic Systems – Elements of an Optical fiber Transmissionlink – Basic laws and definitions – ray optics – Optical fiber modes andconfigurations – Mode theory of circular waveguides – Overview of modes – Keymodal concepts – Linearly Polarized waves – Single Mode Fibers – GradedIndex Fiber Structure- design optimization of SM fibers – RI profile and cut – off wavelength.			
2	SIGNAL DEGRADATION IN OPTICAL FIBERS	Total Hrs	9
. Attenuation – absorption loss – Scattering loss – Bending loss – Core andCladding loss – Signal distortion in optical wave guides – Information capacitydetermination – Group delay – material dispersion – Wave Guide dispersion –Signal distortion in single mode fibers – Polarization mode dispersion –Intermodal dispersion – Pulse broadening in GI fibers – Mode Coupling .			
3	OPTICAL SOURCES	Total Hrs	9
LED's – LASER Diodes : Semiconductor Laser Diodes- Fabry-Perot Lasers -Distributed Feedback (DFB) Lasers – Modulation of LASER diodes –Temperature effects - Power Launching and Coupling : Source to fiber powerlaunching – Lensing Schemes for Coupling improvement - LED coupling tosingle mode fibers			
4	OPTICAL RECEIVERS	Total Hrs	9
. PIN Photo detector – Schottky-Barrier Photodiodes - Avalanche Photodiodes –Photodetector noise – Detector response time – Avalanche multiplication ofNoise – Temperature effects on Photo detectors – Phototransistors -Fundamental Receiver operation – preamplifiers – Error sources – Receiverconfiguration – Probability of error – Quantum limit.			
5	DIGITAL TRANSMISSION SYSTEMS	Total Hrs	9
Point to point link systems considerations – Link Power budget – Rise timebudget – Noise effects on system performance – Operational principles of WDM– Solitons – EDFA's – Basic concepts of SONET/SDH.Design considerations-Transmitter and Receiver Units			
Total hours to be taught			45
Text book (s) :			
1	G.P Agarwal- "Fiber Optic Communication systems"- II edition- John wiley& Sons- NewYork-1997.		
2	Gerd Keiser- 'Optical Fiber Communication "- Tata McGraw Hill - 3rd ed-2007.		

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Reference(s) :	
1	John M.Senior-"Optical Fiber communications –principles and practice"-Third edition,Pearson/Prentice Hall. 2012
2	Palais " Fiber optic communications " pearson 2005 5e
3	Harry J. R Dutton- "Understanding Optical Communications"- IBM
4	Corporation- International Technical Support Organization- 1998

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECT04	MICROWAVE ENGINEERING	3	0	0	3	50	50	100
Course objective	To learn the microwave network characterization in passive components. To learn the specification and operations of the various microwave tubes. To learn the methods to the measure the various parameters in the microwaves. To know about the different types of microwave semiconductor devices. To understand microwave strip lines and their effects							
Prerequisites :	Electromagnetic Fields							

1	MICROWAVE NETWORK CHARACTERIZATIOANDPASSIVE COMPONENTS	Total Hrs	9

Circuit and S parameter representation of N ports- Reciprocity Theorem- Losslessnetworks and unitary conditions- ABCD parameters-Cascaded networks- Effect of changing the reference planes in the Smatrix- S Matrix of a Directional Coupler- waveguide tees and rat race coupler-Qualitative discussion on: Waveguide Corners- Bends- Twists- Matched loads andmovable shorts.

2	MICROWAVE TUBES	Total Hrs	9

Transit time effect- Velocity modulation –current modulation-bunching-Two cavityKlystron amplifier- Reflex Klystron- Slow-Wave structures -Helix Traveling-WaveTubes- Convection Current- Axial Electric Field- Wave Modes- Bandwidth, Power andGain Considerations – cross field device –Magnetron-power and frequencyconsiderations

3	MICROWAVE MEASUREMENTS	Total Hrs	9

Slotted line VSWR measurement- impedance measurement- insertion loss andattenuation measurements- measurement of scattering parameters – Return lossmeasurement using directional coupler-Introduction to vector network analyzer and itsuses- return loss and insertion loss.

4	MICROWAVE SEMICONDUCTOR DEVICES	Total Hrs	9

Gunn-Effect – Gunn Diode- Differential Negative Resistance- Modes of Operation-Amplification-Microwave Generation- Read Diode- Physical Description- AvalancheMultiplication- IMPATT Diodes- TRAPATT Diode- BARITT Diode- Principles of Operation- Physical Structures- Parametric Amplifiers -Nonlinear Reactance andManley – Rowe Power Relations.

