COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

VISION AND MISSION

VISION

The Institute strives to inculcate a sound knowledge in engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

MISSION

The mission of the Institute is to impart high quality education and training to its students to make them World-Class Engineers with a foresight to the changes and problems and pioneers to offer innovative solutions to benefit the nation and the world at large.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COIMBATORE INSTITUTE OF TECHNOLOGY

VISION AND MISSION

VISION

To develop excellence in education and research, to nurture excellence to the learners, to induct the students to become leaders and entrepreneurs in large numbers and mould them to meet the current and impending challenges so that they will be of use to Industry, Nation and Mankind.

MISSION

M1 : To impart high quality education and training to the students in the field of Electronics and Communication Engineering.

M2 : To promote the creation and dissemination of knowledge.

M3 : To provide a framework for promoting collaborative research with industry.

M4 : To prepare them for professional careers and continuous learning and benefit the nation and the world at large.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COIMBATORE INSTITUTE OF TECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The following Programme Educational Objectives are designed based on the Department Mission

PEO 1 : To provide basic knowledge and understanding of concepts in basic engineering sciences and mathematics.

PEO 2 : To develop an ability to identify, formulate, analyze and solve design problems in Electronics and Communication Engineering, thereby enabling them to develop basis for R&D activities.

PEO 3 : To inculcate in students professional and ethical standards, effective communication skills, teamwork spirit, multidisciplinary approach, needed for professional success in national and multinational companies, institutions and organizations.

PEO 4 : To develop and apply engineering solutions for solving contemporary social and human issues within realistic constraints and engage in lifelong learning.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COIMBATORE INSTITUTE OF TECHNOLOGY

PROGRAMME OUTCOMES (POs)

Students in the Department of Electronics and Communication Engineering programme at the time of their graduation should be in possession of :

PO1 : An ability to apply knowledge of mathematics, science, and engineering

PO2 : An ability to design and conduct experiments, as well as to analyze and interpret data

PO3 : An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

PO4 : An ability to function in and lead multidisciplinary teams

PO5 : An ability to identify, formulate, and solve engineering problems

PO6 : An understanding of professional and ethical responsibility

PO7 : An ability to communicate effectively

PO8 : The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

PO9 : A recognition of the need for, and an ability to engage in life-long learning

PO10 : A knowledge of contemporary issues

PO11 : An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

PO12 : An in-depth understanding of core electronics and communication engineering in both theoretical concepts and practical aspects

PO13 : An ability to model, understand and develop complex software and information systems

PO14 : An ability to apply skills and tools to develop electronic hardware systems

COIMBATORE INSTITUTE OF TECHNOLOGY

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B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Curriculum from the Academic Year 2013 - 2014 onwards

Semester III

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13CE31	MATHEMATICS III	3	1	0	4
2.	13EC32	PRINCIPLES OF ELECTRICAL ENGINEERING	3	0	0	3
3.	13EC33	ELECTRON DEVICES	3	0	0	3
4.	13EC34	MEASUREMENTS AND INSTRUMENTATION	3	0	0	3
5.	13EC35	DIGITAL CIRCUITS AND SYSTEM DESIGN	3	1	0	4
6.	13EC36	SIGNALS AND SYSTEMS	3	1	0	4
7.	13EC37	DIGITAL CIRCUITS AND SYSTEM DESIGN LABORATORY	0	0	3	2
8.	13EC38	ELECTRICAL ENGINEERING AND MEASUREMENTS LABORATORY	0	0	3	2
9.	13CE49	SCIENCE OF CREATIVITY & PROFESSIONAL ETHICS	2	-	-	-
		TOTAL				**25**

Semester IV

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13EC41	PROBABILITY & RANDOM PROCESS	3	1	0	4
2.	13EC42	ELECTRONIC CIRCUITS	3	1	0	4
3.	13EC43	PRINCIPLES OF COMMUNICATION	3	0	0	3
4.	13EC44	NETWORKS AND TRANSMISSION LINES	3	1	0	4
5.	13EC45	ELECTROMAGNETIC FIELDS AND WAVEGUIDES	3	1	0	4
6.	13EC46	COMPUTER ARCHITECTURE & ORGANIZATION	3	0	0	3
7.	13EC47	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	0	0	3	2
8.	13EC48	NETWORKS AND TRANSMISSION LINES LABORATORY	0	0	3	2
9.	13CE49	SCIENCE OF CREATIVITY & PROFESSIONAL ETHICS	2	-	-	2
		TOTAL				**28**

Semester V

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13EC51	LINEAR INTEGRATED CIRCUITS	3	0	0	3
2.	13EC52	DIGITAL COMMUNICATION	3	1	0	4
3.	13EC53	MICROPROCESSORS & MICROCONTROLLERS	3	0	0	3
4.	13EC54	DATA COMMUNICATION & NETWORKS	3	0	0	3
5.	13EC55	OOPS AND C++	2	0	3	4
6.	13EC56	CONTROL SYSTEMS	3	1	0	4
7.	13EC57	MICROPROCESSORS & MICROCONTROLLERS LABORATORY	0	0	3	2
8.	13EC58	LINEAR INTEGRATED CIRCUITS LABORATORY	0	0	3	2
9.	13EC69	MINI PROJECT	-	-	3	-
		TOTAL				**25**

Semester VI

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13EC61	DIGITAL SIGNAL PROCESSING	3	1	0	4
2.	13EC62	EMBEDDED SYSTEMS	3	0	0	3
3.	13EC63	OPTICAL COMMUNICATION AND NETWORKS	3	0	0	3
4.	13EC64	MICROWAVE ENGINEERING	3	0	0	3
5.	13EC65	ANTENNAS & WAVE PROPAGATION	3	0	0	3
6.	13EC66	INFORMATION THEORY & CODING	3	1	0	4
7.	13EC67	EMBEDDED SYSTEMS LABORATORY	0	0	3	2
8.	13EC68	DIGITAL SIGNAL PROCESSING LABORATORY	0	0	3	2
9.	13EC69	MINI PROJECT	-	-	3	2
		TOTAL				**26**

Semester VII

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13EC71	RF SYSTEMS	3	0	0	3
2.	13EC72	DIGITAL IMAGE PROCESSING	3	0	0	3
3.	13EC73	REAL TIME CONTROLLERS	3	0	0	3
4.	13EC74	ELECTIVE- I	3	0	0	3
5.	13EC75	ELECTIVE- II	3	0	0	3
6.	13EC76	COMMUNICATION SYSTEMS LABORATORY	0	0	3	2
7.	13EC77	RF, FIBER OPTICS LABORATORY	0	0	3	2
8.	13EC88	PROJECT WORK & VIVA VOCE	-	-	6	-
		TOTAL				**19**

Semester VIII

S. No.	Subject Code	Course Title	L	T	P	C
	THEORY					
1.	13EC81	INDUSTRIAL ECONOMICS AND CORPORATE MANAGEMENT	3	0	0	3
2.	13EC82	PRINCIPLES OF MOBILE COMMUNICATION	3	0	0	3
3.	13EC83	VLSI DESIGN	3	0	0	3
4.	13EC84	ELECTIVE- III	3	0	0	3
5.	13EC85	ELECTIVE -IV	3	0	0	3
6.	13EC86	VLSI DESIGN LABORATORY	0	0	3	2
7.	13EC87	DATA NETWORKS LABORATORY	0	0	3	2
8.	13EC88	PROJECT WORK & VIVA VOCE	-	-	6	6
		TOTAL				**25**

LIST OF ELECTIVES

S. No.	Subject Code	Course Title	L	T	P	C
1.	13ECE01	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3
2.	13ECE02	MULTIRATE SYSTEMS	3	0	0	3
3.	13ECE03	WIRELESS NETWORKS AND STANDARDS	3	0	0	3
4.	13ECE04	WIRELESS SENSOR NETWORKS	3	0	0	3
5.	13ECE05	LINEAR ALGEBRA AND NUMERICAL METHODS	3	0	0	3
6.	13ECE06	WAVELET TRANSFORMS AND APPLICATIONS	3	0	0	3
7.	13ECE07	ADVANCED PROCESSOR ARCHITECTURE	3	0	0	3
8.	13ECE08	ADVANCED EMBEDDED SYSTEM DESIGN	3	0	0	3
9.	13ECE09	VERILOG HDL	3	0	0	3
10.	13ECE10	VLSI SIGNAL PROCESSING	3	0	0	3
11.	13ECE11	TESTING OF VLSI CIRCUITS	3	0	0	3
12.	13ECE12	AUTOMOTIVE ELECTRONICS	3	0	0	3
13.	13ECE13	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	3	0	0	3
14.	13ECE14	MEMS	3	0	0	3
15.	13ECE15	MULTIMEDIA COMPRESSION TECHNIQUES	3	0	0	3
16.	13ECE16	3D IMAGING TECHNIQUES	3	0	0	3
17.	13ECE17	RF MICROELECTRONICS	3	0	0	3
18.	13ECE18	NANO ELECTRONICS	3	0	0	3
19.	13ECE19	MEDICAL ELECTRONICS AND INSTRUMENTATION	3	0	0	3
20.	13ECE20	ADVANCED MEDICAL INSTRUMENTATION	3	0	0	3
21.	13ECE21	RESOURCE MANAGEMENT TECHNIQUES	3	0	0	3
22.	13ECE22	JAVA PROGRAMMING	3	0	0	3
23.	13ECE23	DATA STRUCTURES	3	0	0	3
24.	13ECE24	ROBOTICS	3	0	0	3

13CE31 - MATHEMATICS III

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge about the complex variables and partial differential equations those are imperative for effective understanding of Electronics and Communication Engineering subjects*
- *to understand the concepts of Fourier transforms that have a direct leverage over Communication and Signal Processing applications*
- *to identify, analyze and solve boundary value problems*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an ability to apply knowledge of complex variables and partial differential equations to solve Electronics and Communication problems*

CO2 *: an understanding of Fourier Transforms to analyze and solve Communication and Signal Processing problems*

CO3 *: an ability to identify, analyze and solve boundary value problems*

COMPLEX DIFFERENTIATION

Analytic functions - Definitions and properties - Cauchy Riemann equations in Cartesian and polar coordinates - Construction of analytic functions - Conformal mappings -Bilinear Transformation - The mappings of the form w= z+a, az, 1/z, z2, eZ, sinz, cosz, -Simple problems. **(9)**

COMPLEX INTEGRATION

Cauchy's integral theorem - Integral formula - Taylor's and Laurent's series (without proof) - Types of singularities, Poles and residues - Cauchy's residue theorem -Applications - Contour integration using circular and semicircular contours. **(9)**

PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and functions - Solution by direct method - Solution of first order non-linear PDE - Standard types - Lagrange linear equation -Linear higher order homogeneous PDE with constant coefficients. **(9)**

FOURIER TRANSFORMS

Fourier integral theorem (without proof) - Infinite Fourier transform - Infinite Fourier sine and cosine transforms - Properties and problems - Convolution theorem - Parseval's identity - Finite Fourier sine and cosine Transforms - Properties and Problems. **(9)**

BOUNDARY VALUE PROBLEMS

Vibration of strings - One dimensional wave equations, one dimensional heat flow - unsteady state and steady state - Two dimensional heat flow steady state in Cartesian coordinates - Separation of variables - Fourier series solution. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Kandasamy, P.et al., "Engineering Mathematics", Volume - II & III S.Chand &Co., 2004.
2. Veerarajan .T, "Engineering Mathematics", (for Semester III), (3rd Edition (Fifth Reprint) Tata .Mc Graw - Hill publishing company Ltd, 2008.
3. Venkataraman.M.K, "Engineering Mathematics III", (for B.E., Third Semester), (Revised and Enlarged 14th Edition) The National Publishing Company, 2008.
4. Venkataraman.M.K, "Engineering Mathematics III-A", 11th Edition. The National Publishing Company, 2008.

REFERENCE BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons (Asia) Private Limited., 2008.
2. Grewal, B.S., "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2007.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×			×	×	×
2	×		×		×				×			×	×	×
3	×		×		×				×			×	×	×

13EC32 - PRINCIPLES OF ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to identify, analyze and solve the problems in DC and AC circuits*
- *to understand the principles of operation and speed control of DC and AC Machines.*
- *to acquire knowledge on the concepts of constructional features of Transformers*
- *to acquire knowledge on the concepts of Synchronous Machines, Induction Machines and special motors.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an ability to identify, analyze and solve the problems in DC and AC circuits*

CO2 *: an understanding the principles of operation and speed control of DC and AC Machines.*

CO3 *: knowledge of the concepts and constructional features of Transformers*

CO4 *: knowledge of the concepts on Synchronous Machines, Induction Machines and Special motors*

CO5 *: an ability to design, analyze and solve problems in Electrical Engineering.*

DC AND AC CIRCUITS

DC circuits : Resistance in series- Resistance in parallel-Series parallel Circuit- Kirchhoff's Law.

AC circuits: Average Value- R.M.S Value-Form Factor and Peak Factor-Phasor Representation of Sinusoidal quantity- AC Response of Series RLC Circuit.

Three phase circuits: Poly phase Systems-Interconnection of Three Phases-Star and Delta Connection-Voltage and Current in Balanced Star and Delta Connection- Advantages of Star and Delta Connection **(9)**

DC MACHINES

DC Generator: Constructional details-Principles of operation-EMF equation-Types-Characteristics-Losses and efficiency-Applications.

DC Motor: Principles of operation-Torque equation-Characteristics-Speed Control-Applications. **(9)**

TRANSFORMERS

Construction - Principles of operation - EMF equation - Types - Single Phase Transformer under no load and loaded condition - Equivalent circuit - OC and SC test - Regulation - Efficiency - Auto Transformer. **(9)**

INDUCTION MACHINES

Three phase Induction motor - Construction - Types - Principle of operation - Torque slip characteristics - Speed control - Starting - Applications-Single phase Induction motor- Capacitor start - Capacitor run - Induction motor - Universal motor. **(9)**

SYNCHRONOUS MACHINES AND SPECIAL MOTORS

Synchronous machines:Alternator-Construction-EMFequation-Regulation-Synchronous motor- Principle of operation-Starting-Applications.

Special motors: DC and AC servomotors-Stepper motor-Permanent magnet motors-Printed circuit motors-Hysteresis motors. **(9)**

TOTAL : 45

TEXT BOOKS

1. Edward Hughes, "Electrical Technology", ELBS Edition, 2008.
2. D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition,2010.

REFERENCE BOOKS

1. Ashfaq Husain "Electrical Machines", Dhanpat Rai & Co, New Delhi, 2007.
2. V. K. Mehta, "Principles of Electrical Engineering and Electronics", S. Chand&Co Ltd, New Delhi, 1st Edition, 2005.
3. B.L.Theraja,"A Text book of Electrical Technology", S.Chand &Co Ltd, New Delhi, volume II, First multicolor Edition, 2007.
4. Del Toro, "Electrical Engineering Fundamentals" Pearson Education, New Delhi, 2007.
5. Dhogal, "Basics of Electrical Engineering with numerical problems", McGraw Hill, 2007.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×	×	×	×	×	×
5	x	×	×		×				×	×	×	×	×	×

13EC33 - ELECTRON DEVICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on the principles of operation, characteristics and applications of semiconductor diodes and electronic devices*
- *to acquire basic knowledge of BJT, FET and their biasing techniques.*
- *to learn the operation and applications of special semiconductor devices.*
- *to explore the applications of diodes, BJT and FET.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *knowledge on the principles of operation, characteristics and applications of semiconductor diodes and electronic devices*

CO2 : *basic knowledge on BJT, FET and their biasing techniques*

CO3 : *an understanding of the operation and applications of special semiconductor devices*

CO4 : *an understanding of applications of diodes, BJT and FET*

SEMICONDUCTOR DIODE THEORY

Semiconductor Diode - Ideal Diode - Resistance Levels - Equivalent Circuits - Transition and Diffusion Capacitance - Reverse recovery time - Diode Approximations - Diode testing - Breakdown mechanism of Diodes- Load line analysis - Diode configurations - Switching times of diode - Zener Diodes - Operation and Equivalent Circuits. **(9)**

BJT THEORY AND BIASING

Transistor construction - Operation - Common Base, Common Emitter, Common Collector Configurations - Transistor amplifying action - Operation limits - Operating Point - Fixed Bias - Emitter Bias - Voltage Divider Bias Circuits - DC bias with Voltage feedback - Bias circuit Design - Bias Stabilization. **(9)**

FET THEORY AND BIASING

Field Effect Transistor - Construction and Characteristics - Depletion Type MOSFET - Enhancement Type MOSFET - CMOS - FET DC load line and Bias point - Fixed Bias, Self Bias, Voltage Divider Bias Configurations - Bias Circuit Design - Universal JFET Bias Curve. **(9)**

SPECIAL SEMICONDUCTOR DEVICES

Construction, Operation and Characteristics of Schottky, Varactor, Power, Tunnel and Photo Diodes - Photoconductive Cells - Solar Cells - Photo Transistors - Opto-Isolators - Light Emitting Diodes - IR Emitters - Liquid Crystal Displays - Thermistors - SCR - DIAC - TRIAC - UJT - Shockley Diode. **(9)**

APPLICATIONS OF SEMICONDUCTOR DEVICES

Applications of Diode: Rectifier Circuits Half Wave, Full wave and Bridge Rectifier with Capacitor, Inductor Filter - L and π Section Filter - Clippers - Clampers - Voltage Multipliers - Zener diode Voltage regulator.

Applications of BJT: Relay driver - Transistor switch -Voltage level indicator- Transistor switching circuits.

Applications of FET: Voltage controlled resistor - Timer network - FET in Fiber Optic system

Applications of Special semiconductor Devices: SCR in Variable Resistance Phase Control, VVC in tuning circuits, UJT as Relaxation Oscillator, Tunnel diode as Negative Resistance Oscillator. **(9)**

TOTAL : 45

TEXT BOOKS

1. Robert L. Boylestead and Louis Nasheresky, "Electron Devices and Circuits: Theory and Practice", Prentice Hall of India, 10th Edition, 2009.
2. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.

REFERENCE BOOKS

1. B.G.Streetman,"Solid state Electron Devices", PHI learning,6th edition,2009.
2. Millman and Halkias.C., "Integrated Electronics", Tata McGraw Hill, 2nd Edition, 2009.
3. Albert Paul Malvino and David J.Bates, "Electronic Principles", Tata McGraw Hill, 7th edition, 2007.
4. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition, 2009.
5. Allen Mottershead,"Electron devices and Circuits",PHI learning,1st edition,2011.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×		×	×	×	×
2	×	×	×		×				×		×	×	×	×
3	×	×	×		×			×	×		×	×	×	×
4	×	×	×		×				×		×	×	×	×

13EC34 - MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

To enable the students

- *to understand the basic concepts of Measurements and instruments.*
- *to gain knowledge in detail about sensors and transducers.*
- *to understand the concepts of bridge circuits used for measurements.*
- *to acquire basic knowledge on signal generators, oscilloscopes and display systems.*
- *to develop knowledge and skills in virtual instrumentation software.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *understanding of basic concepts of measurements and instruments*

CO2 : *in-depth knowledge on sensors and transducers.*

CO3 : *in-depth understanding of bridge circuits used for measurements.*

CO4 : *knowledge on signal generators, oscilloscopes and display systems.*

CO5 : *an ability to apply skills in virtual instrumentation software.*

INTRODUCTION TO MEASUREMENTS AND INSTRUMENTS

Measurement - Instrumentation - Methods of measurements - Modes of Measurements -Functional elements of instruments - Static and Dynamic characteristics of instruments -Errors in Measurements - Statistical analysis of data. **(8)**

SENSORS AND TRANSDUCERS

Classification of Transducers - Resistance transducers - Inductance transducers -Capacitance transducers - Piezo electric transducer - Strain gauge - Pneumatic sensors -Light sensors - LVDT - Thermistors - Thermocouples - Pressure sensors - Electronic weighing machines - Ultrasonic detectors - Photo sensitive devices. **(9)**

BRIDGE MEASUREMENTS

DC Bridges: Wheatstone Bridge, Kelvin Bridge - AC bridges: Hay Bridge, Maxwell Bridge, Desauty bridge, Schering Bridge, Wien Bridge - Q meters - Automatic Bridges. **(8)**

SIGNAL GENERATORS AND DISPLAY SYSTEMS

Sine wave generator - Frequency synthesized signal generator - Pulse and square wave generator - CRO: Block diagram of General Purpose Oscilloscope, Basic controls of CRO - Digital Storage Oscilloscope

- Sampling Oscilloscope - Digital Frequency Meter, LED, LCD & dot matrix display,Data Loggers,Touch Screen-Application of aircrafts. **(12)**

VIRTUAL INSTRUMENTATION

Introduction to Virtual Instrumentation - Basics of LabVIEW - FOR and WHILE loops - Structures - Arrays and Clusters - Graphs and Charts - Data Acquisition with LabVIEW. **(8)**

TOTAL : 45

TEXT BOOKS

1. Albert D Helfrick, Cooper. W.D, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2006.
2. Sanjay Gupta and Joseph John, "Virtual Instrumentation Using LabVIEW", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.