5	STRIP LINES	Total Hrs	9

Introduction- Microstrip Lines- Derivation of Characteristic Impedance of MicrostripLines using Quasi Static analysis- Losses in Microstrip Lines- Quality Factor Q ofMicrostrip Lines- Substrate materials-surface wave excitation- Parallel Strip Lines-Characteristic Impedance- Attenuation Losses- Coplanar Strip Lines- Shielded StripLines- Problems- Microstrip based broadband matching networks. Applications of microstrip line Introduction to MIC's

Total hours to be taught	45
Text book (s) :	

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1	Samuel Y-LIAO : Microwave Devices and Circuits – Pearson/Prentice Hall of India – 3rd Edition (2003) .
2	Annapurna Das and Sisir K-Das: Microwave Engineering – Tata McGraw-Hill (2000).
Reference(s) :	
1	R-E- Collin : Foundations for Microwave Engg- – IEEE Press Second Edition (2002) .
2	David M-POZAR : Microwave Engg- – John Wiley & Sons – 2nd Edition (2003
3	Rizzi " microwave engineering-passive circuits " PHI 2007

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECP07	ELECTRONIC SYSTEM DESIGN LABORATORY	0	0	3	2	50	50	100
Course objective	• To illustrate the design, application, and limitations of electronic circuits by laboratory experience. • To study the engineering design of a commercial electronic system.							

Prerequisites: Electric Circuits and Electron Devices and Microprocessors and Microcontrollers

1. Design of AC/DC voltage regulator using SCR
2. Design of Process Control Timer
3. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using
   a. LVDT
   b. Strain gauge and Pressure Transducer
   c. Photocell / LDR
   d. Temperature measurement using RTD- Thermo couples
4. Data acquisition and storage of signals through Serial / Parallel port to PC
5. PC based data acquisition using add-on (PCI) card or USB compatible card
6. DC motor speed control using digital logic circuits/Microprocessor/PC
7. Simulation Experiments (using MATLAB)
   a. DTMF generation & detection
   b. Multirate Processing
   c. Echo Cancellation
   d. Error Detection coding
   e. Modulation and Demodulation
8. PCB Layout design using CAD

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECP08	OPTICAL AND MICROWAVE LABORATORY	0	0	3	2	50	50	100
Course objective	• This is an exercise. It is intended to develop your manual dexterity while teaching you the proper installation of an ST connector on the ends of a plastic optical fiber • Students are expected to pay attention to the proper way to install the connector on the fiber. This must be done in a way that will ensure longevity and prevent premature failure of the fiber optic link • Students will use room temperature epoxy and mechanical crimping to secure the fiber firmly into the connector. Oven cured epoxy may not be used with plastic fiber							
Prerequisites: Digital communication								

Microwave Lab Experiments:

1. Characteristics of Reflex Klystron and Gunn diode Oscillator
2. Study of Power Distribution in directional coupler,
3. Study of power distribution in E / H -Plane Tee, Magic Tee.
4. VSWR Measurements – Determination of terminated impedance
5. Radiation Pattern of Horns.
6. Determination of guide wavelength, frequency measurement.
7. Parabolaods design using MATlab/Ansoft HFSS

Optical Experiments:

1. Measurement of Numerical Aperture and Coupling (Angular and Lateral) in Optical Fiber.
2. DC Characteristics of LED and VI characteristics of LASER Diode.
3. Data Communication and Wave length Division multiplexing and de multiplexingusing Single Mode Fiber Optic System.
4. Attenuation and Chromatic dispersion Measurement in Single Mode Optical Glass Fiber.
5. BER and Eye pattern measurement using a High Bandwidth Oscilloscope.

List of Equipments Required to perform the above Experiments.

1. Fiber optics Trainer board with LED and facility for BER and Eye pattern Measurement.
2. LASER Based Fiber Optic training System with Dual Wavelength Source and Detector with WDM and Data Communication Facility
3. Optical Power Meter.
4. Single mode Fiber of Different Length for Attenuation and Chromatic Dispersion.

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECE04	PRINCIPLES OF MANAGEMENT	3	0	0	3	50	50	100
Course objective	• To learn the historical development of management and administration. • To study responsibility of the working environment. • To study the structure and process of the functional area of organization • To understand the responsibility of the leadership in organization. • To learn the controlling strategies for the global issues..							
. Prerequisites: Nil								
1	FOUNDATIONS				Total Hrs			9
Historical developments –approaches to management– Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organization-								
2	MANAGERS & ENVIRONMENT				Total Hrs			9
Social responsibility–Planning – Objectives – Setting Objectives – Process of Managing through Objectives – Strategies- Policies & Planning Premises- Forecasting – Decision- making-								
3	FUNCTIONAL AREA OF ORGANISATION				Total Hrs			9
Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness								
4	MOTIVATION & DIRECTIONS				Total Hrs			9
Objectives– Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication								
5	CONTROLLING STRATEGIES				Total Hrs			9
System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology– Computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management-								
Total hours to be taught								45
Text book (s) :								
1	Harold Kooritz& Heinz Weihrich "Essentials of Management"- Tata McGraw- Hill-7th Edition-2007.							
2	Joseph L Massie "Essentials of Management"- Prentice Hall of India- (Pearson) 4th Edition-2003.							