REFERENCE BOOKS

1. Barry Paron, "Sensor, Transducer and LabVIEW", Prentice Hall, New Delhi, 2000.
2. Nakra B C and Choudhury K K, "Instrumentation Measurement and Analysis", Tata McGraw Hill, New Delhi, 2nd Edition, 2009.
3. Sawhney A K, "A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi, 2011.
4. Garry M Johnson, "LabVIEW Graphical Programming", Tata McGraw Hill, New Delhi, 4th Edition, 2006.
5. LabVIEW Basics-I Manual, National Instruments, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×		×	×		×
2	×		×		×				×		×	×		×
3	×		×		×				×		×	×		×
4	×		×		×				×		×	×		×
5			×								×		×	×

13EC35 - DIGITAL CIRCUITS AND SYSTEM DESIGN

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To enable the students to acquire knowledge on methods of representation, simplification and implementation of basic digital circuits using Boolean algebra.*
- *To enable the students to identify, formulate, design and analyze combinational, sequential and asynchronous sequential logic circuits.*
- *To enable the students to have an understanding of Programmable Logic Devices.*
- *To enable the students to describe digital circuits using VHDL and be aware of functional verification of digital circuits by simulating VHDL descriptions.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: knowledge on methods of representation, simplification and implementation of basic digital circuits using Boolean algebra.*

CO2 *: an ability to identify, formulate, design and analyze combinational, sequential and asynchronous sequential logic circuits*

CO3 *: an in-depth understanding of Programmable Logic Devices*

CO4 *: an ability to describe digital circuits using VHDL and be aware of functional verification of digital circuits by simulating VHDL descriptions*

INTRODUCTION

Review of Binary Number Systems- Binary codes -Boolean Algebra and Logic Gates -Karnaugh Map - Canonical and standard forms - Product of Sums Simplification, Sum of Products Simplification,Don't Care Conditions - NAND and NOR implementation -Quine-McClusky method. **(9)**

COMBINATIONAL LOGIC DESIGN

Adder -Subtractor- BCD adder - Magnitude Comparator -Decoders - Encoders -Code convertors - Multiplexers - Demultiplexers- Design of Combinational Logic Circuits using decoders, multiplexers and demultiplexers - implementation of combinational circuits using ROM - PLDs: Programmable Array Logic- Programmable Logic Array. **(9)**

SYNCHRONOUS SEQUENTIAL LOGIC DESIGN

Flip-Flops - Types - Master Slave configuration - Characteristic table and equation -Flip Flop excitation tables - Shift registers -Universal Shift registers-Binary Counter- Ring Counter - Johnson's Counter - Modulo-N counters - Timing Signal Generation - Mealy/Moore models - Analysis of clocked sequential circuits- Concepts of state equations: State diagrams, State table, State reduction, State Assignment - Design of synchronous sequential circuits. **(9)**

ASYNCHRONOUS SEQUENTIAL LOGIC DESIGN

Block diagram -Analysis and Procedure-Circuit with Latch-Design Procedure-Reduction of state and flow table-Race free state assignment-Hazards. **(9)**

VHDL

Introduction to Hardware Description Language and VHDL - Design flow - Entity, architecture, process, configuration and package declarations - Signals and data types - Operators and expressions - Concurrent and sequential statements - Behavioral modeling -Data flow modeling -structural modeling - VHDL code for Combinational circuits, Flip Flops, Registers and Counters. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. M. Morris Mano, "Digital Design", Pearson Education, 4th Edition, 2008.
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL Design", Tata McGraw Hill Education Pvt.Ltd., 2nd Edition, 2010.

REFERENCE BOOKS

1. Tocci R J and Widmer N S, "Digital Systems - Principles and Applications", Prentice Hall of India, New Delhi,10th Edition, 2009.
2. Charles H Roth, "Fundamentals of Logic Design", Thomas Publication Company, 6th Edition, 2010.
3. J.Basker, "A VHDL Primer", Addison Wesley, New Delhi, 3rd Edition, 2006.
4. John.F.Wakerly,"Digital Design Principles and Practices", Pearson Education,4th Edition, 2006.
5. Roger Tokhiem, "Schaum's Outline of Digital Principles", McGraw Hill publication, 1994.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	×
2	×	×	×		×			×	×	×	×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13EC36 SIGNALS AND SYSTEMS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the representation and analysis of continuous time and discrete time signals and systems.*
- *to acquire knowledge about the analysis of continuous time systems using CTFT.*
- *to understand the concepts of sampling.*
- *to acquire knowledge about the analysis of discrete time systems using DTFT and z-Transform tools.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *a basic knowledge on the representation and analysis of continuous time and discrete time signals and systems.*

CO2 : *an ability to apply knowledge of CTFT to solve the problems in analysis of continuous time systems.*

CO3 : *an in-depth understanding about the concepts of sampling*

CO4 : *an ability to apply knowledge of DTFT and z-Transform tools to solve the problems in analysis of discrete time systems.*

INTRODUCTION TO SIGNALS AND SYSTEMS

Basic continuous time signals - Basic discrete time signals - Representation of signals in terms of impulses - Continuous time systems - Discrete time signals - Properties of systems - Linear Time Invariant systems : Discrete and Continuous - Continuous time system representation by differential equations - Discrete time system representation by difference equation - Block diagram representation. **(11)**

FOURIER ANALYSIS OF CONTINUOUS TIME SIGNALS AND SYSTEMS

Fourier series representation of periodic signals - Approximation of periodic signals using Fourier series and convergence of Fourier series - Representation of aperiodic signals - Continuous Time Fourier Transform - Properties of Fourier Transform - Response of Continuous time systems to complex exponentials - Frequency response of systems characterized by differential equations. **(9)**

FOURIER TRANSFORM OF DISCRETE TIME SIGNALS AND SYSTEMS

Fourier Transform of Discrete time Aperiodic Signals - Properties of Discrete Time Fourier transform - Parseval's relation - Convolution property - Response of discrete time systems to complex exponentials - Frequency response of systems characterized by difference equations. **(8)**

SAMPLING

Representation of continuous time signals by samples - Sampling theorem for Low pass signals - Band pass signal Sampling - Reconstruction from samples using interpolation - Effect of under sampling - Aliasing error - Discrete time processing of continuous signals - Sampling of discrete time signals - Up Sampling - Down Sampling. **(8)**

z-TRANSFORM

z-Transform and Inverse z-Transform - Sampling rate conversion - Properties of z-Transform - Analysis and characterization of LTI system using z-Transform- Cauchy Residue Theorem. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Oppenheim A.V, Willsky A. S and Nawab S. H, "Signals and Systems", Pearson Education Asia, 2nd Edition, 2004.
2. Krishnaveni.V, Rajeswari.A, "Signals and Systems", Wiley India Pvt.Ltd, 1st Edition, 2012.

REFERENCE BOOKS

1. Haykin. S and Barry Van Veen, "Signals and Systems", John Wiley and Sons, 2nd Edition, 2002
2. Hsu.H.P, Rakesh Ranjan, "Signals and Systems", Schaums's Outlines, Tata McGraw Hill 2nd Edition, 2008.
3. Samir S. Soliman, Mandyam Dhati Srinath, "Continuous and Discrete Signals and Systems", 2nd Edition, Prentice-Hall International, 1998
4. Lathi. B. P, "Linear Systems and Signals", Oxford University Press, 2nd Edition, 2009.
5. Ronald E. Ziemer, William H. Transter and Ronald. D. Fanmin, "Signals and Systems - Continuous and Discrete", Pearson Higher Education, 4th Edition, 1998.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×				×	×	×	×	×	×
2	×	×	×	×	×				×	×	×	×	×	×
3	×	×	×	×	×				×	×	×	×	×	×
4	×	×	×	×	×				×	×	×	×	×	×

13EC37 - DIGITAL CIRCUITS AND SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

To enable the students

- *to design, model, implement, test and verify combinational and sequential logic circuits using IC's.*
- *to design, model, implement, test and verify combinational and sequential logic circuits using HDL in FPGA kit.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an ability to identify, formulate, design and model combinational and sequential logic circuits.*

CO2 : *an ability to design, model, implement, test and verify digital circuits using HDL in FPGA boards.*

CO3 : *an ability to apply knowledge of HDL and FPGA for developing electronic hardware and/or software systems.*

CO4 : *an ability to communicate effectively the concepts, principles and techniques learnt on Digital Circuits and Design.*

CO5 : *an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

Design and testing of combinational and sequential logic circuits and implementation using HDL in FPGA kit.

- Adders and Subtractors.
- Code converters.
- Multiplexers and Demultiplexers.
- Encoders and Decoders.
- Parallel Adder.
- Flip Flops and Shift Registers.
- Asynchronous Counters.
- Synchronous Counters.

TOTAL : 45

REFERENCES

1. Digital Circuits And Design Laboratory Manual prepared by ECE Department, CIT.
2. Stephen D. M. Brown, Zvonko G. Vranesic," Fundamentals of Digital Logic with VHDL Design", McGraw Hill higher Education, 3rd Edition, 2008

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×		×	×	×	×	×	×		×
2	×	×	×	×	×		×	×	×		×	×		×
3	×	×	×	×	×		×	×	×	×	×	×	×	×
4		×		×			×		×	×				×
5				×		×								×

13EC38 - ELECTRICAL ENGINEERING AND MEASUREMENTS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

ELECTRICAL ENGINEERING LABORATORY

COURSE OBJECTIVES

This course will enable the students

- *to analyze the performance characteristics of DC Machines, Transformers and AC Machines.*
- *to understand speed control methods of DC motors.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an ability to apply the theoretical concepts and test the performance characteristics of DC Machines, Transformers and AC Machines.*

CO2 : *an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

- No load and load test on DC shunt motor.
- Speed control methods of DC shunt motor.
- OCC and critical speed of DC shunt generator.
- OC and SC test on transformer.
- Load test on alternator.
- Load test on Three phase induction motor.

REFERENCES

1. Edward Hughes, "Electrical Technology" ELBS Edition, 2008.
2. D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×		×	×		×		×	×	×			
2			×	×	×	×	×	×	×		×			

MEASUREMENTS LABORATORY

L	T	P	C
3	0	0	3

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

- *To expose the student to understand the basic concepts and principles of operation of DC and AC measuring instruments.*
- *To enable the student to gain knowledge in detail about various transducers.*
- *To enable the student to understand the concepts of bridge circuits used for measurements.*
- *To enhance the student to acquire basic knowledge on usage of oscilloscopes for measuring frequency & phase angle.*
- *To enhance the student to develop knowledge and skills in virtual instrumentation software.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of basic concepts and principles of operation to design DC and AC measuring*

CO2 *: in-depth knowledge on sensors ,transducers and bridge circuits used for measurements..*

CO3 *: an in depth knowledge on measurement using oscilloscopes.*

CO4 *: an ability to apply skills in virtual instrumentation software.*

CO5 *: an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

- Calibration of Voltmeter & Ammeter using Standard meters.
- Measurement of displacement using various transducers.
- Measurement of temperature using RTD / Thermocouple.
- Measurement of force using strain gauge / piezoelective pickup.
- Measurement of unknown impedances using bridges.
- Measurement of frequency & phase using Lissajous method.
- Simulation using virtual instrumation software.

TOTAL : 45

REFERENCES

1. Measurements and Instrumentation Lab Manual, Department of ECE, CIT.
2. LabVIEW Basics-I Manual, National Instruments, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×		×	×		×		×	×	×	×	×	
2	×	×	×	×	×		×	×	×		×	×	×	
3	×	×	×	×	×		×	×	×		×	×		×
4				×		×								
5	×	×	×	×	×	×	×		×	×	×	×	×	×

13EC41 - PROBABILITY AND RANDOM PROCESS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To enable the students to acquire knowledge understand the basics of probability.*
- *To enable the students to acquire an in-depth understanding of correlation and power spectral densities.*
- *To expose the students to various stochastic processes.*
- *To help the students understand random sequences & moments.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 *: acquire knowledge and understanding of probability.*

CO2 *: acquire an in-depth understanding of correlation and power spectral densities.*

CO3 *: understand the various stochastic processes.*

CO4 *: learn the probablity density function & moments.*

INTRODUCTION TO PROBABILITY

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. **(9)**

RANDOM VARIABLES

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions. **(9)**

MOMENTS AND PROBABILITY DENSITY FUNCTION

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds. **(9)**

RANDOM SEQUENCES

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem. **(9)**

RANDOM PROCESS.

Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density. Classification of Random Processes - Wide-Sense Stationary Processes and LSI Systems - Periodic and Cyclostationary Processes - Vector Processes and State Equations. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. H. Stark and J. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education,2006.
2. Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw Hill,2006.

REFERENCE BOOKS

1. K. L. Chung, "Elementary Probability Theory with Stochastic Processes", 4th Edition, Springer International,2010.
2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability", UBS Publishers.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Stochastic Processes", UBS Publishers.
4. Sheldon.M.Ross, "Introduction to Stochastic Models", Harcourt Asia, Academic Press, 11th Edition, 2013.
5. Scott L.Miller,Donald G.Childers, "Probability and Random Processes", 2nd Edition, Elsevier, 2012

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×			×	×				×	×	×		×	
2	×			×	×				×	×	×		×	
3	×		×	×	×			×	×	×	×		×	
4	×				×					×	×	×		

13EC42 - ELECTRONIC CIRCUITS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the small signal analysis of BJT & FET circuits and apply the knowledge in design problems.*
- *to know about frequency response of BJT & FET Amplifiers and model their equivalent circuits.*
- *to acquire knowledge about the concepts of power amplifiers.*
- *to understand the effects and methods of feedback in amplifiers*
- *to identify, analyze and design oscillators in BJT &FET and multivibrator circuits.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding about the small signal analysis of BJT and FET circuits and have the ability to apply the same in design problems.*

CO2 : *an in-depth knowledge on Frequency response of BJT, FET Amplifiers and model their equivalent circuits.*

CO3 : *an in-depth knowledge of power amplifiers and feedback amplifiers.*

CO4 : *an ability to identify, analyze and design oscillators in BJT &FET and multivibrator circuits.*

BJT AMPLIFIERS

AC load line -Transistor models and parameters -Analysis and design of CE,CB,CC Hybrid model circuits-Comparison of CE,CB,CC circuits-Frequency response of CE amplifier-Capacitor coupled two stage CE amplifier-Direct coupled two stage circuits-Two stage circuit with emitter follower output-Cascode amplifiers-Differential Amplifier. **(9)**

FET AMPLIFIERS

AC load line -FET models and parameters- Analysis and design of CS,CD,CG Hybrid model circuits-Comparison of CS,CD,CG circuits- High Frequency Model- Frequency response of CS amplifier-Cascaded RC coupled amplifiers-Cascode amplifiers-JFET amplifiers **(9)**

POWER AMPLIFIERS

Series fed Class A Common Emitter Power Amplifier-Transformer Coupled Class A Amplifier- Class B Amplifier Operation-Class B Amplifier circuits-Non Linear Distortion-Power Transistor and Heat sinks-Amplifiers using Complementary Symmetry configuration-Class C Amplifier-Class D Amplifier-Class S Amplifier-Switched Mode Power Supply (SMPS). **(9)**

FEEDBACK AMPLIFIERS AND OSCILLATORS

Feedback Concept-Effect of negative feedback-Analysis of feedback amplifiers: Voltage Series, Current Series, Current Shunt, Voltage Shunt-Conditions for Oscillation-Classification of Oscillators-RC&LC Oscillators using BJT and FET-Wien Bridge Oscillator-Hartley Oscillator-Tuned Collector Oscillator- Tuned Drain Oscillator- Crystal Oscillators **(9)**

MULTIVIBRATORS AND TIME BASE GENERATORS

Collector coupled Astable multivibrator-Bistable multivibrator-Collector coupled Monostable multivibrator-Triggering Methods-General features of time base signal-Exponential sweep circuit-Negative Resistance switches-Sweep circuit using a Transistor switch-Transistor constant current sweep-Miller and bootstrap time base generators-Transistor Current Time Base Generator-Methods of Linearity Improvement. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. David A. Bell, "Electronic Devices and Circuits", PHI, 5th Edition, 2007.
2. Robert L. Boylestead and Louis Nasheresky, "Electron Devices and Circuits: Theory and Practice", Prentice Hall of India, 10th Edition, 2009.

REFERENCE BOOKS

1. B.Visvesvara Rao, K.Raja Rajeswari, P.Chalam Raju Pantulu, K.Bhaskara Rama Murty, "Electronic Circuit analysis",Pearson,2012.
2. Millman. J and Taub H., "Pulse Digital and Switching Waveforms", Tata McGraw Hill, 2nd Edition, 2008.
3. Millman and Halkias.C, "Integrated Electronics", Tata McGraw Hill, 2010.
4. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 5th Edition, 2004.
5. Jagannathan .V, "Power Electronics :Devices and circuits", PHI Learning P(Ltd), 2nd Edition, 2011.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×	×	×	×	×	×

13EC43 - PRINCIPLES OF COMMUNICATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge about the random processes for effective understanding of communication systems*
- *to acquire knowledge about the generation and demodulation methods in Amplitude Modulation and Angle Modulation.*
- *to learn about the concepts of pulse modulation schemes.*
- *to gain knowledge about the effects of noise in communication receivers.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *a knowledge about the random processes for effective understanding of communication systems*

CO2 : *a knowledge about the generation and demodulation methods in Amplitude Modulation and Angle Modulation systems.*

CO3 : *an understanding of the concepts of pulse modulation schemes.*

CO4 : *an understanding about the effects of noise in various communication receivers.*

CO5 : *an ability to identify, formulate and solve problems in above mentioned topics.*

RANDOM PROCESSES

Elements of Communication System - Communication Channels - Modulation - Mathematical Definition of a Random Process - Stationary Processes - Mean, Correlation & Covariance Functions - Ergodic Processes - Transmission of a Random Process through a Linear Time-Invariant Filter - Power Spectral Density- Gaussian Process - Noise - Narrow Band Noise - Representation of Narrow Band Noise: In-phase & Quadrature Components, Envelope & Phase Components - Sine Wave Plus Narrowband Noise. **(9)**

AMPLITUDE MODULATION

Amplitude Modulation - Linear Modulation Schemes: DSB-SC Modulation - SSB Modulation - VSB Modulation - Frequency Spectrum of AM signals, DSB-SC, SSB-SC - AM Modulators: Power law Modulator - Switching Modulator - Balanced Modulator - Ring Modulator.

Demodulation of AM: Envelope detector - Coherent Detection of DSB-SC, SSB-SC - Costas Receiver - Frequency Translation - Multiplexing: Frequency Division Multiplexing, Quadrature Carrier Multiplexing - AM Transmitters - AM Receivers: Superheterodyne. **(9)**

ANGLE MODULATION

Phase Modulation - Frequency Modulation - Narrow Band FM - Wide Band FM - Frequency Spectrum of FM - Transmission Bandwidth of FM Signals - Direct FM generation: Varactor diode modulator - Reactance

Modulator - Narrowband FM generation - Indirect FM generation - Demodulation of FM: Slope detector, Balanced Slope Detector, Foster Seeley Discriminator, Ratio Detector, PLL Demodulator, Quadrature FM Demodulator - FM Transmitters and Receivers. **(9)**

PULSE MODULATION

Sampling Process - Pulse Amplitude Modulation - Other forms of Pulse Modulation - Bandwidth - Noise Trade-off - Quantization Process - Pulse-Code Modulation - Time-Division Multiplexing - Digital Multiplexers - Delta Modulation - Delta-Sigma Modulation - Linear Prediction - Differential Pulse-Code Modulation - Adaptive Differential Pulse-Code Modulation. **(9)**

NOISE IN CW AND PULSE MODULATION SYSTEMS

Receiver Model - Noise in DSB-SC Receivers, SSB receivers, AM receivers, FM Receivers, Pre-Emphasis and De-Emphasis in FM, Noise consideration in Pulse-Code Modulation and Delta Modulation Systems. **(9)**

TOTAL : 45

TEXT BOOKS

1. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 2004.
2. Herbert Taub and Donald L. Schilling, "Principles of communication", McGraw Hill International student Edition, 3rd Edition, 2008.