Reference(s) :	
1	Harold Kooritz& Heinz Weihrich "Essentials of Management"- Tata McGraw- Hill-7th Edition-2007.
2	Joseph L Massie "Essentials of Management"- Prentice Hall of India- (Pearson) 4th Edition-2003.
3	Tripathy PC And Reddy PN- " Principles of Management"- Tata McGraw-Hill- 1999.
4	Decenzo David- Robbin Stephen A- "Personnel and Human Reasons Management"- Prentice Hall of India- 1996
5	Robbins-" Principles of Management" Pearson education -2005

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Semester VII								
Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECE06	REAL TIME OPERATING SYSTEMS	3	0	0	3	50	50	100
Course objective	• To learn the concept of operating systems • To study the overview of RTOS • To study the Models and Language of RTOS • To study the RTOS Kernel and Application							
Prerequisites: Embedded Systems								
1	REVIEW OF OPERATING SYSTEMS				Total Hrs		9	
Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes –Introduction to Distributed operating system – Distributed scheduling.								
2	OVERVIEW OF RTOS				Total Hrs		9	
RTOS Task and Task state - Process Synchronization- Message queues – Mail boxes - pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks								
3	REAL TIME MODELS AND LANGUAGES				Total Hrs		9	
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.								
4	REAL TIME KERNEL				Total Hrs		9	
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of various RTOS like QNX – VX works – PSOS – C Executive – Case studies.								
5	RTOS APPLICATION DOMAINS				Total Hrs		9	
RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.								
Total hours to be taught							45	
Text book (s) :								
1	Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006							
2	MukeshSighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill 2000							
Reference(s) :								
1	Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 1997.							
2	Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill 1997							
3	C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.							
4	Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systeems", PHI 1999.							

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECE08	TELEVISION AND VIDEOENGINEERING	3	0	0	3	50	50	100
Course objective	• To learn the basic concepts of the television and scanning system. • To study the various television standards and studio equipments. • To learn the transmission system and its propagation of television. • To learn the various equipments and methods of television receiver systems. • To study the specification of the advanced television system.							
Prerequisites: Antennas and Wave Propagation								
1	FUNDAMENTALS OF TELEVISION				Total Hrs		9	
Television System and scanning Principles: Sound and picture transmission- scanning process, video signals, characteristics of human eye, brightness perception and Photometric qualities, Aspect ratio and Rectangular scanning, persistence of vision and flicker, vertical resolution, Kell factor, Horizontal Resolution and video bandwidth, Interlaced scanning. Camera tubes- camera lenses- auto focus systems, camera pick up devices, Image orthicon- vidicon - plumbicon- silicon diode array vidicon –CCDsolid state image scanners - Comparison of Camera tubes- camera tube deflection unit- video processing of camera signals- color television signals and systems.								
2	TELEVISION STANDARDS AND STUDIO EQUIPMENTS				Total Hrs		9	
Composite video signal, scanning standards- Horizontal and vertical syn- blanking standards, video modulation and video signal standard- sound modulation and Inter carrier system- standard channel characteristics – Reception of VSB signals, TV Broadcast channels- CCIR-B standards-various TV broadcast systems- NTSC, PAL and SECAM system- comparison –Television studio system- production and master control Rooms- Tele cine equipments- Helical and AST system								
3	TELEVISION TRANSMISSION SYSTEM, PROPAGATION AND ANTENNAS				Total Hrs		9	
REQUIREMENTS OF TV Broadcast Transmission, Design principle of TV Transmitters, IF Modulation, power output stages- Block diagram of TV transmitters, visual exciter,- Aural Exciter- Diplexer- Transmitting antennas- Radio wave Characteristics- propagation phenomena- space wave propagation- Line of sight range- space wave reception over smooth terrain- distance reception- Shadow zonesco channel interference- Ghost images- interference problems. Receiving antenna requirements, characteristics and types- parasitic elements- Yagi aerials- Feeders matching- booster amplifiers.								
4	TELEVISION RECEIVER SYSTEM				Total Hrs		9	
Block diagrams for monochrome and colour receivers-Specifications- VHF/UHF tuner with AFT, Digital tuning-Video If amplifier requirements- trap circuit- IF amplifier design SAW filter- video amplifier requirements- design of sound IF Takeoff – Sound If amplifier- FM discriminators.- Picture Tube- Electron Gun-Deflection system characteristics- colour picture tubes- shadow mask- Trinitron- PIL picture tubes- purity convergence- automatic degaussing, pincushion correction- flat panel displays plasma- displays-LCD- Horizontal vertical deflection systems- requirements- EHT generation and regulation- synch separators- SMPS- colour killer-colour decoders- CCD techniques.								
5	ADVANCED TELEVISION SYSTEMS (Qualitative				Total Hrs		9	