REFERENCE BOOKS

1. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", Pearson Education, 5th Edition, 2009.
2. John G. Proakis and Masoud Salehi, "Fundamentals of Communication Systems", Pearson Education, LPE, 2005.
3. Kennedy G, "Electronic Communication Systems", Tata McGraw Hill, 4th Edition, 1999.
4. Lathi. B. P, "Communication Systems", BS Publications, 4th Edition, 2004.
5. Hwei P. Hsu, "Schaum's Outlines of Analog and Digital Communication", McGraw Hill, 3rd Edition, 2003.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×			×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×			×				×	×	×	×	×	×
5	×				×									

13EC44 - NETWORKS AND TRANSMISSION LINES

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on two port network parameters and characterization.*
- *to acquire knowledge about filters, attenuators and equalizers.*
- *to acquire knowledge about transmission line theory, concepts and parameters in medium and high frequencies.*
- *to analyze and solve problems in filters, attenuators, equalizers, impedance matching and transmission line parameters.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *in-depth knowledge on two port networks, network parameters and network characterization.*

CO2 : *an ability to design filters, attenuators and equalizers.*

CO3 : *knowledge about transmission line theory, concepts and parameters in medium and high frequencies.*

CO4 : *an ability to analyze and solve problems in filters, attenuators, equalizers, impedance matching and transmission line parameters.*

TWO PORT NETWORKS AND NETWORK PARAMETERS

Functional classification of Networks - Two Port Network parameters - Impedance - Admittance - ABCD & Hybrid parameters - Interconnection of Two Port Networks: Series, Parallel, Cascade - Characteristics of Symmetrical and Asymmetrical networks - Half section networks **(9)**

FILTERS

Application of filters in communication systems - Low pass, High pass, Band pass and Band stop Filters - m-derived and Constant- k filter design - T and Pi sections - Filter Characteristics- Composite filters. **(9)**

ATTENUATORS AND EQUALIZERS

Attenuators : T-type , Pi Type, Lattice , Bridged T , L-Type attenuators - Equalizers - Inverse Networks - Series Equalizer - Full Series Equalizer - Shunt Equalizer - Full Shunt Equalizer - Constant Resistant Equalizer - Bridged-T Attenuation Equalizer - Bridged-T Phase Equalizer - Lattice Attenuation - Lattice Phase Equalizers. **(8)**

TRANSMISSION LINE THEORY

Transmission line as a cascade of T-Sections - General Solution of the transmission line - Voltage and Current of a line - Infinite line - Input impedance - Reflection coefficient - Wavelength and velocity of propagation - Waveform distortion - Distortion less transmission line - Input impedance of lossless

lines - Reflection - Transfer impedance - Reflection factor and reflection loss - T and Pi Section equivalent to lines. **(9)**

THE LINE AT RADIO FREQUENCIES

Standing waves and standing wave ratio on a line - One eighth wave line - Quarter wave line and impedance matching - Half wave line - Circle diagram for the dissipation-less line - Smith Chart - Application of the Smith Chart - Conversion from impedance to reflection coefficient - Impedance to Admittance conversion - Input impedance of a lossless line terminated by impedance - Single stub matching and double stub matching. **(10)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. J.D.Ryder, "Networks, Lines and Fields", Prentice Hall of India, New Delhi, 2nd Edition, 1997.
2. Sudhakar.A, Shyammohan S.P, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill, New Delhi, 4th Edition, 2010.

REFERENCE BOOKS

1. Hayt, Kemmerly and Durbin, "Engineering Circuit Analysis" McGrawHill Education, 8th Edition, 2011.
2. F.F.Kuo, "Network Analysis and Synthesis", Wiley India, 2nd Edition, 2005.
3. Umesh Sinha, "Transmission lines and Networks", Sathya Prakashan Publishers, 8th edition, 2003.
4. D. Roy Choudhury,"Networks and Systems", New Age International (P) Ltd., 1st edition, 1998.
5. R K Shevgaonkar, " Electromagnetic Waves", Tata McGraw Hill, 1st edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×		×	×	×	×
2	×	×	×		×				×		×	×	×	×
3	×	×	×		×				×		×	×	×	×
4	×	×	×		×				×		×	×	×	×

13EC45 - ELECTROMAGNETIC FIELDS AND WAVEGUIDES

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge on electrostatic fields, magneto static fields and fundamental laws & equations governing them*
- *to identify and analyze the time varying fields and potentials*
- *to understand the concepts of electro-magnetic wave propagation in space and media*
- *to formulate and analyze the characteristics of wave propagation in parallel plates, rectangular waveguides, circular waveguides and cavity resonators*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the concepts of electrostatic fields, magneto static fields and the fundamental laws & equations governing them*

CO2 : *an in- depth understanding of time varying fields and potentials*

CO3 : *an in-depth understanding of the propagation of electro-magnetic waves in different media*

CO4 : *an ability to formulate and analyze the characteristics of wave propagation in parallel plates, rectangular waveguides, circular waveguides and cavity resonators*

ELECTROSTATIC FIELDS

Fundamentals of vector calculus-Introduction to electrostatic fields- Coulomb's Law and field intensity-Electric Field due to continuous charge distributions- Electric flux density-Gauss's law- Maxwell's equation-Application of Gauss's law- Electric potential-Relationship between E and V-Flux lines- Energy density-Conductors- Boundary conditions in electrostatic fields- Capacitance of parallel plate-Capacitance of Coaxial cable-Parallel wire capacitance - Laplace and Poisson's equations-Application Note: Capacitance of Microstrip lines **(9)**

MAGNETIC FIELDS

Biot-Savart's Law-Ampere's circuital law - Applications -Magnetic flux density and Maxwell's equations - Magnetic -Scalar and Vector potential- Magnetic Torque and Moment -Magnetic Boundary conditions-Derivations of Biot-Savart's Law and Ampere's circuital law -Magnetic energy-Inductors and Inductances - Energy stored in magnetic field-Energy density- Application Note : Magnetic Levitation. **(9)**

ELECTROMAGNETIC WAVES

Maxwell's equation-Equation of continuity-Inconsistency of Ampere's law-Wave motion in free space-Uniform plane waves-wave equation for conducting medium-Sinusoidal time variations-Conductors and Dielectrics -Polarization -Reflection by a perfect conductor -Normal and Oblique incidence-Reflection by a Dielectric- Normal and Oblique incidence-Total internal reflection-Surface impedance-Poynting Theorem-power loss in a plane conductor. **(9)**

WAVES AND RECTANGULAR GUIDES

Waves between parallel planes-Transverse Electric waves- Transverse Magnetic waves -characteristics of TM and TE waves - Transverse Electromagnetic waves -velocities of propagation-Attenuation for TM,TE and TEM waves -Wave impedances.

Rectangular guides: Transverse Electric waves in Rectangular guides- Transverse Magnetic waves in Rectangular guides-Impossibility of TEM waves in waveguide- Excitation of various modes. **(9)**

CIRCULAR GUIDES AND CAVITY RESONATORS

Circular guide: Bessel functions-TE and TM waves in circular guides-Wave impedances and characteristic impedances -Attenuation factor and Q factor of Waveguides.

Cavity Resonators-Rectangular cavity resonators-Q factor of rectangular cavity resonator-circular cavity resonators. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Mathew.N.O.Sadiku, "Elements of Electromagnetics", Oxford University press, 4th Edition, 2007.
2. Edward.C.Jordan & Keith.G.Balmain,, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2nd Edition, 2006.

REFERENCE BOOKS

1. William H.Hayt, "Engineering Electromagnetics",Tata McGraw-Hill, 8th Edition, 2012.
2. Joseph A.Edminister, "Schaum's Outline of Electromagnetics", Tata McGraw-Hill, 3rd Edition, 2010.
3. David K.Cheng , "Field and Wave Electromagnetics", Pearson Education, 2nd Edition, 2007.
4. Umesh Sinha, "Electromagnetic Theory and its Applications",Satya Prakashan,1996.
5. Gangadhar.K.A, "Field Theory" Khanna Publishers, 15th Edition, 2002.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×	×		×		×
2	×	×	×		×				×	×		×		×
3	×	×	×		×				×	×		×		×
4	×	×	×		×				×	×		×		×

13EC46 - COMPUTER ARCHITECTURE AND ORGANIZATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge about computers, number system and addressing modes.*
- *to acquire knowledge and understanding of Data path and Control design.*
- *to acquire an in-depth knowledge about memory and system organization.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: basic knowledge about computers, number system and addressing modes.*

CO2 *: an understanding of of Data path and Control design.*

CO3 *: an in-depth understanding of memory and system organization.*

INTRODUCTION

Computing and Computers - Evolution of Computers - System Design - Register Level - Processor Level - CPU Organization - Data Representation - Fixed Point Numbers - Floating Point Numbers - Instruction Formats - Instruction Types - Addressing modes. **(9)**

DATA PATH DESIGN

Fixed Point Arithmetic - Addition, Subtraction, Multiplication and Division - Combinational and Sequential ALUs - Carry look ahead adder - Robertson Multiplication algorithm - Booth's Multiplication algorithm - Non-Restoring division algorithm - Floating Point Arithmetic - Coprocessor - Pipeline Processing. **(9)**

CONTROL DESIGN

Hardwired Control - Micro programmed Control - Multiplier Control Unit - CPU Control Unit - Pipeline Control - Instruction Pipelines - Pipeline Performance - Superscalar Processing - Nano Programming. **(9)**

MEMORY ORGANIZATION

Random Access Memories - Serial Access Memories - RAM Interfaces - Magnetic Surface Recording - Optical Memories - Multi-level memories - Cache & Virtual Memory - Memory Allocation - Associative Memory. **(9)**

SYSTEM ORGANIZATION

Communication methods - Buses - Bus Control - Bus Interfacing - Bus arbitration - IO and system control - IO interface circuits - Handshaking - DMA and Interrupts - Vectored interrupts - PCI interrupts - Pipeline interrupts - IOP organization - Operation Systems - Multiprocessors - Fault tolerance - RISC and CISC Processors - Superscalar and Vector Processor. **(9)**

TOTAL : 45

TEXT BOOK

1. John P.Hayes, "Computer architecture and Organization", Tata McGraw - Hill, 3rd Edition, 2012.

REFERENCE BOOKS

1. P.Pal Chaudhuri, "Computer organization and design", Prentice Hall of India, New Delhi, 3rd Edition, 2008.
2. William Stallings, "Computer Organization and Architecture: Designing for Performance" ,Prentice Hall, 9th Edition, 2012.
3. B.Govindarajalu, "Computer architecture and Organisation: Design principles and Applications", Tata McGraw Hill Education, 2nd Edition, 2010
4. Morris Mano, "Computer System Architecture", Prentice Hall of India, 3rd Edition, 2007.
5. Nicholas Carter, "Computer Architecture", Tata McGraw Hill Education, 2008.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×		×	×	×	×
2	×	×	×		×			×	×		×	×	×	
3	×	×			×			×	×	×	×	×		×

13EC47 - ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students to acquire ability

- *to test, measure and plot the characteristics of semiconductor diodes, transistors, FET and determine their parameters.*
- *to design and test transistor voltage amplifiers and oscillators.*
- *to design and test the operation of power amplifiers and multivibrators.*
- *to design and model electronic circuits using circuit simulation software.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *practical knowledge to design and test various electronic devices & circuits, analyze and interpret their characteristics and determine their parameters.*

CO2 : *an ability to apply knowledge of analog electronics for developing electronic hardware systems.*

CO3 : *an ability to communicate effectively the concepts, principles and techniques learnt on above topics.*

CO4 : *an ability to work in teams to achieve goals.*

CO5 : *an ability to use the skills and circuit simulation tools for modeling electronic circuits used in various fields and engaged in lifelong learning.*

LIST OF EXPERIMENTS

- Testing of Circuit Laws
- Characteristics of Semiconductor Devices (Diodes, BJT, FET)
- Applications of Semiconductor Devices
- Design and testing of Voltage Amplifiers
- Design and testing of Power Amplifiers
- Design and testing of Feedback Amplifiers
- Design and testing of Cascade Amplifiers
- Design and testing of Oscillators
- Design and testing of Multivibrators

Design and testing of all the above experiments using circuit simulation software

TOTAL : 45

REFERENCS

1. Laboratory Manual prepared by ECE Department, CIT.
2. M. H. Rashid, "Introduction to PSPICE using ORCAD for Circuits and Electronics", Pearson / Prentice Hall, 3rd edition, 2004.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×		×		×		×	×	×	×
2	×	×	×	×	×		×	×	×	×	×	×	×	×
3		×		×	×		×		×	×	×	×	×	×
4				×		×	×							
5	×	×	×	×	×		×	×	×	×	×	×	×	

13EC48 - NETWORKS AND TRANSMISSION LINES LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to acquire practical knowledge and ability to measure transmission line parameters.*
- *to acquire practical knowledge and ability to measure unknown loads.*
- *to understand the principles behind matching of arbitrary impedances using stub lines.*
- *to acquire practical knowledge on lines equalization.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *ability and practical knowledge to measure transmission line and unknown loads parameters.*

CO2 : *understanding of the principles behind matching of arbitrary impedances using stub lines.*

CO3 : *practical knowledge on lines equalization.*

CO4 : *an ability to work in teams to achieve goals.*

CO5 : *an ability to explore engineering solutions for solving various problems in electronic circuits used in various fields and engaged in lifelong learning.*

LIST OF EXPERIMENTS

- Measurement of characteristic impedance of a transmission line.
- Measurement of phase velocity and dielectric constant of propagation medium.
- Measurement of attenuation constant of a transmission line and study the effect of frequency.
- Setting up of standing waves and measurement of Transmission line parameters for matched and unmatched loads.
- Study of effects of reactive loads on transmission line parameters.
- Study of behavior of lossless, lossy, infinite and short lines.
- Study of using balanced to unbalanced transformer on 300 ohms parallel line.
- Impedance matching using single and double stub lines.
- Equalization of lines.
- Measurement of unknown impedance using smith chart and line measurements.
- Measurement of 'S' parameters.

REFERENCES

1. Lab manual- by ECE department, CIT.
2. Annapurna Das and Sisir Das, "Microwave Engineering" Tata Mc GRaw Hill, 2nd Edition, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×		×	×	×	×	×	×		×
2	×	×	×	×	×		×	×	×	×	×	×	×	×
3	×	×	×	×	×	×	×		×	×	×	×	×	×
4				×		×	×		×					
5	×	×	×	×	×	×	×		×	×	×	×	×	×

13CE49 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
2	0	0	2

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to inculcate among students the need for creative thinking and personality development.*
- *to acquire knowledge about evolution of the Universe and evolution of living beings.*
- *to understand the benefits of yoga and introspection for better living.*
- *to understand about human values, value of time, developing self confidence and team work spirit.*
- *to acquire knowledge about professional ethics and responsibility for career growth in National and Multinational Companies.*

COURSE OUTCOMES

Upon completion of this syllabus, the students will have

CO1 : *an understanding about the need for creative thinking and personality development.*

CO2 : *knowledge about evolution of Universe and evolution of living beings.*

CO3 : *an understanding of benefits of yoga and introspection for better living.*

CO4 : *an understanding of human values, value of time, self confidence and team work spirit.*

CO5 : *knowledge about professional ethics and responsibility for career growth in National and Multinational Companies.*

LIFE FORCE, MIND AND CONCIOUSNESS

Science of Creativity and Personality Development - Objectives - Principles of Karma Yoga - Duty Consciousness - Communism and Capitalism - Law of Nature - Life Force - Origin - Potentiality of the Life Force - Premordial State - Wave Theory - Consciousness - Pancha Thanmatras - Secret of Revelations - Mind - Biomagnetism - Physical Transformation of Biomagnetism - Attachment, Detachment and Moderation in Enjoyment. **(9)**

EVOLUTION OF THE UNIVERSE AND LIVING BEINGS

Evolution of the Universe: Creation Theory - Evolution Theory - Theory of Permanence - Theory of Mithya - Big-Bang Theory - Evolution of Living Beings: Absolute Space and Force - Plants Experience Pain - Two Eyes and Two Ears - Seven Constituent Layers in the Body - Totality and Man - Six Temperaments - Realization of Truth - Space is The Almighty - Science and Spiritualism. **(9)**

YOGA AND INTROSPECTION

Simple and Safe Yoga - Physical Exercise - Meditation - Seven Centres of Meditation - Benefits - Effect of Good Vibrations - Cause and Effect System - Imaginary Expectations - Harmony in Life: Self, Family, Society and Nature - Introspection: Analysis of Thought, Moralization of Desire, Neutralization of Anger, Eradication of Worries and Self Realization. **(9)**

HUMAN VALUES

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Virtues - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment- Empathy - Self Confidence - Challenges in Work Place - Cyberspace - Pros and Cons of Cyberspace. **(9)**

ENGINEERING ETHICS, RESPONSIBILITIES AND RIGHTS

Senses of Engineering Ethics - Moral Issues - Inquiries - Moral Dilemma - Moral Autonomy - Profession and Responsible Professionalism - Social Responsibility - Collegiality, Loyalty and Confidentiality - Human and Employee Rights - Intellectual Property Rights. **(9)**

TEXT BOOKS

1. Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications, 4th Edition, 2009.
2. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.

REFERENCE BOOKS

1. Sadhguru, "Body the Greatest Gadget and Mind is your Business", Diamond Pocket Books Pvt. Ltd, Isha Foundations, 2013.
2. Swami Vivekananda and Swami Nikhilananda, "Karma Yoga and Bhakti Yoga", 2nd Edition, Ramakrishna Vivekananda Publications, 2008.
3. Henry Dreyfuss, "The Measure of Man and Woman: Human Factors in Design", John Wiley and Sons Publications, 2012.
4. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition, McGraw Hill, NewYork, 2005.
5. M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", 1st Edition, Prentice Hall of India, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CO1			×		×			×	×	×				
CO2						×								
CO3				×	×	×								
CO4			×	×		×	×	×	×					
CO5			×		×	×	×	×	×					

13EC51 - LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to gain knowledge on operational amplifiers basic characteristics, their parameters and applications*
- *to analyze and design operational amplifier based circuits*
- *to acquire knowledge about the operation and applications of Timer, PLL*
- *to acquire knowledge about the operation of Voltage regulators*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of operational amplifier basic characteristics, parameters and their applications*

CO2 *: an ability to analyze and design operational amplifier based circuits*

CO3 *: knowledge on the operation and applications of Timer, PLL*

CO4 *: knowledge on the operation of voltage regulators*

INTRODUCTION TO OPERATIONAL AMPLIFIERS

Differential amplifier-differential amplifier with constant current source-current mirror-Types of current mirrors-Building blocks of 741 operational amplifier-I/O stages, gain stage and level translator stage of 741op-amp-Characteristics of an Ideal Operational Amplifier-Op-amp parameters & characteristics-frequency response - stability-frequency compensation- Introduction to low power Op.amp. **(10)**

OP-AMP APPLICATIONS

Linear applications: voltage follower - inverting, non inverting amplifiers-peaking amplifier-summing, scaling, averaging amplifiers-instrumentation amplifiers-difference amplifier-V-I and I-V converters-integrator-differentiator.

Nonlinear applications: Precision half wave & full wave rectifiers- peak detector-clipper-clamper-sample & hold circuit-log & anti-log amplifiers

Open loop applications: Comparator-zero crossing detector- Schmitt trigger. **(9)**

ACTIVE FILTERS AND OSCILLATORS

Active filters - Sallen-Key filter structure- Design of Butterworth & Chebyshev filters: Low pass filter- High pass filter- Band pass filter- Band reject filter - All pass filters-Switched capacitor filters-Design of Oscillators: RC phase shift oscillator- Wien bridge oscillator- LC Oscillators: Hartley oscillator - Colpitts oscillator - Clapp oscillator - Crystal oscillator. **(9)**

MULTIVIBRATORS AND DATA CONVERTERS

Design of Astable Multivibrator & Monostable Multivibrator using Op.Amp -Triangular wave generator-Saw tooth wave generator - IC 555 timer: Functional block diagram and description of Astable & Monostable

multivibrators using IC555 -Digital to Analog converters: Binary weighted Network-R-2R

Ladder network-inverted R-2R ladder network-Analog to Digital converters: Successive Approximation-Counter Type-Dual slope-Flash type converters. **(9)**

PLL AND VOLTAGE REGULATORS

Phased Locked Loop: operating principles-Basic building blocks- Applications: Frequency multiplier-Frequency translator-AM detector, FM demodulator, FSK demodulator - PLL IC - Voltage regulators: Fixed voltage regulator-Adjustable voltage regulator - Dual tracking regulator - Switching regulator: step down - step up - buck & boost type - self oscillating type switching regulator-IC voltage regulators. **(8)**

TOTAL : 45

TEXT BOOKS

1. Gayakwad Ramakant A, "Op-amps and Linear Integrated Circuits" Prentice Hall of India Private Limited, 4th Edition, New Delhi, 2009.
2. Roy Choudhury and Shail Jain "Linear Integrated Circuits", New Age International Private Limited, 3rd Edition, New Delhi, 2010.

REFERENCE BOOKS

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Tata McGraw-Hill, 3rd Edition, 2007.
2. Ron Mancini, "OP AMPs for Everyone", Newnes, An Imprint of Elsevier, 2nd Edition, 2003.
3. K.R.Botkar, "Integrated Circuits", Khanna Publishers, 2nd Edition, 2003.
4. S.Salivahanan and V.S. Kanchana Bhaaskaran, "Linear Integrated Circuits", Tata McGraw Hill Publishing company Ltd, 1st Edition, 2008
5. B.Somanathan Nair, "Linear Integrated Circuits, Analysis, Design and Applications", Wiley India Publishers, 1st Edition, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×		×	×		×
2	×	×	×		×			×	×		×	×	×	×
3	×	×	×		×			×	×	×	×	×		×
4	×	×	×		×			×	×	×	×	×		×

13EC52 - DIGITAL COMMUNICATION

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the principles of baseband and bandpass modulation, demodulation and detection techniques and error performance analysis*
- *to acquire knowledge on equalization and synchronization techniques*
- *to gain knowledge about principles of spread spectrum techniques and their applications*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the principles of baseband and band pass modulation, demodulation, and detection techniques and their error performance analysis*

CO2 : *knowledge about equalization and synchronization techniques*

CO3 : *knowledge about spread spectrum techniques and their applications*

CO4 : *an ability to identify, formulate and solve problems in above mentioned topics*

BASEBAND DEMODULATION/DETECTION

Signals and Noise - Vectorial view of signals and noise - Orthogonality - Orthogonal Representation of Signals - E_b/No and SNR - Intersymbol Interference: Pulse Shaping to Reduce ISI - Nyquist Criteria - Error Performance Degradation, Demodulation/Detection of Shaped Pulses -Eye Pattern - Detection of Binary Signals in Gaussian Noise: Maximum Likelihood Receiver Structure, Matched Filter - Correlation Realization of the Matched filter, Optimal Filters - Error probability performance of unipolar and bipolar signaling. **(9)**

BANDPASS MODULATION AND DEMODULATION/DETECTION

Digital Bandpass Modulation Techniques: Phase Shift Keying, Frequency Shift Keying, Amplitude Shift Keying, Amplitude Phase Keying - Detection of Signals in Gaussian Noise: Decision regions, Correlation Regions - Coherent Detection of PSK and FSK - Non-coherent Detection of DPSK and FSK - Quadrature implementation of PSK Modulation and Demodulation - Bit Error Probability for ASK, BPSK, BFSK and DPSK - Comparison of Error Performance for Various Modulation Types - M-ary Signaling and Performance - Symbol Error Probability and Performance for MPSK and MFSK. **(9)**

EQUALIZATION

Channel Characterization, Equalizer Filter Types - Preset and Adaptive Equalization - Fundamentals of Equalization - Training a Generic Adaptive Equalizer - Equalizers in Communication Receiver - Linear Equalizer - Non-linear Equalizers: Decision Feedback Equalization - Maximum Likelihood Sequence Estimation Equalizer - Zero Forcing, Least Mean Square and Recursive Least Squares Equalization Algorithms. **(9)**

SYNCHRONIZATION

Introduction - Receiver Synchronization : Frequency and Phase Synchronization, Steady State Tracking - Non-Linear Loop Analysis - Suppressed Carrier Loops - Acquisition - Symbol Synchronization - Discrete Symbol Modulations - Open and Closed Loop Symbol Synchronizers - Synchronization Errors - Synchronization with Continuous Phase Modulations (CPM) - Frame Synchronization. **(9)**

SPREADSPECTRUM TECHNIQUES

Spread Spectrum - Advantages - Pseudonoise Sequences - Properties - Direct Sequence Spread Spectrum Systems - Processing Gain and Performance - Frequency Hopping Systems - Fast Hopping versus Slow Hopping - FFH/MFSK Demodulator - Processing Gain - Synchronization - Acquisition - Tracking. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson Education, 2nd Edition, 2009.
2. Simon Haykin, "Digital Communications", John Wiley, Student Edition, 1988.

REFERENCE BOOKS

1. Taub and L.Schilling, "Principles of Communication Systems", Tata McGraw Hill, 3rd Edition, 2008.
2. Hwei P.Hsu, "Schaum's outlines - Analog and Digital Communication",Tata McGraw Hill, 3rd Edition, 2003.
3. Lathi B.P, "Modern Digital and Analog Communication Systems", Oxford University Press, 4th Edition, 2009.
4. Sam K Shanmugam, "Digital and Analog Communication Systems", John Wiley, Student Edition, John Wiley, 1985.
5. J.G.Proakis, "Digital Communication", Tata McGraw Hill, 5th Edition, 2008.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×			×	×	×	×	×	×	×
2	×	×	×		×			×	×	×	×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×				×									

13EC53 - MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to gain knowledge about 8086 microprocessor architecture, operating modes, memory and I/O interfacing.*
- *to understand the concepts of 8086 microprocessor programming.*
- *to acquire knowledge about the features and functionalities of the peripheral devices.*
- *to learn about 8051 architecture, instruction set and assembly language programming.*
- *to understand the concepts of developing microprocessor and microcontroller based systems for various applications.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of 8086 microprocessor architecture, operating modes, memory and I/O interfacing.*

CO2 : *an understanding of the concepts of 8086 microprocessor programming.*

CO3 : *an understanding of the features and functionalities of peripheral devices.*

CO4 : *an understanding of 8051 architecture, instruction set and an ability to develop assembly language programs.*

CO5 : *an understanding of the concepts in developing microprocessor and microcontroller based systems for various applications.*

8086 MICROPROCESSOR

8086 Microprocessor Architecture - Pin Description - Minimum/Maximum mode Configuration - Memory and I/O interfacing - Bus cycles - Interrupts. **(9)**

8086 ASSEMBLY LANGUAGE PROGRAMMING

8086 Addressing modes - Instruction set - Simple Assembly Language Programming -Strings - Procedures - Macros - Assembler Directives. **(9)**

PERIPHERAL INTERFACING

Programmable Peripheral Interface (8255) - Keyboard/Display Controller (8279) -Programmable Timer/ Counter (8254) - Programmable Interrupt Controller (8259) - DMA Controller (8257) - Serial Communication Interface (8251) - RS232 Bus Standard. **(9)**

8051 MICROCONTROLLER

8051 Microcontroller Architecture - Interrupts - Timer and counter - Serial Communication - Addressing modes - Instruction set - Simple Assembly Language Programming. **(9)**

SYSTEM DESIGN USING 8086 and 8051

Measurement of Electrical Quantities: Voltage, Current, Frequency, Phase Angle, Power Factor, Power - Measurement of Physical quantities: Displacement, Strain, Force, Pressure, Temperature - Keyboard Interface - Seven Segment Interface - ADC/DAC Interface - LCD - Stepper Motor Interface - DC Motor Interface. **(9)**

TOTAL : 45

TEXT BOOKS

1. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051, 8096", Prentice Hall of India, Ist Edition, 2011.
2. Soumitra Kumar Mandal "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085 8086 & 8051" Tata McGraw Hill Publishing Co Ltd, Ist Edition, 2011.

REFERENCE BOOKS

1. Douglas V Hall, "Microprocessor & Interfacing", Tata McGraw Hill, 2nd Edition, 2006.
2. Barry B Brey, "The Intel Microprocessor Architecture Programming and Interfacing", Pearson Education, 4th Edition, 2006.
3. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education Asia, 2nd Edition, New Delhi, 2008.
4. U.S.Shah, "Microprocessor & Application", Macmillan Publishers India Limited, 2nd Edition, 2011.
5. D.P. Kothari, Shriram K. Vasudevan, Subashri V. Sivaraman Ramachandran, "Analysis of Microcontrollers", MedTech Publishers, 1st Edition, 2013.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×		×	×		×
2	×	×	×		×			×	×		×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×
5	×	×	×		×			×	×		×	×		×

13EC54 - DATA COMMUNICATION & NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basic concepts of computer based data networks and network architecture.*
- *to acquire knowledge about various protocols used in Data Link, Network, Transport and Application layers.*
- *to understand the concepts of congestion control, QoS and traffic shaping in networks*
- *to understand the basics of Cloud Computing.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the basic concepts of computer based data networks and network architecture.*

CO2 : *knowledge about protocols used in Data Link, Network, Transport and Application layers.*

CO3 : *knowledge about congestion control, QoS and traffic shaping in networks*

CO4 : *an basic understanding on Cloud Computing*

NETWORKS ARCHITECTURE AND DATA LINK LAYER

Introduction: Building blocks - links, nodes - layering and protocols - OSI architecture - Internet architecture - Multiplexing - Circuit switching vs Packet switching - Datagram Networks - TCP/IP reference model - Logical link control functions - Framing - Flow Control - Error Control - CRC - Protocols: ARQ - HDLC - Point-to-Point. **(9)**

MEDIUM ACCESS SUBLAYER

Medium Access layer: Random access - Controlled access - Channelization - LAN Protocols - IEEE 802 standards: Ethernet - Token bus - Token ring - FDDI - Internetworking, Interconnection issues - Connecting devices: Repeaters, Hubs, Switches and Gateways. **(9)**

NETWORK LAYER PROTOCOLS & ROUTING TECHNIQUES

Internet Protocols, IPv4: Layers and Functions - Naming, Addressing and Routing in an internet - Address Resolution Protocol (ARP) - Reverse Address Resolution Protocol (RARP) - Internet Control Message Protocol (ICMP) - Internet Group Management Protocol (IGMP) - Introduction to IPv6 - Forwarding and Routing techniques - Optimization - Distance Vector Routing - Link State Routing - Open Shortest Path First (OSPF) - Multicasting Routing. **(9)**

TRANSPORT LAYER PROTOCOLS, CONGESTION CONTROL & QoS

Process-to-process delivery - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion control - QoS - Flow classes - Improvement techniques - Scheduling - Traffic shaping - Integrated services - Differentiated services. **(9)**

UPPER OSI LAYERS

Stream Control Transmission Protocol (SCTP) - Teletype Network (TELNET) - Simple Mail Transfer Protocol (SMTP) - File Transfer Protocol (FTP) - Hyper Text Transfer Protocol (HTTP) - Simple Network Management Protocol (SNMP) - Cloud Computing - Cloud Architecture - Cloud Storage - Cloud Service. **(9)**

TOTAL : 45

TEXT BOOK

1. Behrouz.A. Forouzan, "Data Communication and Networking", Tata McGraw Hill, 4th Edition, 2006.

REFERENCE BOOKS

1. Stallings.W, "Data and Computer Communication", Prentice Hall of India, 8th Edition, 2007.
2. Michael Miller, "Cloud Computing: Web - Based Applications that change the way you work and collaborate online", Que Publishing, 2009.
3. Ed Tittle," Schaum's outlines - Computer Networking", Tata McGraw Hill, 2nd Edition, 2002.
4. Srinivasan Keshav, "An Engineering Approach to Computer Networking", Addision Wesley Professional,1999 .
5. Tanenbaum.A.S, "Computer Networks", Prentice Hall of India, 4th Edition, 2003.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×		×	×	×	×
2	×		×						×		×	×	×	×
3	×		×						×	×	×	×	×	×
4	×		×						×	×	×	×	×	×

13EC55 - OOPS AND C++

L	T	P	C
2	0	3	4

ASSESSMENT : THEORY & PRACTICAL

COURSE OBJECTIVES

- *To familiarize the students about the object oriented programming paradigm using C++*
- *To make the learners to model the problems and to develop and test codes for them in object oriented paradigm.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of object-oriented programming principles by producing a design that meets identifiable requirements and standards*

CO2 : *an ability to adapt approaches including some at the forefront of the discipline and identify possibilities for originality or creativity*

CO3 : *an ability to use appropriate development tools and processes to create, debug, test and optimize and efficient, robust, real-time, C++ application based on an object-oriented design.*

CO4 : *critical awareness and be able to participate within the professional, legal and ethical frameworks for software development*

PRINCIPLES OF OOP

Programming Paradigms-Object Oriented Technology-Basic concepts and benefits of OOP-Application of OOP- OOP languages. INTRODUCTION TO C++: Basic data types-Derived data types- Symbolic constants-Scope resolution operator-Type modifiers- Type casting-Operators and control statements-Input and output statements- FunctionPrototyping-Inlinefunction-Overloadedfunction-Introduction to friend function. **(9)**

CLASSES AND OBJECTS

Class specification- Member function definition- Nested member function-Access qualifiers-Static data members and member functions -Instance creation-Array of objects-Dynamic objects-Static Objects-Objects as arguments- Returning objects. **(9)**

CONSTRUCTORS AND DESTRUCTORS

Constructors - Parameterized constructors- Overloaded Constructors- Constructors with default arguments -Copy constructors- Dynamic constructors- Dynamic initialization using constructors-Destructors. **(9)**

OPERATOR OVER LOADING

Operator function-Overloading unary and binary operator-Overloading the operator using friend function-Stream operator overloading-Data Conversion. **(9)**

INHERITANCE

Defining Derived classes-Single Inheritance-Protected Data with private inheritance-Multiple Inheritance-Multilevel inheritance-Hierarchical Inheritance-Hybrid Inheritance-Multipath inheritance-Constructors in

derived and base class-Template in inheritance-Abstract classes-Virtual function and dynamic polymorphism-Virtual Destructor-Nested Classes. **(9)**

I/O SRTEAMS

I/O STREAMS - unformatted I/O operations - formatted I/O operations - manipulators - hierarchy of file stream classes - opening and closing of files - file pointers and manipulation - sequential access file - random access file. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Robert Lafore, "Object Oriented Programming in Turbo C++", 4th Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.
2. Budd Timothy, "Introduction To Object-Oriented Programming", 3/E,Pearson Education India, 2008.

REFERENCE BOOKS

1. HerbertSchildt,"C++:TheCompleteReference",TataMcGrawHill PublishingCompany,NewDelhi,2003.
2. K.R.Venugopal, Rajkumar and Ravishankar T,"Mastering C++",TataMcGrawHillPublishingCompany
3. Deitel, "C++ How to Program", Prentice Hall of India, New Delhi, 2004.
4. Bruce Eckel, "Thinking in C++", II Edition, PEA, 1999.
5. BjarneStroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education Asia, 2001.
6. Art Friedman, Lars Klander and Mark Michaelis, "C/C++ Annotated Archives", Tata-McGraw Hill Publishing Company Ltd., New Delhi, 1999.

PRACTICALS

1. Basic Programs implementing Constructors, Destructors
2. Operator Overloading
3. Function Overloading
4. Inheritance
5. Multiple and Multi-level, Access Specifiers
6. Function Overriding
7. Pure Virtual Functions
8. Abstract Classes
9. I/O Streams
10. File Handling

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×			×	×	
2	×	×	×		×				×		×	×	×	×
3	×		×		×				×			×	×	
4	×	×	×		×				×	×	×	×	×	

ASSESSMENT PROCEDURE

THEORY :

Final Examination = 40%

Internal Assessment = 10%

PRACTICAL :

Continuous Assessment = 50%

13EC56 - CONTROL SYSTEMS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To enable the students to understand the basic knowledge on the principles of control system, modeling, system analysis and feedback control.*
- *To enable the students to understand the concept of transient and steady state conditions.*
- *To expose the students to the challenges of frequency response analysis using Bode and Polar plots.*
- *To enchance the students knowledge in the area of system stability using Routh-Hurwitz technique and Nyquist Criterion.*
- *To enable the students to formulate and solve state equations using Laplace Transform.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth knowledge on the principles of control system, modeling and analysis.*

CO2 *: an ability to analyze transient and steady state behavior of control systems.*

CO3 *: an in-depth understanding of the frequency response and stability analysis.*

CO4 *: an ability to apply state-space model using Laplace Transform.*

CONTROL SYSTEM MODELLING

Linear control systems- Open loop and closed loop systems-Elements of closed loop systems - Transfer function- Mathematical model of physical systems - Mechanical systems: Translational & Rotational systems- Electrical systems - Analogous systems - Block diagram reduction method - Signal flow graph - Mason's gain formula - Introduction to control systems components - Servomechanism. **(10)**

TIME DOMAIN ANALYSIS

Standard test signals - Type and order of systems -Time domain study of first and second order feedback control systems - Time domain specifications - Steady state errors - Error constants- Introduction to P, PI and PID Controllers. **(9)**

FREQUENCY DOMAIN ANALYSIS

Frequency response - Frequency domain specifications - Bode plot- Polar plot - Gain Margin - Phase Margin - All pass and minimum phase systems. **(9)**

STABILITY ANALYSIS

Concepts of stability - Location of roots on S-plane for stability - Necessary conditions for stability- Routh Hurwitz criterion- Root locus - Construction of root loci - Nyquist stability Criterion - Assessment of relative stability using Nyquist criterion - closed loop stability. **(9)**

STATE VARIABLE ANALYSIS

Concepts of State, State variable and state model- State space representation using physical, phase and canonical variables- State transition matrix - Solution of state equations - Concepts of Controllability & Observability (Kalman's test only). **(8)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Nagrath,I.J. and M.Gopal, "Control Systems Engineering", New age International Publishers, 5th Edition, 2011.
2. Ktsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Limited, 5th Edition, 2010.