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Remote control of TV receivers, Wobbuloscope, pattern generators- Cam corders- Cable TV – Types, processors, scrambling and conditional access systems- Satellite Television system –Tele text of video text systems- digital TV system- HDTV- 3DTV – VCR-Videodisc system.			
Total hours to be taught			45
Text book (s) :			
1	A-M-Dhake-" Television and video Engineering" second Edition TMH 2003		
2	R-R-Gulati-"Modern Television Practice -Technology and servicing –secondedition –		
Reference(s) :			
1	Bernard Grob," Basic Television Principles and servicing"- second edition,New age International Publisher -2004.		
2	R.G.Gupta, "Television Engineering and Video systems," First Edition, TMHIndia 2007		

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
711ECE09	HIGH SPEED NETWORKS	3	0	0	3	50	50	100
Course objective	• To study principles and standards of the ISDN, ATM, MPLS and DSLADSL. • To study the structure and protocols of the ISDN, ATM, MPLS and DSLADSL. • To learn the working of various networking applications. • To study the quality of services and traffic in high speed networks. To learn about the design considerations and future enhancements in HSN							
Prerequisites	Computer Networks							

1	HIGH SPEED NETWORKS	Total Hrs	9
Principles and standards - ISDN - B-ISDN- High Speed LAN- Frame Relay- DSLADSL-ATM and MPLS			
2	PROTOCOLS AND STRUCTURE	Total Hrs	9
Overview of Higher Layer-Layer ATM and MPLS protocol and Control Plane Protocol- ATM Control Plane Structure and AAL- ATM User Network Interface (UNI) Signalling- ATM control Plane addressing- MPLS Control Plane Architecture- MPLS Label Distribution Protocols- ATM – PNNI- and B-ISDN User Services Part-			
3	NETWORKING APPLICATIONS	Total Hrs	9
Packet Voice Networking- Voice Trunking- Broadband Local Loop Emulation- Voice Over ATM and Pocket Networks- Multi-protocol Encapsulation over AAL5- ATM Forum LAN Emulation- Ethernet over MPLS			
4	QUALITY OF SERVICE AND TRAFFIC ENGINEERING	Total Hrs	9
Quality of Service- Traffic Parameters and Conformance Definitions- Classes of Service- Achieving Conformance- Checking Conformance- Ensuring conformance- Delivering QoS- Congestion Control and Management			
5	DESIGN CONSIDERATIONS AND FUTURE DIRECTIONS	Total Hrs	9
Design Considerations for ATM and MPLS Networks- Efficiency Analysis- Scalability Analysis- Complexity Analysis- Applications of ATM- Applications of MPLS- Possible Future of Multi-Service Networking-			
Total hours to be taught			45

Text book (s) :

1	Uyless Black: MPLS and Label Switching Networks- Second Edition- PearsonEducation- Asia-2001
2	Stallings"High speed networks"- pearson/PHI,2006

Reference(s) :

1	David E- WcDysan and Dave Paw- "Communications Networking: ATM- MPLSTheory and

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	Application Foundations of Multi-Service Networking"- Osborne/McGraw Hill- USA- 2003- Published in India by Dreamtech- New Delhi-
2	SumitKasera- and PankajSethi- "ATM Networks"- Tata McGraw-Hill- New Delhi- 2000-
3	Rainer Handel, ATM Networks, Addison-Wesley-1994

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
811ECT01	CELLULAR AND MOBILE COMMUNICATION	3	0	0	3	50	50	100
Objective(s)	• To provide the student with an understanding of the cellular concept, frequency reuse, hand-off strategies. • To enable the student to analyze and design wireless and mobile cellular communication sytems over a stochastic fading channel. • To provide the student with an understanding of digital cellular systems(GSM, CDMA) • To give the student an understanding of present day cellular technologies implemented in LTE like OFDM, MIMO systems							
Prerequisites	Digital Communications							

1	**MULTIPLE ACCESS TECHNIQUES AND CELLULAR CONCEPT**	Total Hrs	9
Multiple Access Techniques: FDMA- TDMA- spread spectrum multiple access- CDMA- SDMA- CSMA protocols- Cellular Concept: Frequency reuse- channel assignment- hand off- Interference and system capacity- tracking and grade of service- Improving Coverage and capacity in Cellular systems			
2	**MOBILE RADIO PROPAGATION**	Total Hrs	9
Free space propagation model- relating power to electric field -Propagation mechanisms- reflection –Ground reflection model -diffraction- scattering- link budget design using path loss models -Small scale Multipath propagation- Impulse response model of a multi-path channel- Small scale Multipath measurements parameters of Mobile multipath channels- types of small scale fading			
3	**MODULATION TECHNIQUES- DIVERSITY AND ANTENNAS**	Total Hrs	9
Modulation Techniques: Binary frequency shift keying- Minimum Shift Keying- Gaussian MSK- Orthogonal Frequency Division Multiplexing- Diversity reception- -Types of diversity- RAKE receiver -Basic combining methods- Base station and mobile station antennas			
4	**SPEECH CODING**	Total Hrs	9
. Characteristics of speech signals - Quantization techniques - Adaptive Differential pulse code modulation(ADPCM)- Frequency domain coding of speech Vocoders- Linear Predictive Coders- Selection of Speech Codecs for Mobile Communication- GSM Codec- USDC Codec - Performance evaluation			
5	**CELLULAR STANDARDS**	Total Hrs	9
Total hours to be taught			45

Text book (s) :

1. T.S.Rappaport- Wireless Communications: Principles and Practice- Second Edition- Pearson Education/ Prentice Hall of India- Third Indian Reprint 2003.
2. Vijay K-Garg- "Wireless Network Evolution 2G to 3G"- Pearson Education- New Delhi- 2003.

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Reference(s) :	
1	Dharma Prakash Agarwal and Qing – An Zeng- "Introduction to Wireless and Mobile Systems"- 2nd Edition- Thomson Learning- New Delhi- 2007
2	William C.Y.Lee-"Mobile and Cellular Telecommunications Analog and Digital Systems"- 2 e -TMH
3	Tse & viswanath "cellular communicatoion
4	*Schiller"mobile communications" pearson 2005*

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
811ECE01	SATELLITE COMMUNICATION	3	0	0	3	50	50	100
Course objective	• To understand the Kepler's law of motion and different orbital elements • To know the Altitude and orbit control in spacecraft subsystems • To understand the design of Spacelinks • To understand the multiple access technique for Satellite Communication							

1	ORBIT DYNAMICS	Total Hrs	9
Kepler's Three laws of Planetary motion- Definition of terms for Earth-Orbiting Satellites- orbital elements- orbital parameters- orbital perturbations- station keeping frequency allocation- non Geo-stationary orbits- Geo stationary orbits- sun transit outages- limits of visibility- Look Angle determination-Sub satellite point- Elevation Angle Calculation- Azimuth angle calculation- Launching of Geo Stationary satellites-			
2	SPACE SEGMENT AND LINK DESIGN	Total Hrs	9
Space Segment: Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders – Wideband Receiver – Input Demultiplexer – Power Amplifier – Antenna Subsystem- **Link Design:** Satellite uplink – down link- link power budget- c/no- G/T- Noise temperature- System noise- propagation factors- rain and ice effects- polarization-			
3	SATELLITE ACCESS	Total Hrs	9
Modulation and Multiplexing: Voice- Data- Video- Analog – digital transmission system- Multiple access: FDMA systems- TDMA systems- Beam Switching and Satellite Switched TDMA- CDMA			
4	EARTH SEGMENT	Total Hrs	9
Transmitters- receivers- Antennas- Terrestrial Interface- TVRO- MATV- CATV- Test Equipments- Measurements on G/T- C/No- EIRP- Antenna Gain-			
5	SATELLITE APPLICATIONS	Total Hrs	9
INTELSAT Series- INSAT- VSAT- Weather service- Remote sensing- mobile satellite services: GSM- GPS- INMARSAT- Satellite Navigational System- Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH)- Digital audio broadcast (DAB)- Business TV(BTV)- GRAMSAT- Digital video Broadcast-			
Total hours to be taught			45

Text book (s) :

1	Dennis Roddy- 'Satellite Communication'- Tata McGraw Hill-2006
2	Wilbur L- Pritchard- Hendri G- Suyderhoud- Robert A- Nelson- 'Satellite Communication Systems Engineering'- Pearson/Prentice Hall- II Edition- 1993
3	Pratt and Bostian " Satellite Communication" John Wiley - 2001

Reference(s) :

1	Timothy Pratt - Charles Bostian & Jeremy Allmuti- Satellite Communications-John Willy & Sons (Asia) Pvt- Ltd- 2004
2	M-Richharia : Satellite Communication Systems (Design Principles)Pearson Second Edition

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
811ECE02	**TELECOMMUNICATION SWITCHING NETWORKS**	3	0	0	3	50	50	100
Course objectives	• To introduce the students the latest development of Telecommunication systems • To provide an introduction to and an understanding of the architecture and major design issues relating to switching systems							