REFERENCE BOOKS

1. Norman S.Nise, "Control Systems Engineering", John Wiley, 6th edition, 2012.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison Wesley, 11th edition, 2008.
3. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 8th Edition, 2007.
4. A.Nagoor Kani, "Control Systems", RBA Publications, 2006.
5. W.Bolton, "Control Systems", Newnes, Elsevier Limited, 1st Edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×			×				×		×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×		×	×	×	×

13EC57 - MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to develop 8086 and 8051 based programming skills and use them for practical applications.*
- *to develop skills to interface I/O devices such as keyboard, display, Traffic light, Programmable Interrupt Controller, ADC and DAC with 8086 and 8051.*
- *to develop skills to design and develop micro computer based systems.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 : *have programming skills for 8086 processors and 8051 microcontrollers.*

CO2 : *be able to design and develop micro-computer based systems based on I/O devices such as keyboard, display, Traffic light, Programmable Interrupt Controller, ADC and DAC*

CO3 : *be able to model and design microprocessor based systems for practical applications.*

CO4 : *have an ability to communicate effectively on the concepts, principles and techniques learnt on Microprocessors and Microcontrollers*

CO5 : *have an ability to work in teams to achieve goals.*

Developing Assembly Language Programs using 8086 Microprocessor and 8051 Microcontroller Kits

- Arithmetic and Logic Operations
- Code conversion
- String operations (Block Move, Searching, Sorting, Swapping and Reversal).
- Solving a Polynomial, Palindrome and Generating Fibonacci Series

Developing Programs using Interface Boards for 8086 and 8051 kits

- Traffic Light Interface
- Keyboard Interface
- Display Interface
- DAC Interface
- ADC Interface
- 8259 PIC Interface

TOTAL : 45

REFERENCES

1. Laboratory manual prepared by ECE department, CIT.
2. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051, 8096", Prentice Hall of India, 1st Edition, 2011.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×		×	×	×	×	×	×		×
2	×	×	×		×		×	×	×	×	×	×	×	×
3	×	×	×		×		×	×	×		×	×		×
4		×		×	×		×		×	×	×	×	×	×
5				×		×	×							

13EC58 - LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to test, measure and plot the characteristics of operational amplifier and determine its parameters*
- *to design and test operational amplifier and 555 Timer based analog circuits*
- *to gain knowledge on the function and applications of PLL*
- *to test the characteristics of IC voltage regulators*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an ability to design, build and test linear integrated circuits, analyze, plot the characteristics and determine their parameters*

CO2 *: an ability to apply knowledge on Linear ICs for developing electronic hardware systems.*

CO3 *: an ability to communicate effectively the concepts, principles and techniques learnt on Linear Integrated Circuits.*

CO4 *: an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

- Operational Amplifier Characteristics
- Operational Amplifier Applications
- Design and testing of Active Filters
- Design and testing of Oscillators & Multivibrators
- Design and testing of Comparator & Schmitt Trigger
- Design and testing of D/A & A/D Convertors
- Design and testing of Multivibrators using Timer IC
- PLL Characteristics and applications
- Design of voltage regulators using IC

TOTAL : 45

REFERENCES

1. Linear Integrated Circuits Laboratory Manual of ECE Department, CIT.
2. David A.Bell, "Laboratory Manual for Operational Amplifiers and Linear ICs", Oxford University Press, 2nd Edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×		×	×	×	×	×	×		×
2	×	×	×	×	×		×	×	×		×	×		×
3	×	×	×	×	×		×	×	×	×	×	×	×	×
4	×	×	×	×	×	×	×	×	×	×	×	×	×	×

13EC61 - DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to know about Discrete Fourier Transform, Fast Fourier Transform and their properties.*
- *to know about basics of filters, their characteristics, implementation methods and acquire an ability to design digital FIR and IIR filters*
- *to understand the effects of finite word length in FIR filters*
- *to acquire knowledge on multirate signal processing*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of Discrete Fourier Transform, Fast Fourier Transform and their implementation*

CO2 : *knowledge about basics of filters, their characteristics, implementation methods and an ability to design digital FIR and IIR filters*

CO3 : *an understanding of the effects of finite word length in FIR filters*

CO4 : *an in-depth understanding of concepts of multirate signal processing*

DISCRETE FOURIER TRANSFORM

Frequency Domain Sampling and Reconstruction of Discrete Time Signals - Discrete Fourier Transform(DFT) - Properties of the DFT - DFT in Linear Filtering, Filtering of Long Data Sequences - Radix-2 FFT Algorithms - Decimation-in-Time FFT algorithm, Decimation-in-Frequency FFT algorithm - Spectral Factorization - Periodogram - FFT for Spectral estimation **(10)**

IIR FILTERS

Design of Discrete time IIR filters from continuous time filters - Analog filters - Bilinear Transformation Method of IIR Filter Design - Design of Lowpass IIR Digital Filters - Design of Highpass, Bandpass and Bandstop IIR Digital Filters - Spectral Transformation of IIR Filters - IIR filter realization - Direct, Cascade and Parallel realizations. **(9)**

FIR FILTERS

Symmetric and Antisymmetric FIR Filters - Design of Linear Phase FIR Filters using Windows and Frequency Sampling Method, Design of FIR Differentiators and Hilbert Transformers - Structure of FIR Systems. **(9)**

FINITE WORD LENGTH EFFECTS

Quantization Process and Errors - Quantization of Fixed point and Floating point numbers - Coefficient quantization effects - A/D Conversion Noise Analysis - Arithmetic Round-off Errors - Product Round-off errors - Dynamic range Scaling - Limit Cycles in IIR Filters - Round off Errors in FFT Algorithm **(6)**

MULTIRATE DIGITAL SIGNAL PROCESSING

Decimation - Interpolation - Basic sample rate alteration - Multirate structures for sampling rate conversion - Multistage design of decimator and interpolator - Polyphase decomposition - Quadrature mirror filter banks **(11)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. John G Proakis and Dimitris G Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, 4th Edition, 2007
2. Sanjit. K. Mitra and Sanjit Kumar Mitra, "Digital Signal Processing - A computer based approach", Tata McGraw Hill, 4th Edition, 2011.

REFERENCE BOOKS

1. A. V. Oppenheim, R. W. Shafer and J.R.Buck, “Discrete-Time Signal Processing”, Pearson Education, 2nd Education, 2007.
2. Ifeacher E.C. & Jervis B.W., "Digital Signal Processing: A Practical Approach", Pearson Education, 2nd Edition, 2002.
3. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., Singapore, 2009
4. Monson H Hayes, "Schaum's Outlines - Digital Signal Processing", McGraw Hill, 1998.
5. Vinay K Ingle & John Proakis, "Digital Signal Processing using Matlab", Brooks/Cole, 2nd Edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	×
2	×	×	×		×			×	×	×	×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13EC62 - EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand ARM architecture, instruction set and programming of ARM Devices.*
- *to gain knowledge about peripheral devices, communication buses and device drivers.*
- *to acquire knowledge on principles of process modeling and Real Time Operating Systems.*
- *to understand the concepts in developing embedded systems*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth understanding of ARM architecture, instruction set and programming ARM devices.*

CO2 *: knowledge on peripheral devices, communication buses and device drivers.*

CO3 *: knowledge on principles of process modeling and Real Time Operating Systems.*

CO4 *: an understanding of the concepts in developing embedded systems.*

INTRODUCTION TO EMBEDDED SYSTEMS & ARCHITECTURE OF ARM

Definition and classification - Overview of Processors and Hardware units in embedded system - Software embedded into the System - Exemplary Embedded Systems-ARM Architecture - 3 and 5 Stage Pipeline ARM Organization - ARM Instruction Execution and Implementation- ARM Co-Processor Interface. **(9)**

ARM PROCESSOR PROGRAMMING

ARM Instruction Set - ARM Instruction Types - Data Transfer, Data Processing and Control Flow Instructions -Co-Processor Instructions. **(9)**

PERIPHERAL DEVICES, BUSES AND DEVICE DRIVERS

I/O types - Serial communication - Parallel device ports -Timer and Counting devices -Watchdog timer - Real Time Clock-Serial Bus Communication Protocols - Parallel Bus Protocols. Device Drivers and Interrupt Servicing Mechanism: ISR Concept - Interrupt Sources - Interrupt Servicing Mechanism - Multiple Interrupts - Context Switching - Interrupt Latency - Deadline. **(9)**

PROGRAMMING MODELS AND RTOS

Program models - DFG model - State machine programming models for Event Controlled Program Flow - Inter Process Communication and Synchronization of Process: Tasks and Data, Semaphores and Shared Data Message Queues, Mailboxes and Pipes - Real Time Operating System (RTOS) Concepts: Timer function, Events-memory management, Interrupt routines - RTOS Programming Tools: Micro C/OS-II. **(9)**

EMBEDDED SYSTEM APPLICATIONS

Hardware/Software Integration: Compiler - Cross compiler - Emulator, Simulators - Host and Target Machines - Linkers/Locators for Embedded Software - Getting Embedded Software into the Target System and Testing on Host Machine. Case Study: Digital Camera - Smartcard - Set - Top-Box. **(9)**

TOTAL : 45

TEXT BOOKS

1. Raj Kamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill, 2nd Edition, 2008.
2. Steve Furber, "ARM System on Chip Architecture", Addison Wesley Professional, 2nd Edition, 2000.

REFERENCE BOOKS

1. David E Simon, "An Embedded Software Primer", Addison Wesley, 7th Edition, 2009.
2. Andrew N.Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann Publishers, 1st Edition, 2004.
3. Steve Heath, "Embedded Systems Design", Elsevier Publications, 2nd Edition, 2006.
4. Frank Vahid and Tony Gwasrgie, "Embedded system Design", John Wiley and Sons, 2nd Edition,2002.
5. Arnold Berger, "Embedded System Design: An Introduction to Processes, Tools, and Techniques" CMP Books, 2nd Edition, 2002.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×					×	×		×	×	×	×
2			×					×	×	×	×	×		×
3	×	×	×		×			×	×		×	×		×
4	×	×	×		×			×	×		×	×	×	×

13EC63 - OPTICAL COMMUNICATION AND NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on the fundamental concepts of Optical fiber.*
- *to gain knowledge on the operating principles of optical transmission system and it's components*
- *to gain knowledge on the various optical network Architecture.*
- *to acquire knowledge on wavelength routing networks.*
- *to know about the principles of operation of photonic packet switching and access networks.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *in-depth understanding of the fundamental concepts of Optical Fiber.*

CO2 : *an understanding of the operating principles of optical transmission system and it's components.*

CO3 : *an in-depth understanding of Optical Network architectures.*

CO4 : *detailed knowledge on wavelength routing networks.*

CO5 : *an understanding of the principles of operation of photonic packet switching and access networks.*

INTRODUCTION TO OPTICAL FIBERS

Element of an Optical Fiber Transmission link - Optical Fiber Modes and Configurations - Single mode fiber - Graded index fiber structure - Signal Degradation in Optical Fibers: attenuation, distortion - Optical Sources: LEDs, Laser Diodes - Detectors: PIN diode, APD. **(9)**

OPTICAL SYSTEM COMPONENTS AND TRANSMISSION SYSTEM

Non-Linear effects - Solitons - Optical Components: Couplers, Isolators, Circulators, Multiplexers & Filters - Optical Amplifiers - Switches - Wavelength Converters.

Transmission System Engineering - System model - Power penalty - Transmitter - Receiver - Optical amplifiers - Crosstalk - Dispersion - Wavelength stabilization - Overall design considerations. **(9)**

OPTICAL NETWORK ARCHITECTURES

Introduction to Optical Networks - SONET/SDH - Metro Networks - Layered Architecture - Broadcast and Select Networks - Topologies for Broadcast Networks - Media Access Control Protocols - Testbeds for Broadcast & Select WDM. **(9)**

WAVELENGTH ROUTING NETWORKS

Wavelength Routing Architecture -Optical layer - Cost trade-off- Light path topology Design - Routing and Wavelength assignment - Wavelength conversion - Wavelength re-routing - Virtual topology Design - VPN over WDM optical networks. **(9)**

PACKET SWITCHING AND ACCESS NETWORKS

Photonic Packet Switching - OTDM - Multiplexing and Demultiplexing - Synchronization - Broadcast OTDM networks - Switch based networks - OTDM testbeds- Access Networks - Network Architecture overview - Future Access Networks - Optical Access Network Architectures: G.709 OTN, Gigabit-capable Passive Optical Network (GPON) , Ethernet Passive Optical Network (EPON), Broadband Passive Optical Network (BPON). **(9)**

TOTAL : 45

TEXT BOOKS

1. Gerd Keiser, "Optical Fiber Communication" McGraw-Hill International,New Delhi, 4th Edition, 2008.
2. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks: A Practical Perspective", Morgan Kaufmann, 2nd Edition, 2002.

REFERENCE BOOKS

1. C.Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, 1st Edition, 2002.
2. Rajiv Ramaswami and Kumar N. Sivarajan, Galen Sasaki "Optical Networks: A Practical Perspective", Elsevier Science Ltd, 2009, 3rd Edition, 2009.
3. Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.
4. Govind P.Agarwal, "Fiber Optics Communication Systems", 3rd Edition, John Wiley&Sons, 2012.
5. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×		×	×		×
2	×	×	×		×				×	×	×	×		×
3	×		×		×				×	×	×	×	×	
4	×	×	×		×				×	×	×	×		×
5	×	×	×		×				×	×	×	×		×

13EC64 - MICROWAVE ENGINERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to know about two-port analysis methods and apply them to solve problems in transmission lines and microstrip lines.*
- *to understand the principles of operation of basic types of passive microwave devices.*
- *to gain in-depth knowledge about the construction and operation of microwave vacuum tubes and solid state devices.*
- *to know about methods of measurement of microwave circuit parameters.*

COURSE OUTCOMES

On completion of this course, the students will have acquired

CO1 : *knowledge about two-port analysis methods and have an ability to apply them to solve problems in transmission lines and microstrip lines.*

CO2 : *knowledge of operation of basic types of passive microwave devices.*

CO3 : *in-depth knowledge about the construction and operation of microwave vacuum tubes and solid state devices.*

CO4 : *knowledge on methods of measurement of microwave circuit parameters.*

TWO PORT RF NETWORK ANALYSIS AND CIRCUIT REPRESENTATION

Impedance and Admittance (Z and Y) Matrices - Scattering Matrix - Generalized Scattering Matrix - Transmission (ABCD) Matrix - Relation between Impedance, Admittance, Scattering and Transmission Matrices. **(9)**

MICROWAVE PASSIVE DEVICES

Dividers and Couplers - Three port Network - Four port Network - Lossless Divider - Resistive Divider - Quadrature Hybrid (Branch line Coupler) - 180^{O} Hybrid Junction - Fundamentals of Ferri Magnetic Devices: Ferrite Isolators, Ferrite Phase Shifters, Ferrite Circulators. **(9)**

MICROWAVE VACUUM TUBE DEVICES

Problems of operating vacuum tube devices at high frequencies - Klystrons - Velocity and Density Modulation - Two Cavity Klystron Amplifier - Power Output - Reflex Klystron Oscillator - Mechanism of oscillation - Modes - Power output and Efficiency - Electronic Admittance - Travelling Wave Tube Amplifier - Wave propagation in Helix - Magnetron Oscillator - Mechanism of oscillation - Cut off field and Voltage - Modes - Power output **(9)**

MICROWAVE SOLID STATE DIODES AND CIRCUITS

Problems of operating Solid State Devices and Circuits at high frequencies - PIN Diode and its Applications

- Gunn Diode and its modes of operation - Read, IMPATT and TRAPATT Diodes - Tunnel Diode Amplifier and Oscillator **(9)**

MICROWAVE MEASUREMENTS

Tunable Detector - Slotted line Carriage - VSWR Meter - Spectrum Analyzer - Network Analyzer - Power measurements - Insertion Loss, Attenuation and VSWR measurements - Impedance measurement by Slotted line method - Frequency measurement methods - Dielectric constant measurement by waveguide method. **(9)**

TOTAL : 45

TEXT BOOKS

1. David M.Pozar, "Microwave Engineering", John Wiley and Sons, Wiley India Edition, 4th Edition, 2011
2. Samuel Y. Liao, "Microwave Devices and Circuits", Prentice Hall of International Ltd, 4th Edition, 1997

REFERENCE BOOKS

1. F.E.Terman, "Electronic and Radio Engineering", Tata McGraw Hill, 4th Edition, 1988
2. Annapurna Das and Sisir K.Das, "Microwave Engineering", Tata McGraw Hill, New Delhi, 2nd Edition, 2009
3. George Kennedy, "Electronic Communication Systems", Tata McGraw Hill, 4th Edition, 1999
4. Robert.E.Colin, "Foundations of Microwave Engineering", John Wiley and Sons, 2nd Edition, 2005.
5. R.S. Rao, "Microwave Engineering", Prentice Hall of India, 2012

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×		×	×	×	×
2	×	×	×		×				×		×	×	×	×
3	×		×		×				×	×		×	×	×
4	×	×	×		×				×		×	×	×	×

13EC65 - ANTENNAS AND WAVE PROPAGATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire in-depth knowledge on the principles of operation of antennae and antenna arrays.*
- *to understand the principles of operation of special antennas.*
- *to know the techniques of measurement of antenna parameters.*
- *to know in detail about the modes of radio wave propagation.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: in-depth knowledge on the principles of operation of antennae and antenna arrays.*

CO2 *: an understanding of the principles of operation of special antennas.*

CO3 *: knowledge on the techniques of measurement of antenna parameters.*

CO4 *: knowledge in detail about the modes of radio wave propagation.*

FUNDAMENTALS OF ANTENNA

Radiation : Retarded potentials - Radiation from an alternating element - Power radiated by a current element - Radiation from Half Wave Dipole - Power radiated by Half wave Dipole

Antenna Parameters : Radiation pattern - EIRP - Radiation Intensity - Beam width- Directivity-Antenna Efficiency-Gain-Bandwidth-Polarization-Radiation Resistance - Effective area - Effective length and Aperture - Reciprocity theorem - Radiation resistance - Self and Mutual impedance of antennas. **(10)**

ANTENNA ARRAYS

Two element array - Pattern Multiplication - Linear array - Broad side array - End fire array - Phased array - Binomial array - Log Periodic antenna - Programmable phased array - Smart antennas. **(9)**

SPECIAL ANTENNAS

Folded dipole - Yagi Uda antenna- Helical antenna - Travelling wave antennas - Horn Antenna- Parabolic Reflector - Cassegrain feed - Radio direction finding - Loop antennas - Adcock direction finders - Bellini Tosi type. **(9)**

ANTENNA MEASUREMENTS

Measurement of Radiation Pattern - Beam Width - Gain - Directivity - Polarization- Input impedance - Bridge method - SWR method -Radiation efficiency - Ranges- Elevated ranges-Ground reflection ranges-Anechoic chambers & absorbing materials-Compact Antenna Test Ranges(CATRS). **(8)**

WAVE PROPAGATION

Modes of propagation - Structure of atmosphere - Characteristics of different ionized regions - Sky wave propagation - Effects of the earth's magnetic field on ionospheric radio wave propagation - Virtual height - Maximum usable frequency - Critical angle - Skip distance - Ionospheric abnormalities - Space wave propagation - Duct propagation. **(9)**

TOTAL : 45

TEXT BOOKS

1. Balanis E.S., "Antenna Theory Analysis and Design", John Wiley & Sons Inc Singapore, 3rd Edition, 2005.
2. Prasad.K.D, "Antennas and Wave Propagation", Sathya Prakashan, 3rd Edition, 2009.

REFERENCE BOOKS

1. Edward C. Jordan and Keith.G.Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2nd Edition, 2005.
2. F.E.Terman, "Electronic and Radio engineering", McGraw Hill International Students Edition, 4th Edition, 1995.
3. John Daniel Kraus, Ronald J. Marhefka Ahmad Khan , "Antennas for all applications", McGraw Hill, 3nd Edition, 2006.
4. John . D.Kraus, Ronald J.Marhefka, Ahmad Khan, " Antennas and Wave Propagation " Tata Mcgraw Hill, 4th Edition, 2010.
5. H.D. Griffiths, J.Encinas, A.Papiernik,S.Drabowitch " Modern Antennas", Chapman and hall,2005.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×						×		×			×
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3	×								×	×				
4	×	×	×		×					×	×	×	×	×

13EC66 - INFORMATION THEORY AND CODING

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge and understanding of information theory, discrete sources and channel capacity.*
- *to acquire an in-depth understanding of source coding theorems and techniques.*
- *to know in detail about random error and burst error detection and correction techniques.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 : *have knowledge on information theory, discrete sources and channel capacity..*

CO2 : *have an in-depth understanding of source coding theorems and techniques.*

CO3 : *know in detail about random error and burst error detection and correction techniques.*

CO4 : *have an ability to design a error-free coding system based on the topics learnt above.*

MEASURES OF INFORMATION THEORY IN DISCRETE MEMORYLESS SOURCES

Uncertainty Information and Entropy- Basic Properties of entropy - Information rate- Conditional entropy - Joint Entropy - Mutual Information -Properties of mutual information - Differential entropy and mutual information for continuous ensembles-Markov Sources-n-gram models. **(9)**

MEMORYLESS FINITE SCHEMES FOR SOURCE CODING

Uniquely decodable codes - Prefix codes - The Kraft Mcmillan Inequality - Extension of Discrete Memory less Source -Shannon's Theorem, Source Coding Theorem - Huffman Coding - Shannon Fano Coding - Huffman Codes -Adaptive Huffman Coding-efficiency calculations. **(8)**

MEMORYLESS FINITE SCHEMES FOR CHANNEL CODING

Discrete Memoryless Channel - Channel models - BSC and BEC channels - Cascaded channels - Channel capacity of discrete and analog channels - Channel capacity of a Gaussian channel-Bandwidth-S/N trade-off-Channel coding theorem - Information capacity theorem - Code rate and redundancy-Parity check codes - Rate Distortion Theory **(9)**

LINEAR BLOCK CODES AND CYCLIC CODES

Rationale for coding - Types of codes - Matrix description of linear block codes - Syndrome decoding - Minimum distance considerations -Repetition codes - Dual codes- Cyclic codes :Generator polynomial - Parity check polynomial - Encoder of cyclic codes - Calculation of syndrome - Cyclic codes for error correction: Burst error correcting codes- Interlaced codes for random and burst error correction - Interleaving and Concatenated codes :Block Interleaving - Convolutional Interleaving. **(10)**

CONVOLUTIONAL CODES

Convolutional codes : Tree codes- Trellis codes- Viterbi decoding of convolutional codes - Catastrophic Error Propagation in Convolutional Codes -Performance Bounds for Convolutional Codes - Coding Gain - Convolutional Code Trade off - Soft Decision Viterbi Decoding -Feedback Decoding - Sequential Decoding **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Simon Haykins, Michael Moher," Communications Systems", 5th Edition, John Wiley and Sons, 2009.
2. Bernard Sklar, Pabitra Kumar Ray "Digital Communications : Fundamentals and Applications", Pearson Education, 2nd Edition, 2009.

REFERENCE BOOKS

1. Ranjan Bose, "Information Theory Coding and Cryptography", Tata McGraw Hill, 2007.
2. Taub & Schilling, " Principles of Communication Systems", Tata McGraw Hill, 3rd Edition 2008.
3. Khalid Sayood ,"Introduction to Data Compression", 4th Edition, Elsevier, 2012.
4. Thomas M. Cover and Joy A. Thomas, " Elements of Information Theory", John Wiley & Sons, 2nd Edition, 2006.
5. Todd K.Moon, "Error Correction Coding : Mathematical Methods and algorithms", John Wiley & Sons, 2005.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×	×	×	×	×	×
2	×		×		×				×	×	×	×	×	×
3	×		×		×				×	×	×	×	×	
4	×		×	×	×				×	×	×	×	×	×

13EC67 - EMBEDDED SYSTEMS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to gain knowledge on Cross Compilers and IDE Tools used in embedded applications.*
- *to acquire knowledge on simulation softwares to develop and test 8051 microcontroller and ARM processor programs for practical applications.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 : *have an ability to program 8051 microcontroller and ARM processor.*

CO2 : *be able to model and design microprocessor based systems for practical applications.*

CO3 : *be able to use simulation software to develop and test 8051 microcontroller and ARM processor programs.*

CO4 : *have an ability to communicate effectively the concepts, principles and techniques learnt on Embedded Systems.*

CO5 : *have an ability to work in teams to achieve goals.*

Using ALP and IDE Tool for 8051 Microcontroller and ARM Processor

- Arithmetic and Logic Operations.
- External and Internal Memory Data Transfer Operations.
- Input/Output Port Programming.
- Handling Interrupts
- Timer/Counter Programming.
- Serial Port Programming.
- Switch and Buzzer Interface.
- Relay Interface.
- Elevator Interface
- Stepper Motor and DC Motor Interface

TOTAL : 45

REFERENCES

1. Laboratory manual prepared by ECE department, CIT.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education Asia, 2nd Edition, New Delhi, 2008.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×		×	×	×	×	×	×		×
2	×	×	×		×		×	×	×		×	×		×
3	×	×	×		×		×	×	×	×	×	×	×	×
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5				×		×								

13EC68 - DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

- *To enable the students to study the applications of different types of Transforms.*
- *To enhance the students to design and model Filter Design and Finite word Length Effects.*
- *To expose the students to develop and test multirate systems.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth understanding of practical aspects relevant to transforms in time domain and frequency domain.*

CO2 *: practical knowledge to design and test various Filter models.*

CO3 *: an ability to develop skills to develop multirate systems.*

CO4 *: an ability to communicate effectively the concepts, principles and techniques learnt on Digital Signal Processing.*

CO5 *: an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

- Generation of Sequences.
- Linear and Circular Convolution.
- Discrete Fourier Transform and Fast Fourier Transform.
- IIR Filter Design.
- FIR filters Design.
- Multirate system design.
- Finite Word-Length Effects in digital filters.
- One Dimensional Discrete Wavelet Transform- applications.
- Implementation of DSP algorithms in DSP processors.

TOTAL : 45

REFERENCES

1. Digital Signal Processing Lab Manual,Department of ECE, CIT.
2. Vinay K.Ingle, John G.Proakis , "Digital Signal Processing, A MATLAB -based approach", Cengage Learning India Pvt. Ltd., 3rd Edition,2012.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×		×		×				×	×	×	×	×	
4		×			×		×		×	×				
5				×		×	×							

13EC69 - MINI PROJECT

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to identify, formulate and design solutions and systems using knowledge in core electronics and communication engineering*
- *to acquire an ability to apply techniques, skills and modern engineering tools for developing electronic hardware and software*
- *to acquire an ability to work in teams.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an ability to use the techniques, skills and modern engineering tools for developing electronic hardware and software*

CO2 : *an ability to identify, formulate, analyze and design systems or processes to meet desired needs within realistic constraints.*

CO3 : *an ability to function on multidisciplinary teams and will have an understanding of professional responsibility.*

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×		×	×	×	×	×	×		×
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3	×	×	×	×	×	×	×	×	×	×	×	×	×	×

13EC71 - RF SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge and understanding of passive and active RF components and devices.*
- *to formulate, analyze and solve design problems in RF transmission lines.*
- *to design filters and matching networks and implement them using lumped and micro strip elements.*
- *to design IC based sub systems of communication receivers such as LNA, power amplifier and PLL.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of passive and active RF components and devices.*

CO2 : *an ability to analyze, design and solve problems in transmission lines.*

CO3 : *an ability to design filters and matching networks and implement using lumped or micro strip elements.*

CO4 : *an ability to design IC based sub systems of communication receivers such as LNA, power amplifier and PLL.*

PASSIVE RF COMPONENTS AND MATCHING NETWORKS

Significance and issues of RF design - Frequency Spectrum - RF behavior of Passive components: Transmission line analysis - Micro strip Transmission line - Smith Chart - Impedance transformation - Admittance transformation - Impedance matching using discrete components - Stub Matching - Micro-stripline Matching Networks. **(10)**

FILTERS

Basic Resonator and Filter configurations - Filter characteristics - Filter design based on Insertion Loss Method - Butterworth and Chebyshev filters - Prototype filter design and normalization - LPF, HPF, BPF and BSF - Filter Implementation - Kuroda's Identities - Microstrip realization of filters. **(8)**

RF TRANSISTORS, MODELING AND BIASING NETWORKS:

Modeling of RF BJT and RF FET - small signal and large signal models - Noise models-MESFET and High Electron Mobility Transistor: Construction and characteristics-Biasing Network for RF BJT and FET circuits. **(9)**

RF AMPLIFIER

Two port Power Gains - Unilateral power gain - Available power gain - Stability - Stability Circles - Tests for unconditional stability - Single Stage Transistor Amplifier design - Design for maximum gain - constant gain circles - Low noise amplifier design -Frequency compensated Matching network - Power Amplifiers : Characteristics - Class-A power amplifier design. **(9)**

OSCILLATORS AND MIXERS

Basic Oscillator Model - Negative Resistance oscillator - Feedback oscillator design -High Frequency oscillator: Fixed frequency, Dielectric resonator, YIG tuned and Voltage controlled oscillators - Mixers - Single Ended mixer - Single and Double Balanced Mixer - Image Reject Mixer. **(9)**

THEORY : 45

TUTORIAL : 15

TOTAL : 60

TEXT BOOKS

1. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design - Theory and Applications", Pearson Education, Second Edition, 2009.
2. David M. Pozar, " Microwave Engineering", Wiley Student India Edition, Third Edition, 2009.

REFERENCE BOOKS

1. Matthew M. Radmanesh "Radio Frequency and Microwave Electronics illustrated", Pearson Education Asia Publication, New Delhi, 2001.
2. Ulrich Rhode, "RF/Microwave Circuit design for Wireless Applications", John Wiley, 2000.
3. Peter P. Kenington "High linearity RF Amplifier Design", Artech House, Mumbai, 2002.
4. W. Alan Davis, "Radio Frequency Circuit Design", 2nd Edition, John Wiley and Sons, 2011.
5. John Rogers & Calvin Plett, "Radio Frequency Integrated Circuits", Artech House, 2003.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×			×	×	×
2	×	×	×		×				×			×	×	×
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13EC72 - DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the concepts of image fundamentals and mathematical transforms necessary for image processing.*
- *to understand the concepts of image enhancement, restoration, and segmentation techniques in spatial and frequency domains.*
- *to have an understanding of image compression techniques.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *basic knowledge on image processing and Transforms applicable in Digital Image Processing Systems.*

CO2 : *an understanding of the concepts and techniques of image enhancement, restoration, and segmentation in spatial and frequency domains.*

CO3 : *an understanding of image compression techniques.*

CO4 : *an ability to develop algorithms for real applications such as medical images, cryptography and video processing.*

DIGITAL IMAGE FUNDAMENTALS & TRANSFORMS

Fundamental steps in image processing - Components of an image processing system - Elements of visual perception - Color image fundamentals - RGB, HSI Models - Image sampling and Quantization - Basic relationship between pixels. Image Transforms: Discrete Cosine Transform, Hadamard Transform, Walsh transform, Haar, Slant and Karhunen Loeve Transform. **(9)**

IMAGE ENHANCEMENT

Basic intensity transformation functions - Histogram processing: Specification, Equalization - Smoothing spatial filters - Sharpening spatial filters - Frequency domain Filters: Smoothing and sharpening - Morphological operators -Dilation, Erosion, Opening and Closing. **(9)**

IMAGE RESTORATION

Model of image degradation- Atmospheric turbulence - Relative motion between camera and scene-Noise Models - Mean, Order statistics filters - Linear position invariant degradations - Inverse filtering - Wiener filtering - Constrained least square filtering - Geometric Transformations. **(9)**

IMAGE COMPRESSION

Coding redundancy - Spatial and temporal redundancy - irrelevant information - Measuring image information - Fidelity criteria - Image compression models - Lossless compression: Huffman coding, Arithmetic coding, Variable length coding, LZW coding, Bit plane coding and Lossless predictive coding

- Lossy compression : Lossy predictive coding, Block transform coding, Wavelet Coding - Image formats - Bilevel Image compression standards- JPEG. **(9)**

IMAGE SEGMENTATION AND DESCRIPTION

Point detection- line detection - Edge detection - Edge linking and boundary detection: Local processing, Global processing - Hough Transform and Graph-theoretic methods Thresholding - Region based segmentation: Region growing by pixel aggregation - Region splitting and merging- Chain codes- Skeletons.-Texture - Boundary descriptors: Simple descriptors, Shape numbers, Statistical moments - Regional Descriptors: Simple descriptors, Topological descriptors, Texture - Relational descriptors. **(9)**

TOTAL : 45

TEXT BOOK

1. Rafael C.Gonzalez & Richard E.Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2009.

REFERENCE BOOKS

1. Anil.K.Jain, "Fundamentals of Digital image Processing", Prentice Hall of India, 1989.
2. Sid Ahmed M.A., "Image Processing - Theory, Algorithm and Archietecture", McGraw Hill, 2009.
3. William K.Pratt, "Digital Image Processing", John Wiley, 4th edition, 2006.
4. Jayaraman S, Esakkirajan S & Veerakumar T, "Digital image Processing", Tata McGraw Hill, reprint 2010.
5. Milan Sonka, Vaclav Hlavac & Roger Boyle, "Image processing, Analysis and Machine Vision", Thomson Asia Prt. Ltd, 2nd Edition, 1999.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
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4	×	×	×		×				×	×	×	×	×	×

13EC73 - REAL TIME CONTROLLERS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To enable the student to gain knowledge about characteristics of Real Time Systems.*
- *To expose the student to gain knowledge about architecture of TI C2000 controllers, programming skills.*
- *To enhance the student to acquire in-depth knowledge about deployment consideration, energy efficiency to develop Real Time Systems*
- *To enable the student to acquire an in-depth knowledge about Real Time Communication.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *knowledge of characteristics of real time systems.*

CO2 : *an in-depth knowledge of architecture of TI C2000 controllers, programming skills.*

CO3 : *an in-depth knowledge of deployment consideration, energy efficiency to develop real time systems*

CO4 : *an in-depth knowledge of real time communication.*

INTRODUCTION

Real Time Systems -Types of Real Time systems - Hard and Soft, Real Time Event Characteristics, Challenges in Real Time System Design - Distributed and Multi-processor Architecture - Embedded systems and its Characteristics. **(9)**

ARCHITECTURE OF TI C2000

Introduction to Software Development and the Process - Assembler Directives - C2000 Architecture - Central Processing Unit - Program Control - Programming and System Issues - Phase Locked Loop Application. **(9)**

DEPLOYMENT CONSIDERATIONS

Data Representation and Arithmetic - Fixed Point vs Floating Point Format - Finite Word Length Effects - Addressing Modes - Pipeline - Instruction Cache - Interrupts - Hardware and Software - Real Time Implementation Considerations. **(9)**

ENERGY EFFICIENT REAL TIME SYSTEMS

Basic Concepts of Energy Efficiency and its Estimates - Thermal Effects - Reliability - Hardware Techniques - Power Reduction - Low Power Design - Power Gating - Real Time - Execution Time - Software Techniques - Software Tools - Energy Sources - Batteries - Energy Harvesting. **(9)**

REAL TIME COMMUNICATION

Communication Requirements - Timeliness - Dependability - Design Issues - Flow Control and Thrashing - Event Triggered Communication - Ethernet - Controller Area Network - User Datagram Protocol - Token Protocol - Time triggered communication - Flexray - Control Law Accelerators - Fixed Point Libraries (iQMath). **(9)**

TOTAL : 45

TEXT BOOK

1. Hermann Kopetz , "Real Time Systems: Design Principles for Distributed Embedded Applications", Springer publications, 2nd Edition, 2011

REFERENCE BOOKS

1. Robert Oshana,"DSP Software Development Techniques for Embedded and Real-Time Systems",Newnes publication,1st edition, 2006
2. Sen M Kuo and WoongSenGan, "Digital Signal Processors, Architecture, Implementations and Applications", Prentice Hall,1st edition , 2004
3. C2000 Teaching CD ROM from Texas Instruments
4. TMS320C28x CPU and Instruction Set Reference Guide, TI Literature Number: SPRU 430E, Revised January 2009
5. TMS320x28xx, 28xxx DSP Peripheral Reference Guide, TI Literature Number: SPRU566J, Revised April 2011

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×							×	×	×	×		×
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3	×	×			×			×	×	×	×	×		×
4	×	×			×			×	×	×	×	×		×

13EC76 - COMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

- *To enhance the student to design and model Analog and Digital Communication systems*
- *To expose the student to study about various error correcting algorithms.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth understanding of practical aspects relevant to analog and digital Communication Systems.*

CO2 *: practical knowledge to design and test various analog and digital Communication systems.*

CO3 *: an ability to develop skills for using tools for error correction.*

CO4 *: an ability to communicate effectively the concepts, principles and techniques about communication systems.*

CO5 *: an ability to work in teams to achieve goals.*

LIST OF EXPERIMENTS

- DSB-SC Generation and Detection
- FM Modulation and Demodulation
- Pulse Analog Modulation and demodulation
- Pulse Digital Modulation and demodulation
- Design and testing of IF Amplifier and Mixer
- Time Division Multiplexing.
- Digital Modulation and Demodulation Schemes.
- PN Sequence Generation and Spread Spectrum communication.
- Random Error Correcting codes.
- Burst Error Correcting codes.
- Characteristics of AWGN.

TOTAL : 45

REFERENCES

1. Communication Systems Lab Manual, Department of ECE, CIT.
2. John G. Proakis, Masoud Salehi, Gerhard Bauch, "Contemporary Communication Systems Using MATLAB", 3rd edition, 2013.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×	×	×	×	×		×	×	×	×
2	×	×	×	×	×		×	×	×		×	×	×	×
3	×	×	×	×	×	×	×	×	×		×	×	×	
4						×	×	×			×	×	×	×
5	×			×			×	×	×		×	×	×	×

13EC77 - RF, FIBER OPTICS LAB

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students to acquire ability

- *to test and measure parameters, characterize and interpret measured data for Reflex Klystron Microwave Source, Microwave passive devices.*
- *to test and measure radiation pattern and beam width for Horn and Dielectric Antennae.*
- *to test and measure parameters, characterize and interpret measured data for Fiber-optic cable, Optical Source, Detector and passive components.*
- *to simulate and verify the operation of radiation pattern of various types of antennae*
- *to apply skills and tools to develop software / systems in the areas of RF/Microwave Engineering and Fiber optic communication.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 *: be able to test and measure parameters, characterize and interpret measured data for Reflex Klystron MW Source, Microwave passive devices.*

CO2 *: be able to test and measure radiation pattern and beam width for Horn and Dielectric Antennae*

CO3 *: be able to test and. measure parameters, characterize and interpret measured data for Fiber-optic cable, optical Source, Detector and passive components.*

CO4 *: be able to develop basic software / systems in the areas of RF/Microwave Engineering and Fiber optic communication.*

LIST OF EXPERIMENTS

RF LAB

- Characteristics of Passive devices: Isolator, Circulator, Magic Tee and Directional coupler
- Mode characteristics of Reflex Klystron
- Measurements of VSWR and unknown impedance
- Measurement of Dielectric constant of solid dielectric
- Radiation pattern of antennae (Horn, Dielectric, Dipole and Log- periodic)
- Study of Microstrip-lines and antennae.
- Measurement of S- parameters for two port devices.
- Design and simulation of RF filter
- Design and simulation of RF amplifier
- Design and simulation of RF oscillator

FIBER OPTICS LAB

- Measurement of Numerical Aperture
- Losses in optic Fiber
- Study of Fiber Optic Analog link's characteristics
- Study of Fiber Optic Digital link's characteristics and Pulse broadening
- Electromagnetic/ RF interference in OFC and copper media
- Measurement of speed of light
- Fault location using OTDR

REFERENCES

1. "RF, Fibre Optics Lab manual" by ECE department, CIT, Coimbatore.
2. Annapurna Das and Sisir K.Das, "Microwave Engineering", Tata McGraw Hill, New Delhi, 2nd Edition, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×	×	×	×		×	×	×	×	×
2	×	×	×	×	×	×	×	×		×	×	×	×	×
3	×	×	×	×	×	×	×	×	×	×	×	×	×	×
4	×	×	×		×		×	×	×		×	×	×	×

13EC81 - INDUSTRIAL ECONOMICS AND CORPORATE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge on economics, demand, supply, pricing, break-even analysis, banking, industrial finance and accounting.*
- *to have basic understanding about skills required for industrial management, human resource management, job-analysis, recruitment and training processes.*
- *to acquire basic knowledge in marketing and insurance.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: basic knowledge on economics, demand, supply, pricing, break-even analysis, banking, industrial finance and accounting.*

CO2 *: knowledge on skills required for industrial management, human resource management, job-analysis, recruitment and training processes.*

CO3 *: basic knowledge in marketing and insurance.*

CO4 *: an understanding of skills required for managerial success and to face the boom and recession in industry.*

ECONOMICS

Definition - Relationship between Economics and Engineering - Demand Analysis and Supply Analysis, Elasticity of Demand and Supply - Cost of Production - Break-even Analysis - Pricing under perfect competition, monopoly and monopolistic market. **(9)**

INDUSTRIAL FINANCE AND ACCOUNTING

Need for Finance, Types of Finance - Sources of Finance -Business cycle and Business policies-Demand Recession in India-Causes, Indicators and Prevention- Stock Exchange. **(9)**

MONEY AND EMPLOYMENT

Estimation of National Income, Methods and Problems - Inflation and Deflation - Unemployment - Money and Changes in Value of Money, Commercial Banks, Central Banking - New Economic Environment - Privatisation, Liberalisation and Globalisation - Importance of Patent Rights. **(9)**

HUMAN RESOURCE MANAGEMENT

Principles of Management, Evolution of Management, Development of Managerial Skills - Human Resource Management - Importance - Objectives - Job Analysis - Recruitment - Selection and Placement and Training Development. **(9)**

MARKETING AND INSURANCE

Marketing - Definition , Aims, Need for Marketing - Marketing function - Marketing management and its functions - Marketing versus Selling - Concept of Insurance - Life Insurance, Fire Insurance, Marine Insurance. **(9)**

TEXT BOOK

1. P.L. Mehta, 'Managerial Economics', S.Chand & Co, 2007.

REFERENCE BOOKS

1. Varshney, R.L and Maheswari,K.L, 'Managerial Economics', S.Chand & Co, 2007.
2. O.P.Khanna, 'Industrial Engineering and Management', Dhanpat Rai Publication (P) Ltd-2006.
3. Philip Kotler, 'Marketing Management', 13th Edition, Pearson Education.
4. R.S.N.Pillai and Bagavathi, 'Marketing Management', Sultan Chand & Sons,2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1			×	×		×	×	×	×	×				
2			×	×		×	×	×	×					
3			×	×		×	×	×	×	×				
4			×	×		×	×	×	×	×				

13EC82 - PRINCIPLES OF MOBILE COMMUNICATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To enable the students to acquire knowledge in the fundamentals of cellular radio, trunking concepts, grade of service.*
- *To enable the students to know about different radio propagation models.*
- *To enhance the students to acquire knowledge and understanding of diversity techniques and capacity of wireless channels.*
- *To enable the students to learn about multiple access techniques and multiuser communication.*
- *To enable the students to know about wireless networks and standards.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 *: understand the basics of cellular radio, trunking concepts, grade of service and multiple access techniques.*

CO2 *: be able to analyze different radio propagation models.*

CO3 *: have in-depth understanding of Diversity techniques and capacity of wireless channels.*

CO4 *: understand the concepts of multiple access techniques and multiuser Communication*