1	**MULTIPLEXING**	Total Hrs	9
Transmission Systems- FDM – TDM - Line Coding - 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-			
2	**DIGITAL SWITCHING**	Total Hrs	9
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 SSN07 signaling-			
3	**NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT**	Total Hrs	9
Timing: Timing Recovery: Phase-Locked Loop- Clock Instability- Jitter Measurements- Systematic Jitter- Timing Inaccuracies: Slips- Asynchronous Multiplexing- Network Synchronization- Network Control- Network Management-			
4	**DIGITAL SUBSCRIBER ACCESS**	Total Hrs	9
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-			
5	**TRAFFIC ANALYSIS**	Total Hrs	9
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-			
Total hours to be taught			45
Text book (s) :			
1	Bellamy John- "Digital Telephony"- John Wily & Sons- Inc- 3rd edn- 2000-		
2	Thiagarajan Viswanathan,"Telecommunication switching systems and Networks"-PHI-2004		

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Reference(s) :	
1	D N Krishna Kumar- "Telecommunication & Switching"- Sanguine Technical Publishers-Bangalore-2006
2	J.E.Flood, Telecommunication switching, Traffic and Networks, Pearson Education Ltd, New Delhi, 2001.
3	Syed R Ali, Digital switching systems, McGraw-Hill, New York 1998.

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		L	T	P	C	CA	EA	Total
811ECE03	WIRELESS NETWORKS	3	0	0	3	50	50	100
Course objective	• To understand fundamentals of wireless communication technology • To understand the Network principles with different parameters • To understand the network operation with different accessing technique • To design infrastructure-less network and MAC protocol							

1	INTRODUCTION	Total Hrs	9
Introduction –Fundamentals of Wireless Communication Technology – Electromagnetic Spectrum – Radio Propagation Mechanisms - Characteristics of the Wireless Channel – Wireless LANs and PANs – Fundamentals of WLANs – IEEE 802- 11 Standard – HIPERLAN Standard – Bluetooth – Home RF – Wireless Sensor Networks – Optical Wireless Networks-			
2	NETWORK PRINCIPLES	Total Hrs	9
Air-Interface Design - Radio Propagation Mechanisms – Path Loss Modeling and Signal Coverage – Effects of Multipath and Doppler- Channel Measurement and Modeling techniques – Simulation of Radio Channel –Wireless Medium Access Alternatives – Fixed Assignment Access for Voice-Oriented Networks – Random Access for Data-Oriented Networks – Integration of Voice and Data Traffic– Wireless Network Topologies – Cellular Topology – Cell Fundamentals – Signal-to-Interference Ratio Calculation – Capacity Expansion Techniques			
3	NETWORK OPERATIONS	Total Hrs	9
Wireless Network Operation - Mobility Management – Radio Resources and Power Management – Radio Resources and Power Management – Security in Wireless Networks - Wireless WANs – GSM and TDMA Technology –CDMA Technology – IS- 95 and IMT-2000 – Mobile Data Networks – CDPD Networks – GPRS – Mobile Application Protocols-			
4	INFRASTRUCTURELESS NETWORK	Total Hrs	9
Introduction – Issues in Ad Hoc Wireless Networks – Medium Access Scheme – Routing - Multicasting – Transport Layer Protocols – Pricing Scheme – Quality of Service Provisioning –Self Organization – Security – Addressing and Service Discovery – Energy Management – Scalability – Deployment Considerations – Ad Hoc Wireless Internet-			
5	MAC PROTOCOLS	Total Hrs	9
Introduction – Issues in Designing a MAC Protocol for Ad hoc Wireless Networks – Bandwidth Efficiency – Quality of Service Support – Synchronization –Hidden and Exposed Terminal Problems – Error-Prone Shared Broadcast Channel – Distributed Nature/Lack of Central Coordination – Mobility of Nodes- Design Goals of a MAC Protocol for Ad Hoc Wireless Networks – Classification of MAC Protocols – Contention Based Protocols – Contention Based Protocols with Reservation Mechanisms – Contention Based Protocols with Scheduling Mechanisms – MAC Protocols That Use Directional Antennas – Other MAC Protocols-			
Total hours to be taught			45

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Text book (s) :	
1	Kaveh Pahlavan- Prashant Krishnamurthy "Principles of Wireless Networks"-Pearson Education- Delhi- 2002 and PHI- 2005
2	C- Siva Ram Murthy and B- S- Manoj "Ad Hoc Wireless Networks Architectures andProtocols"- Pearson Education -2nd Edition -Delhi -2004.
Reference(s) :	
1	Ron Price, Fundamentals of Wireless Networking, TMH,2007.
2	William Stallings- "Wireless Communication and Networks"- Pearson Education-Delhi- 2002
3	Dharma Prakash Agarwal and Qing – An Zeng- "Introduction to Wireless and Mobileystems"- 2nd Edition- Thomson Learning- New Delhi- 2007