BASIC CELLULAR NETWORKS

Evolution of Mobile Radio Communications - Cellular Concept fundamentals : Introduction - Frequency Reuse - Channel Assignment Strategies - Handoff Strategies - Interference and System Capacity - Trunking and Grade of Service - Improving Coverage and Capacity in Cellular Systems - Multiple Access Techniques for Wireless Communications. **(9)**

MOBILE RADIO PROPAGATION

Radio Wave Propagation - Free Space Propagation Model - Basic Propagation Mechanisms - Reflection - Ground Reflection Model - Diffraction - Scattering - Practical link budget design - Outdoor and Indoor propagation Models - Signal penetration into buildings - Ray Tracing and site specification Modeling - Small scale multipath propagation - Impulse Response Model of Multipath Channel - Parameters of Mobile Multipath Channels. **(9)**

CAPACITY OF WIRELESS CHANNELS

AWGN channel capacity - Resource of AWGN channel-linear time invariant Gaussian channels-Capacity of fading channels - slow fading -Transmit Diversity - Receiver Diversity -Time &Frequency Diversity-Fast fading-Transmitter side information- Frequency selective fading channels. **(9)**

MULTIPLE ACCESS TECHNIQUES AND MULTIUSER COMMUNICATION

Frequency division multiple access-time division multiple access-spread spectrum multiples access space division multiple access- packet radio, Uplink with multi receiver antennas- MIMO Uplink - Down link with multi transmit antennas. **(9)**

WIRELESS NETWORKS AND STANDARDS

GPRS- GSM - EDGE Architecture -WCDMA- UMTS - IEEE 802.11a/b/g - Wi-Fi - 802.16 - WiMAX - LTE- LTE advanced - IEEE 802.16e -IEEE 802.16m. **(9)**

TOTAL : 45

TEXT BOOKS

1. *T.S.Rappaport, "Wireless Communications", Pearson Education Asia, New Delhi, 2nd Edition, 2010.*
2. *David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 1st Edition, 2005.*

REFERENCE BOOKS

1. *Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.*
2. *Vijay Garg, "Wireless Communication and Networking", Elsevier, 2010.*
3. *Howard Huang, Constantinos B. Papadias, Sivarama Venkatesan,"MIMO Communication for wireless networks", Springer, 2011.*
4. *Jochen Schiller, "Mobile Communications", Pearson Education Asia Ltd., 2nd Edition, 2003.*
5. *Andreas. F. Molisch, "Wireless Communications", John Wiley, 2nd Edition - India, 2006.*

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×				×				×		×	×		
2	×								×		×	×		
3	×								×		×	×		
4	×	×	×						×	×	×	×	×	×

13EC83 - VLSI DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of CMOS Technology and back-end process for design and implementation of CMOS devices and logic circuits.*
- *to understand clocking strategies and distribution techniques in VLSI circuits*
- *to acquire knowledge on memories, programmable logic devices, testing and fault analysis of CMOS VLSI circuits.*
- *to know about design procedures for CMOS Sub-systems and special purpose circuits.*
- *to acquire knowledge on low power design concepts in CMOS VLSI circuits.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the basics of CMOS Technology and back-end process for design and implementation of CMOS devices and logic circuits.*

CO2 : *an understanding of the clocking strategies and distribution techniques in VLSI circuits*

CO3 : *knowledge on memories, programmable logic devices, testing and fault analysis of CMOS VLSI circuits.*

CO4 : *knowledge about design procedures for CMOS Sub-systems and special purpose circuits.*

CO5 : *knowledge on low power design concepts in CMOS VLSI circuits*

INTRODUCTION TO CMOS CIRCUITS AND PROCESSING TECHNOLOGY

VLSI Design flow - Logic Design with MOSFETs : MOSFETs as Switches, Basic Logic Gates in CMOS, Complex Logic Gates in CMOS, Transmission Gate Circuits - CMOS Layers - Designing FET arrays - Electrical Characteristics of MOSFETs : nFET Current Voltage Equations, FET RC Model, pFET characteristics - n-well CMOS Fabrication and Layout Design Rules. **(9)**

CMOS LOGIC CIRCUIT DESIGN

DC and Switching Characteristics of CMOS inverter, Ring Oscillator - NAND and NOR Gates - Power Dissipation - Analysis of Complex Logic Gates - Gate Design for Transient Performance - Transmission Gates and Pass Transistors - Pseudo nMOS - Tristate Circuits - Clocked CMOS Circuits - Dynamic CMOS Logic Circuits - CMOS Clocking Styles - Clock Generation and Distribution. **(9)**

CMOS SUB SYSTEM DESIGN AND SPECIAL PURPOSE CIRCUITS

Bit Adder Circuits - Ripple Carry Adders - Carry Look Ahead Adders - Comparator- Unsigned Array Multiplier - Serial Division - Latches - D Flip flops - Registers - Synchronous and Asynchronous Counters - Special Purpose Circuits: Schmitt Trigger, Multivibrators, Digital Phase Locked Loops. **(9)**

MEMORIES, PROGRAMMABLE LOGIC DEVICES AND CMOS TESTING

Memory Elements: SRAM, DRAM, ROM - Programmable Logic Devices: CPLDs and FPGAs - Xilinx Architecture - Manufacturing Test Principles: Fault Models, Observability, Controllability, Fault Coverage, Automatic Test Pattern Generation (ATPG) - Design for Testability: Built in Self Test (BIST), IDDQ Testing - Boundary Scan Test. **(9)**

LOW POWER VLSI DESIGN

Need for low power VLSI chips - Charging and Discharging Capacitance - Short Circuit Current in CMOS Circuit - CMOS Leakage Current - Static Current - Basic Principles of Low Power Design - Low Power Techniques for SRAM - Adiabatic Logic Circuits. **(9)**

TOTAL : 45

TEXT BOOKS

1. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, 2009.
2. Neil H.E. Weste, David Harris and Ayan Banerjee "CMOS VLSI Design - A Circuits and Systems Perspective", Pearson Education, 3rd Edition, 2012.

REFERENCE BOOKS

1. Yeap, Gary, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, Boston, 2008.
2. Sung Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata Mc Graw Hill, 3rd Edition, 2008.
3. R. Jacob Baker, Harry W. Li, David E. Boyce "CMOS Circuit Design, Layout and Simulation", John Wiley & Sons, 3rd Edition, 2011.
4. Wayne Wolf, "Modern VLSI Design IP based design", Prentice Hall of India, 4th Edition, 2009.
5. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", Prentice Hall of India, 3rd Edition, 2007.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×	×	×	×	×	×
2	×		×		×				×	×	×	×	×	×
3	×		×		×				×	×	×	×	×	×
4	×		×		×				×	×	×	×	×	×
5	×		×		×				×	×	×	×	×	×

13EC86 - VLSI DESIGN LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to understand the front end and back end tools used in the design of VLSI circuits.*
- *to analyze, design and test the operation of complex logic circuits.*
- *to design, test and implement digital circuits using HDL.*
- *to interface peripheral boards with FPGAs.*
- *to understand 65/90nm technologies in the design of CMOS VLSI circuits*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of the front end and back end tools and communicate effectively the concepts used in the design of VLSI circuits.*

CO2 *: an ability to design, test and implement digital circuits using HDL*

CO3 *: an understanding to interface peripheral boards with FPGAs*

CO4 *: an understanding of 65/90nm technologies in the design of CMOS VLSI circuits*

CO5 *: an ability to work in teams to achieve goals*

LIST OF EXPERIMENTS

- HDL Modeling and Implementation using FPGA Kit
  - Multipliers
  - Filters
  - Digital Modulators and Demodulators
- Interfacing Peripheral Boards with FPGA Kit
  - Matrix Keypad
  - 32 bit I/O
  - Seven Segment Display
  - DC Motor
  - Stepper Motor
- Design of CMOS Circuits using 65nm/90nm Technology
  - CMOS Inverter/ NAND /NOR gate and Complex logic function
  - Ring Oscillator

- o Look Up Table
- o Multiplexer
- o RAM
- o Schmitt Trigger

TOTAL : 45

REFERENCES

1. VLSI Design Laboratory Manual prepared by ECE Department, CIT.
2. Andrzej Handkiewicz, "Mixed Signal Systems - A Guide to CMOS Circuit Design", Wiley India Pvt. Ltd., 2012.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×	×	×	×	×	×	×	×		×
2	×	×	×		×		×		×	×	×	×	×	×
3	×	×	×		×		×		×	×	×	×	×	×
4	×	×	×	×	×		×		×	×	×	×	×	×
5				×		×								

13EC87 - DATA NETWORKS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students to acquire ability

- *to test and measure parameters, plot characteristics as well as to analyze and interpret measured data for various protocols used in Layer-2 of a LAN networks.*
- *to simulate and study the operation of routing protocols in networks.*
- *to apply skills and tools to develop software / systems in the area of Computer Networks.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 : *be able to test and measure parameters, plot characteristics as well as to analyze and interpret measured data for protocols used in Layer-2 of a LAN network.*

CO2 : *be able to simulate and verify the operation of Routing protocols in networks.*

CO3 : *be able to develop basic software / systems in the areas of Computer Networks.*

CO4 : *be able to work in teams to achieve goals.*

CO5 : *have an ability to communicate effectively the concepts, principles and techniques.*

LIST OF EXPERIMENTS

- PC to PC communication:Parallel communication using 8-pin Parallel cable - Serial communication using RS-232.
- Implementation of the CSMA/CD protocol in Ethernet LAN
- Implementation of the Token Bus and Token Ring protocol in Ethernet LAN.
- Implementation of the CSMA/CA and CSMA/CD protocols in Wireless LAN.
- Implementation of Stop and Wait protocol.
- Implementation of Goback-N and Selective Repeat protocol.
- Simulationof Distance Vector Routing Algorithm, Shortest Path Algorithm, Least Cost Routing Algorithm and LinkState Routing Algorithm
- Implementation of Data Encryption and Decryption.
- Transfer of files from PC to PC using Windows/Unix Socket programming.
- Simulation of WLAN, MANET and WSN

TOTAL : 45

REFERENCES

1. "Network Lab manual" by ECE department, CIT, Coimbatore.
2. William Stallings, "Data and Computer Communications', 8th Edition, Pearson Education, 2007.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×	×	×	×		×	×	×	×	×
2	×	×	×	×	×	×	×	×		×	×	×	×	×
3	×	×	×	×	×	×	×	×	×	×	×	×	×	×
4		×	×	×	×	×	×	×	×		×	×	×	×
5	×	×	×		×		×	×	×		×	×	×	×

13EC88 - PROJECT AND VIVAVOCE

L	T	P	C
0	0	6	6

ASSESSMENT : PRACTICAL

COURSE OBJECTIVES

This course will enable the students

- *to identify, formulate, analyze and solve design problems in electronics and communication engineering and thereby enabling them to develop confidence for R&D activities.*
- *to explore engineering solutions for solving real time problems relevant to contemporary issues within realistic constraints and engage in lifelong learning.*
- *to develop an ability to work in teams and acquire skills that will be needed for professional success in industry, institutions and organizations*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an ability to identify, formulate and solve engineering problems in electronics and communication engineering and thereby enabling them to develop confidence for R&D activities..*

CO2 : *an ability to explore engineering solutions for solving real time problems relevant to contemporary issues within realistic constraints and engage in lifelong learning.*

CO3 : *an ability to function on teams and acquire skills that will be needed for professional success in industry, institutions and organizations.*

CO4 : *an ability to apply skills and tools to model and develop hardware and/or complex software systems.*

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×	×	×	×	×	×	×	×	×	×
2	×	×	×	×	×	×	×	×	×	×	×	×	×	×
3	×	×	×	×	×	×	×	×	×	×	×	×	×	×
4	×	×	×	×	×	×	×	×	×	×	×	×	×	×

13ECE01 - ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to analyze in discrete random signal processing*
- *to analyze and solve problems in parametric methods for power spectrum estimation.*
- *to acquire knowledge and understanding of linear estimation and prediction*
- *to understand about adaptive filters and wavelet transforms.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an ability to analyze and solve problems in discrete random signal processing.*

CO2 : *an ability to analyze and solve problems in parametric methods for power spectrum estimation.*

CO3 : *an in-depth understanding of linear estimation and prediction.*

CO4 : *an understanding of adaptive filters and wavelet transforms.*

DISCRETE RANDOM SIGNAL PROCESSING

Discrete Random Processes - Ensemble averages, Stationary processes, Autocorrelation and Autocovariance matrices - Parseval's Theorem - Wiener-Khintchine Theorem - Power Spectrum, Spectral Factorization, Filtering random processes - Low Pass Filtering of White Noise. **(9)**

SPECTRUM ESTIMATION

Estimation of spectra from finite duration signals, Non-Parametric Methods - Correlation Method - Periodogram Estimator, Performance Analysis of Estimators - Unbiased, Consistent Estimators - Modified Periodogram, Bartlett and Welch methods, Blackman-Tukey method - Parametric Methods - AR, MA, and ARMA model based spectral estimation - Frequency Estimation - Yule-Walker equations, solutions using Durbin's algorithm. **(9)**

LINEAR ESTIMATION AND PREDICTION

Linear prediction - Forward and backward predictions - Solutions of the Normal equations - Levinson - Durbin algorithms - Least Mean Squared error criterion - Wiener filter for filtering and prediction - FIR Wiener FIR filter and Wiener IIR filter - Discrete Kalman filter. **(9)**

ADAPTIVE FILTERS

FIR adaptive filters - adaptive filter based on steepest descent method - Windrow Hoff LMS adaptive algorithm, Normalized LMS - Adaptive channel equalization - Adaptive echo cancellation - Adaptive noise cancellation - Adaptive recursive filters (IIR) - RLS adaptive filters - Exponentially weighted RLS - sliding window RLS **(9)**

WAVELET TRANSFORMS

Fourier Transform: Power and Limitations - Short Time Fourier transform - Gabor Transform - Discrete Time Transform and Filter Banks - Continuous Wavelet Transform - Wavelet Transform Ideal Case - Perfect Reconstruction Filter Banks and Wavelets - Recursive multi-resolution decomposition - Haar wavelet - Daubechies wavelet. **(9)**

TOTAL : 45

TEXT BOOKS

1. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., Singapore, 2009.
2. K.P.Soman, K.I.Ramachandran and N.G.Resmi, " Insight into wavelets from Theory to Practice, 3rd Edition, PHI Learning Private limited, 2010.

REFERENCE BOOKS

1. N.J.Fliege, "Mulitrate Digital Signal Processing", John Wiley, 2000.
2. John G.Proakis et.al, "Algorithms for Statistical Signal Processing", Pearson Education, 2003.
3. Dimitris G.Manolakis et.al, "Statistical and Adaptive Signal Processing", McGraw Hill, Newyork, 2000.
4. T.Adali and Simon Haykin, "Adaptive Signal Processing - Next Generation Solutions", Wiley India Pvt. Ltd., 2010.
5. Ali H. Sayed, "Fundamentals of Adaptive Filtering", John Wiley & Sons, 2003.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	×
2	×	×	×		×			×	×	×	×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13ECE02 - MULTIRATE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to know about Sampling rate conversion, Multirate operations in time domain and frequency domain analysis*
- *to know about basics of QMF filters, their characteristics, implementation methods and acquire an ability to design of an alias free QMF bank*
- *to understand the effects of uniform M-channel filter banks and filter banks with polyphase structures*
- *to acquire knowledge on Applications of Multirate signal processing*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of Sampling rate conversion, Multirate operations in time domain and frequency domain analysis*

CO2 : *knowledge about QMF filters, their characteristics, implementation methods and acquire an ability to design of an alias free QMF bank*

CO3 : *an understanding of the effects of uniform m-channel filter banks and filter banks with polyphase structures*

CO4 : *an in-depth understanding of concepts of Multirate signal processing*

SAMPLING RATE CONVERSION

Multirate System Fundamentals : Sampling theorem - Sub-Nyquist sampling; Basic Multirate operations - up sampling and down sampling - time domain and frequency domain analysis - Identities of Multirate operations; Interpolator and decimator design - Rate conversion - uniform DFT filter bank, decimated uniform DFT filter bank. **(9)**

QUADRATURE MIRROR FILTER BANKS

Multirate Filter Banks: Maximally decimated filter banks - Quadrature mirror filter (QMF) banks - Polyphase representation, Errors in the QMF - Aliasing and imaging - Methods of cancelling aliasing error, Amplitude and phase distortions; Filter bank with Perfect reconstruction - PR condition - Design of an alias free QMF bank **(9)**

UNIFORM M-CHANNEL FILTER BANKS

Filter banks with tree structure - Filter banks with parallel structure - Complex modulated Filter banks - Cosine - Modulated filterbanks -Transmultiplexer Filterbanks. **(8)**

FILTER BANKS WITH POLYPHASE STRUCTURES

Polyphase structures: Fundamentals of Polyphase structures - Polyphase QMF Banks - Polyphase filter Banks - General Two channel and M channel - Paraunitary and DFT polyphase Filter banks **(9)**

APPLICATIONS

FSK modems, Orthogonal Multiple Carrier (OMC) data transmission, Digital Audio broadcasting(DAB), Digital Audio Mixing Consoles, Asynchronous conversion of sampling rates, simulation of room acoustics using wavelets, speech and audio coding, Image and Video coding and Multirate Techniques with Sensors. **(10)**

TOTAL : 45

TEXT BOOKS

1. N.J.Fliege, "Multirate Digital Signal Processing", John Wiley, 2000.
2. P. P. Vaidyanathan, “Multirate Systems and Filter Banks”, Prentice Hall, PTR, 1993.

REFERENCE BOOKS

1. Sanjit K. Mitra, “Digital Signal Processing: A Computer based Approach”, 3rd Edition,McGraw Hill, 2001.
2. R.E. Crochiere, L.R. Rabiner, “Multirate Digital Signal Processing”, Prentice Hall Inc, 1983.
3. Fredric J Harris, “Multirate signal Processing For Communication Systems”, 1st Edition, Pearson Education
4. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications” 3rd Edn. Prentice Hall India, 1999.
5. Bruce W.Suter, " Multirate and Wavelet Signal Processing ", Academic Press Ltd.,1998

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×	×	×	×	×	×

13ECE03 - WIRELESS NETWORKS AND STANDRARDS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge about cellular wireless networks*
- *to know in detail about wireless systems operations and standards*
- *to learn about the concepts of Mobile IP and wireless application protocol*
- *to gain knowledge about Wireless LANs and WPAN*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *knowledge about cellular wireless networks*

CO2 : *an in depth understanding of wireless systems operations and standards*

CO3 : *an understanding of the concepts of Mobile IP and wireless application protocol*

CO4 : *an understanding about the Wireless LANs and WPAN*

CELLULAR WIRELESS NETWORKS

First Generation - Second Generation TDMA - Second Generation CDMA - Third Generation systems - GSM architecture - EDGE architecture - UMTS network architecture. **(9)**

WIRELESS SYSTEM OPERATIONS AND STANDARDS

Cordless systems : Time Division Duplex, DECT Operation, ADPCM- Wireless Local Loop : The Role of WLL, Propagation Considerations for WLL, OFDM , MMDS, LMDS - WiMAX and IEEE 802.16 Broadband Wireless Access Standards : IEEE 802.16 Architecture, Services, IEEE 802.16 MAC Layer, IEEE 802.16 Physical Layer, IEEE 802.16a-Long-Term Evolution : System Architecture, Transmission Techniques, Channels in the radio interface, Radio Resource Management. **(9)**

MOBILE IP AND WIRELESS APPLICATION PROTOCOL

Mobile IP : Operation of Mobile IP, Discovery : Agent Solicitation , Move Detection ,Co-located addresses - Registration : Securing the Registration Procedure -Tunneling : IP-within-IP Encapsulation, Minimal Encapsulation -Wireless Application Protocol : Architectural Overview, Wireless Markup Language, WML Script, Wireless Application Environment, Wireless Session Protocol, Wireless Transaction Protocol, Wireless Transport Layer Security, Wireless Datagram Protocol. **(9)**

WIRELESS LANS

Introduction - Infrared LANs : Strengths and Weakness, Transmission techniques - Spread Spectrum LANs : Configuration, Transmission issues - Narrowband Microwave LANs : Licensed Narrow Band RF, unlicensed narrowband RF - IEEE 802 Architecture - IEEE 802.11 Architecture and services : Wi-Fi alliance, IEEE 802.11 Architecture, IEEE 802.11 Services- IEEE 802.11 Medium Access Control : Reliable Data Delivery,Medium Access Control, MAC Frame - IEEE 802.11a/b/g Physical Layer - IEEE 802.11c/d/e/h/i/k/m/n. **(9)**

WPAN

Introduction - Radio Specification - Baseband and Specification - Link Manager Specification - Logical Link Control and Adaptation Protocol - IEEE 802.15: IEEE 802.15.3/a, IEEE 802.15.4 - UWB - Optical Wireless Wavelength division Multiplexing (OWWDM). **(9)**

TOTAL : 45

TEXT BOOK

1. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2nd Edition 2009.