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		L	T	P	C	CA	EA	Total
811ECE06	**MICROWAVE INTEGRATED CIRCUIT DESIGN**	3	0	0	3	50	50	100
Course objective	• To design and realize the couplers and microstrip lines • To design the filters • To design and analyze the amplifiers using MICs • To design Microwave oscillators and mixers							
1					Total Hrs			9
Design and realization of Power Dividers: Hybrids- directional couplers etc using Strip lines and Microstrip lines-								
2					Total Hrs			9
Filter Design: Kuroda identities - K inverter – J inverter- Filter Transformations- Realization using Strip line and Microstrip line-								
3					Total Hrs			9
Transistor Amplifier: Power gain equations- stability considerations- Analysis and Design using MICs								
4					Total Hrs			9
Transistor Oscillators: Active Devices for Microwave Oscillators- Three port S parameter characterization of transistors- Oscillation and stability conditions-								
5					Total Hrs			9
Diode Mixers : Mixer Design- Single ended mixer- Balanced mixer- Image Rejection mixer- Phase shifter Design- PIN diode- Phase shifter-								
Total hours to be taught								45
Text book (s) :								
1.	I-J-Bahl & P-Bhartia: Microwave Solid State Circuit Design- Wiley Interscience-1987-							
2.	G-D Vendelin- Design of Amplifier and Oscillator by the S parameter method-John Wiley- 1982							
Reference(s) :								
1	T-C- Edwards- Foundations for Microstrip Circuit Design- (2/e)- John Wiley-1992							
2	K.C.Gupta etal- Microstrip Lines and Slotlines- Artech House Publishers-2005							

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
811ECE09	**TOTAL QUALITY MANAGEMENT**	3	0	0	3	50	50	100
Course objective	• To understand the quality management concept • To understand the quality management principles and standards • To understand the statistical process control • To understand the quality management tools for the quality systems							

1	**INTRODUCTION**	Total Hrs	9
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.			
2	**TQM PRINCIPLES**	Total Hrs	9
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure-Business Excellence Model-Rajiv Gandhi National Quality Award			
3	**STATISTICAL PROCESS CONTROL (SPC)**	Total Hrs	9
The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.			
4	**TQM TOOLS**	Total Hrs	9
Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.			
5	**QUALITY SYSTEMS**	Total Hrs	9
Introduction, Consensus, Scope, Selection and Use of the ISO 9000:2000 , The ISO 9000 Family, Implementing the ISO 9001:2000 Quality Management System.– Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.			
Total hours to be taught			45

Text book (s) :

1	Subburaj Ramasamy,Total Quality Mangement,Tata McGraw Hill,NewDelhi,2007.
2	Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).

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Reference(s) :	
1	James R.Evans & William M.Lidsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005 (ISBN 978-81-315-0136-8)
2	Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
3	Zeiri. "Total Quality Management for Engineers, Wood Head Publishers, 1991.

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		L	T	P	C	CA	EA	Total
811ECE11	**MOBILE ADHOC NETWORKS**	3	0	0	3	50	50	100
Course objective	• To understand fundamentals of wireless ADHOC technology • To understand the routing principles for ADHOC Networks • To design ADHOC network using security protocol • To provide the QoS sensitive routing and energy management for ADHOC networks							
1	**Wireless Ad Hoc Communication Technologies**					Total Hrs		9
Wireless LANs(W-LANs) - W-LAN Network configuratios-IEEE 802.11 protocol specifications-ETSI Hiper LAN:layers,services, and entities-Bluetooth:Network configuration-protocol stack-topologies-applications-Short-range Ad Hoc Configurations:Body area network-wireless personal area network.								
2	**Dynamic Routing**					Total Hrs		9
Network model-Routing for wired networks:Decentralized and Global Routing Algorithm-Routing in mobile wireless networks-Routing and mobility management in infrastructured wireless networks:location tracking and updating the location database-Mobile wireless networks:route discovery,route maintenance e,androuting protocol categories.								
3	**Transport Layer and Security Protocols**					Total Hrs		9
Design of transport layer protocol for Ad Hoc wireless network-classification of transport layer solution-TCP over Ad Hoc wireless network-security in Ad Hoc wireless network:requirements-issues and challenges in security provisioningattacks- key management-secure routing in Ad Hoc wireless network.								
4	**Quality of Service Sensitive Routing**					Total Hrs		9
Routing with Quality of Service (QoS) consraints-QoS in Infrastructured wireless mobile networks-hurdles for multimedia in mobile multihop wireless networks- Reference framework:Functional specifications-Application model and QoS bands-QoS mapping-QoS manager-call admission block-bandwidth reservationresource adaptation-degradation policies-packet sorter and shaper-schedulermedium access control-channel allocation-end to end path bandwidth calculation-slot assignment phase.								
5	**Energy Management and Multihop Relaying**					Total Hrs		9
Classification of Energy management schemes-Battery management schemes- Transmission power and System power management schemes-3G Networks versus W-LAN-potential of multihop relaying in future generation systems-future of ad hoc networking.								
Total hours to be taught								45
Text book (s) :								
1	George Aggelou,"Mobile Ad Hoc Networks", Tata McGraw Hill Education Private Limited,New Delhi,2009.							
2	Siva Ram Murthy C and Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols",Prentice Hall,June 2004.							

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Reference(s) :	
1	Charles E Perkins, "Ad Hoc Networking",Addison-Wesley,2001.
2	Toh C K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems",Prentice hall,2001.
3	Basangi S,Marco Conti,Silvia Giordano,Ivan Stojmenovi and Cacute,"Mobile Ad Hoc Networking",John Wiley and Sons,2004.

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		L	T	P	C	CA	EA	Total
811ECE12	**ARM SYSTEM ARCHITECHTURE AND APPLICATIONS**	3	0	0	3	50	50	100
Course objective	• To study the ARM architecture • To develop the architecture for high level language • To develop the architecture for system development • To study the memory of ARM and implementing in Embedded applications							
Prerequisites	Advanced Microprocessors							
1	**The ARM Architecture**				Total Hrs			9
ARM Embedded system-ARM processor fundamentals-ARM instruction set- The Thumb instruction set-ARM processor cores- ARM assembly language programming								
2	**Architectural support for High level language**				Total Hrs			9
Writing and optimizing ARM assembly code-Instruction schedules- Register allocation – Conditional execution- looping constructs- Bit manipulation-Function and procedures- use of memory								
3	**Architectural support for System Development**				Total Hrs			9
The ARM memory interface-The advanced Microcontroller bus architecture(AMBA)-Hardware system prototyping tools-the ARMulator- The JTAG boundary scan test architecture-The ARM Embedded trace- debug architecture-Signal processing support-DSP on the ARM-Architectural support for OS								
4	**Memory hierarchy and ARM CPU cores**				Total Hrs			9
Caches-Memory protection unit-Memory management unit-ARM CPU cores-The AMULET asynchronous ARM Processors								
5	**Embedded ARM Applications**				Total Hrs			9
Embedded Operating systems-Principle components-Simple operating system.The VLSI Ruby II Advanced communication processor-The VLSI ISDN subscriber processor-The one CTMVWS22100 GSM chip-The Ericsson –VLSI Bluetooth Baseband Controller-The ARM 7500 and ARM 7500FE.The ARM 7100-The SA-1100								
Total hours to be taught								45
Text book (s) :								
1.	Steve Furber,"ARM System-on-chip architecture" Addison Wesley,2000							
2.	Andrew N.SLOSS,Dominic SYMES,Chris Wright,"ARM System Developer's Guide,Designing and optimizing system software",Morgan Kaufmann,2007.							
Reference(s) :								
1	David Seal , "ARM Architecture Reference Manual", Pearson Education ,2007							

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Course code	Course name	Hours/week			Credit	Maximum mark		
		L	T	P	C	CA	EA	Total
811ECE16	**INTELLECTUAL PROPERTY RIGHTS (IPR)**	3	0	0	3	50	50	100
Course objective	• To study the importance of Intellectual property rights • To learn the copyrights and Infringement • To learn the international agreement for the protection of IPR • To study the significance of Patents and its applications							
1	**IMPORTANCE OF INTELLECTUAL PROPERTY RIGHTS**				Total Hrs			9
Introduction – Tangible and Intangible Properties- Intellectual property- an intangible wealth and a product of creative mind – IPR and its significance- Types of IPRs-								
2	**COPYRIGHTS AND RELATED ISSUSES**				Total Hrs			9
Works protected by copyright- Reproduction rights-moral rights-translation and adaptation rights-copyright issues-Piracy- civil -criminal remedies-Infringement- Patents – Copyrights of designs and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures-								
3	**INTERNATIONAL AGREEMENT FOR THE PROTECTION OF IPR**				Total Hrs			9
Berne convention-Madrid agreement-Hague agreement-Patent cooperation treaty- Paris convention-Lisbon Agreement - Establishment of WIPO – UPOV and WTOMission and Activities – History – General Agreement on Trade and Tariff (GATT)-								
4	**PATENTED INVENTION AND ADMINISTRATION**				Total Hrs			9
Significance of Patent information-classification of invention according to technology- Novelty search and state of art search-Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition-								
5	**APPLICATIONS**				Total Hrs			9
Case Studies on – Patents (Basumati rice- turmeric- Neem- etc-) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition- Patent agents-Examiner of Patents- IPR Managers-								
Total hours to be taught								45
Text book (s) :								
1.	Prabuddha Ganguli, "Intellectual Property Rights,"TMH, 2001.							
2.	Subbaram N-R- " Handbook of Indian Patent Law and Practice "- SViswanathan (Printers and Publishers) Pvt- Ltd—1998.							

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