REFERENCE BOOKS

1. Kaveh Pahlavan & Prashant Krishnamurthy, "Principles of Wireless networks - A unified Approach", Prentice Hall, 2002.
2. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kauffmann Publishers, 2007.
3. Dharma Prakash Agarwal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India, 3rd edition, 2011.
4. Clint Smith, P.E.& Daniel Collins, "3G Wireless Networks", Tata McGraw Hill, 2nd Edition, 2007.
5. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press, 2005.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×					×	×	×	×	×	×	×
2	×		×					×	×	×	×	×	×	×
3	×		×					×	×	×	×	×	×	×
4	×		×					×	×	×	×	×	×	×

13ECE04 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge in fundamentals of Wireless Sensor Network and its applications*
- *to understand the concepts of Physical layer*
- *to acquire knowledge about various protocols used in Data Link and Network layers*
- *to understand the basic concepts of security for Wireless Sensor Network*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of fundamentals of Wireless Sensor Network and its applications.*

CO2 *: an in-depth understanding of Physical layer*

CO3 *: knowledge about various protocols used in Data Link and Network layers*

CO4 *: an understanding of concepts of security for Wireless Sensor Network.*

INTRODUCTION

Single node architecture - Hardware components - Energy consumption of sensor nodes - Network architecture - Sensor network scenarios - Types of sources and sinks - Single-hop versus Multi-hop networks - Multiple Sinks and Sources - Design principles - Development of Wireless Sensor Networks. Home control - Building automation - Industrial automation - Medical applications - Highway monitoring - Military applications - Civil and Environmental engineering applications - Wildfire instrumentation - Habitat monitoring - Nanoscopic sensor applications. **(9)**

PHYSICAL LAYER

Wireless channel and communication fundamentals - Frequency allocation - Modulation and Demodulation - Wave propagation effects and noise - Channels models - Spread Spectrum Communication - Packet transmission and Synchronization - Quality of Wireless channels and Measures for improvement - Physical layer and Transceiver design consideration in Wireless Sensor Networks - Energy usage profile - Choice of Modulation - Power Management. **(9)**

DATA LINK LAYER

MAC protocols - Fundamentals of wireless MAC protocols - Low Duty cycle protocols and Wakeup concepts - Contention-Based protocols - Schedule-based protocols - Link Layer protocols - Fundamentals task and requirements - Error control - Framing - Link management. **(9)**

NETWORK LAYER

Gossiping and Agent-based Unicast forwarding - Energy-efficient Unicast - Broadcast and Multicast - Geographic routing - Mobile nodes - Data-centric and Content-based networking -Data-centric Routing - Data aggregation - Data-centric storage - Higher layer design issues. **(9)**

SECURITY

Fundamentals of network security - Challenges of security in wireless sensor networks - Security attacks in sensor networks: Denial-of-service, Attacks on Routing, Transport layer, Data Aggregation, Privacy attacks - Protocols and mechanisms for security: Symmetric and public key cryptography, key management, Defenses against DoS attacks, Aggregation attacks, Routing attacks - Security protocol for sensor networks.

IEEE 802.15.4 low rate WPAN - Sensor Network Platforms and tools - Sensor node hardware - Node-level software platforms - Node level simulators. **(9)**

TOTAL : 45

TEXT BOOKS

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: An Information Processing Approach", Elsevier Publication, 2004.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley & Sons, INC publication, 2007.

REFERENCE BOOKS

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", John Wiley publication, 2010.
2. C.S.Raghavendra Krishna, M.Sivalingam and Taieb Znati, "Wireless Sensor Networks", Springer publication, 2006.
3. Edgar H .Callaway, "Wireless Sensor Networks: Architecture and Protocol", CRC press, 1st Edition, 2004.
4. Holger Karl, Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley publication, 2005.
5. Sudip Misra, Subhas Chandra Misra, Isaac Woungang, "Guide to Wireless Sensor Networks", Springer, 2009.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×					×	×	×	×	×	×	×
2	×		×					×	×	×	×	×	×	×
3	×		×					×	×	×	×	×	×	×
4	×		×					×	×	×	×	×	×	×

13ECE05 - LINEAR ALGEBRA AND NUMERICAL METHODS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge and understanding of linear algebra and numerical methods.*
- *to acquire an in-depth understanding of orthogonality and eigen vectors.*
- *to know in detail about interpolation and differentiation.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 *: acquire knowledge and understanding of linear algebra and numerical methods.*

CO2 *: acquire an in-depth understanding of orthogonality and eigen vectors.*

CO3 *: know in detail about interpolation and differentiation.*

LINEAR ALGEBRA

Vector spaces-Subspaces-Linear combinations and subspaces spanned by a set of vectors-Linear dependence and Linear independence-Spanning Set and Basis-Finite dimensional spaces-Null Space and Range-Rank and nullity-Consistency conditions in terms of rank-Elementary Row and Column operations-Row Reduced Form- Determinants, cofactors, adjoint, Cramer's Rule. **(9)**

ORTHOGONALITY

Inner product-Inner product Spaces-Cauchy - Schwarz inequality-Norm-Orthogonality-Gram - Schmidt orthonormalization-Orthonormal basis-Expansion in terms of orthonormal basis - Fourier series-Orthogonal complement **(9)**

EIGENVALUES AND EIGENVECTORS

Diagonalization criterion- diagonalizing matrix-Cayley-Hamilton theorem, -Diagonalizability and Minimal polynomial-Projections-Properties of eigenvalues and eigenvectors.Singular Values-Singular Value Decomposition **(9)**

INTERPOLATION AND APPROXIMATION

Lagrangian polynomials - Divided Differences - Interpolating with a cubic spline - Newton's forward and back ward difference formulas.

Numerical Differentiation And Integration:Derivative from Difference table - Divided Differences and finite differences - Numerical integration by Trapezoidal, Simpson's 1/3 and 3/8 rules **(9)**

DIFFERENTIAL EQUATIONS

Single step Methods - Taylor series method-Euler and Modified Euler method - Fourth order Runge Kutta method for solving first and second order equations -Finite difference solution to second order ordinary

differential equation - finite difference Solution to one dimensional heat equation by explicit and implicit methods- one dimensional Wave equation and two dimensional Laplace and poisson equation. **(9)**

TEXT BOOKS

1. Stephen H Friedberg, Arnold J Insel and Lawrence Spence, "Linear Algebra", Prentice Hall of India, New Delhi, 2004.
2. J.D.Faires, Richard Burden, "Numerical Methods" Brooks/Cole (Thomson Publications) ,1998.

REFERENCE BOOKS

1. S.Kumaresan, "Linear Algebra - A geometric approach", Prentice - Hall of India,New Delhi, 2000
2. G.Strang, "Linear Algebra and its applications", Thomson (Books/Cole), 2003.
3. S.Lipschutz "Theory and Problems of Linear Algebra", Schaum's outline series,McGraw Hill, 2004.
4. David C Lay, "Linear Algebra and its Applications", Pearson Education Asia, New Delhi, 2003.
5. Seymour Lipschutz and Marc Lipson, "Schaum's Outline of Linear Algebra", McGraw Hill Trade; New Delhi, Third Edition, 2000.
6. Howard A Anton "Elementary Linear Algebra", John Wiley & Sons, Singapore, Eighth Edition 2000.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×			×	×				×	×	×		×	
2	×			×	×				×	×	×		×	
3	×		×	×	×			×	×	×	×		×	

13ECE06 - WAVELET TRANSFORMS AND APPLICATIONS

L	T	P	C
4	0	0	4

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on the basic concepts of wavelets and Continuous Wavelet Transform.*
- *to gain knowledge on the Discrete Wavelet Transform and Wavelet Decomposition.*
- *to acquire knowledge about MRA, orthogonal wavelets, and their relationship to their filter bank.*
- *to know about the different types of Wavelets.*
- *to gain knowledge on the applications of Wavelets in audio and Image Processing.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of the basic concepts of wavelets and Continuous Wavelet Transform.*

CO2 : *an in-depth understanding of the Discrete Wavelet Transform and Wavelet Decomposition.*

CO3 : *knowledge in the MRA, orthogonal wavelets, and their relationship to their filter bank.*

CO4 : *an understanding of the different types of Wavelets.*

CO5 : *knowledge of the applications of Wavelets in audio and Image Processing.*

MATHEMATICAL PRELIMINARIES

Hilbert Spaces- Vector Spaces and Inner Products- Complete Inner Product Spaces ,Orthonormal Bases, General Bases, Overcomplete Expansions- Elements of Linear Algebra, Basic Definitions and Properties ,Linear Systems of Equations and Least Squares, Eigenvectors and Eigenvalues, UnitaryMatrices, SpecialMatrices- Elements of Linear Algebra, Polynomial Matrices - Overview of Fourier Theory and Sampling- Fourier Transform, Fourier Series, Sampling, Discrete-Time Fourier Transform, Discrete-Time Fourier Series. **(8)**

WAVELETS AND TIME- FREQUENCY DOMAIN

Time- frequency representations- frequency, scale and resolution- uncertainity principle- Continuous wavelet transforms- continuous Short Term Fourier Transform- Frames of wavelet and STFT- Block transform- Block Bases, Cosine Bases, Discrete Cosine Bases, Fast Discrete CosineTransforms- Local CosineTrees, BinaryTree of Cosine Bases, Tree of Discrete Bases, Image Cosine Quad-Tree. **(9)**

DISCRETE WAVELET TRANSFORM

Haar scaling functions and function spaces- Nested spaces- Haar wavelet function- Orthogonality of Ø(t) and Ø(t)- Normalization of Haar bases at different scales- Triangular scaling function- Daubechies wavelets- Orthogonal Wavelet systems- Refinement relation- Restriction on Filter coefficients- Designing Daubechies orthogonal wavelet system coefficients. **(9)**

DESIGN OF WAVELETS AND FILTER BANKS

Wavelet Bases and Filter Banks- Orthogonal Wavelet Bases- Classes of wavelet bases- Classes of Bi-orthogonal Wavelet bases- Two channel filter banks- Multichannel filter banks- Multidimensional filter banks- Design of wavelets in frequency domain: Basic properties of filter coefficients-choice of wavelet function coefficients-vanishing moment conditions in fourier domain- Derivation of Daubechies wavelets. **(10)**

APPLICATIONS

Signal Processing: Image processing: Edge detection- Object isolation- Image fusion-texture classification-finger prints- Image compression- EZW algorithm- Audio Compression- Audio Masking- Denoising- Speech Recognition- speech enhancement- Control Applications: Motion detection and tracking-Robot positioning **(9)**

TEXT BOOKS

1. K.P.Soman, K.I.Ramamchandran,N.G.Resmi, "Insight into wavelets", 3rd edition,PHI,2010.
2. M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding," Prentice Hall, 1995.

REFERENCE BOOKS

1. Stephane G. Mallat, "A Wavelet Tour of Signal Processing", Academic Press, 2nd edition, 1999.
2. Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms: Introduction to Theory & Applications", Pearson Education Asia, New Delhi, 2003.
3. Rao R.M., Bopardikar A.S., "Wavelet Transforms-Introduction to Theory and Applications", Pearson Education, 2009
4. Jaideva C. Goswami, Andrew K.Chan, "Fundamentals of Wavelets - Theory, Algorithms and Applications", John Wiley & Sons, Inc., Singapore, 2006.
5. C.Sidney Burrus, Ramesh ,A. Gopinath, Haitao Guo, "Introduction to Wavelets and Wavelet Transforms", Prentice Hall, New Delhi, 1st Edition, 1998.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×	×	×			×	×	×	×	×	×	×
2	×	×		×	×				×	×	×	×	×	×
3	×				×		×		×	×	×	×	×	
4	×	×		×	×	×	×	×	×	×	×	×	×	×
5	×	×	×			×	×		×	×	×	×	×	×

13ECE07 - ADVANCED PROCESSOR ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge about parallel processing and principles of pipelining.*
- *to understand the structures and algorithms for array processors and multiprocessors.*
- *to acquire knowledge about architecture, instruction set and programming concepts of TMS320C67xx Processors*
- *to program the DSP processors in real time applications.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of parallel processing and principles of pipelining.*

CO2 : *an understanding of structures and algorithms for array processors and multiprocessors.*

CO3 : *an in-depth understanding of architecture, instruction set and programming concepts of TMS320C67xx Processors.*

CO4 : *an ability to develop software using DSP processor for real time applications.*

PARALLEL PROCESSING, MEMORY AND INPUT-OUTPUT SUBSYSTEMS

Trends towards Parallel Processing - Parallel Computer Structures - Architectural Classification Schemes - Parallel Processing Applications - Hierarchical Memory Structure - Virtual Memory System - Cache Memories - Input-Output Subsystems. **(9)**

PRINCIPLES OF PIPELINING AND VECTOR PROCESSING

Principles of Linear Pipelining- Classification of Pipeline Processors - General Pipelines and Reservation Tables- Interleaved Memory Organizations - Principles of Designing Pipelined Processors- Characteristics of Vector Processing - Pipelined Vector Processing Methods - Architecture of Cray-I Vector Processor. **(9)**

STRUCTURES AND ALGORITHMS FOR ARRAY PROCESSORS

SIMD Array Processors: SIMD Computer Organization - Making the Data Routing Mechanism. SIMD Interconnection Networks: Static Vs Dynamic Networks - Mesh-Connected Illiac Network - Cube Interconnection Networks - Barrel Shifter and Data Manipulator - Parallel Algorithms for Array Processors: SIMD Matrix Multiplication - Parallel Storing on Array Processors and SIMD Fast Fourier Transform. **(9)**

MULTIPROCESSOR ARCHITECTURE, PROGRAMMING, CONTROL AND ALGORITHMS

Loosely Coupled Multiprocessors - Tightly Coupled Multiprocessors-Processor Characteristics for Multiprocessing. Interconnection Networks: Time shared or Common Buses - Crossbar Switch and Multiport Memories - Inter-process Communication Mechanisms: Process Synchronization Mechanisms - Synchronization with Semaphores - Conditional Critical Sections and Monitors - System Deadlocks and Protection - Deadlock Prevention and Avoidance - Deadlock Detection and Recovery and Protection Schemes. **(9)**

MSP430 MICROCONTROLLER AND TMS320C6xxx DSP PROCESSOR

Introduction - MSP 430 Architecture - Features - Digital I/O: Input Registers - Output Registers - Direction Registers - Pull Up and Pull Down Enable Registers - Function Select Registers - Configuring Unused Port Pins Digital I/O Registers. TMS320C6000 Family Overview - Typical Applications - TMS320C67xx DSP Processor Features - Architecture - CPU Data Paths - Functional Units - On-chip Peripherals: DMA - EDMA - HPI - McBSP and Timers. **(9)**

TOTAL : 45

TEXT BOOKS

1. Kai Hwang and Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill Publications, 1st Edition, 2012.
2. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming & Applications", Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2011.

REFERENCE BOOKS

1. "MSP430X2xx Family User's Guide", Texas Instruments.
2. SPRU197d.pdf (TMS320C6000 Technical Brief), Texas Instruments.
3. SPRU733A.pdf (TMS320C67xx DSP CPU and Instruction Set Reference Guide, Texas Instruments.

WEB REFERENCE

www.ti.com

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×		×	×	×	×
2	×	×	×		×			×	×		×	×	×	×
3	×	×			×			×	×	×	×	×		×
4	×		×		×			×	×	×	×	×		×

13ECE08 - ADVANCED EMBEDDED SYSTEM DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to gain knowledge about embedded system design life cycle, hardware and software.*
- *to acquire in-depth knowledge about concepts, skills and tools required to develop embedded systems*
- *to acquire an in-depth knowledge about sub-systems, peripherals and interfaces of real time systems.*
- *to understand the programming concepts in designing an embedded system for widely used real time applications including wireless communication protocols.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: knowledge of embedded system design life cycle, its hardware and software.*

CO2 *: in-depth knowledge of concepts, skills and tools required to develop embedded systems*

CO3 *: an in-depth understanding of sub-systems, peripherals and interfaces of real time systems.*

CO4 *: an understanding of programming concepts used in designing embedded systems for widely used real-time applications including wireless communication protocols.*

PRINCIPLES OF EMBEDDED SYSTEM

Overview of Embedded system Architecture - Categories of Embedded Systems - Applications of Embedded System - Embedded Design Life Cycle: Product Specification, Hardware/Software Partitioning, Iteration and Implementation, Detailed Hardware and Software Design, Hardware Software Integration, Product Testing and Release, Maintaining and Upgrading Existing products. **(9)**

SPECIAL SOFTWARE TECHNIQUES

Manipulating the Hardware - Interrupts and Interrupt Service Routine - Watch dog timer - Flash memory - Host-based debugging - ROM Emulators- Remote Debuggers and Debug Kernels- In-Circuit Emulators - Logic analyzer - BDM, JTAG and Nexus. **(9)**

REAL TIME SYSTEM CONCEPTS

Foreground / Background systems - Critical section of code - Resource - Shared Resource - Multitasking- task - Context switch - Kernal - Scheduler - Non-preemptive Kernels - Preemptive Kernels - Reentrancy - Reentrant Functions - Round Robin Scheduling - Task Priorities - Static Priorities - Mutual Exclusion - Deadlock - Intertask Communication - Message Mailboxes - Message Queues - Interrupts - Task Management - Memory Management - Time Management - Clock Ticks - Advantages and disadvantages of real time kernel. **(10)**

INPUT-OUTPUT DEVICES

Keyboard basics - Matrix Keyboard scanning algorithm - Multiplexed LED displays - Character LCD modules - LCD module display - Configuration - Time-of-day clock - Timer manager - Interrupts - Interrupt

service routines - IRQ - ISR - Interrupt vector or dispatch table multiple-point - Interrupt-driven Pulse Width Modulation. **(8)**

APPLICATIONS

Wireless communication Protocols: Zigbee Protocols, Blue tooth Protocols, IrDA. Case Study of Programming with RTOS: Coding for Elevator Controller, Data Compressor, Software Modem, Alarm Clock, Telephone PBX, Inkjet printer, Personal Digital Assistants, Set-Top-Box, System-on-Silicon. **(9)**

TOTAL : 45

TEXT BOOKS

1. Arnold Berger, "Embedded System Design: An Introduction to Processes, Tools, and Techniques", CMP Books, 1st Edition, 2002.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", CMP books, 2nd Edition, 2000.

REFERENCE BOOKS

1. Wayne Wolf, "Computers as Components" Morgan Kaufmann Publishers, 2nd Edition, 2008.
2. David E Simon, "An Embedded Software Primer", Pearson Education Asia, 7th Edition, 2009.
3. Rajkamal, "Embedded Systems: Architecture, Programming and Design", 2nd Edition, Tata McGraw-Hill, 2008.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	×
2	×		×		×			×	×	×	×	×	×	×
3	×		×		×			×	×	×		×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13ECE09 - VERILOG HDL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of digital design with Verilog HDL.*
- *to understand the gate level, data flow, behavioural and switch level modeling techniques used in designing VLSI circuits using Verilog HDL.*
- *to acquire knowledge on tasks and functions used in Verilog HDL.*
- *to develop soft skills in designing VLSI sub systems using Verilog HDL.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the basics of digital design with Verilog HDL.*

CO2 : *an understanding of the gate level, data flow, behavioural and switch level modeling techniques used in designing VLSI circuits using Verilog HDL.*

CO3 : *knowledge on tasks and functions used in Verilog HDL.*

CO4 : *ability to design and develop VLSI sub systems using Verilog HDL*

OVERVIEW OF DIGITAL DESIGN WITH VERILOG HDL

Evolution of Computer Aided Digital Design and Emergence of HDLs - Typical Design flow - Importance of HDLs - Popularity of Verilog HDL - Hierarchical Modeling Concepts : Design Methodologies - 4 bit Ripple Carry Counter - Modules - Instances - Components of a Simulation. **(9)**

GATE LEVEL MODELING

Basic Concepts: Lexical Conventions - Data types - System Tasks and Compiler - Modules - Ports - Gate Types: AND Gate, OR Gate, Buffer, Not Gate - Multiplexer - 4 bit Full Adder - Gate Delays: Rise, Fall, Turn off Delays, Minimum, Typical, Maximum Delays - Delay Examples. **(9)**

DATA FLOW MODELING

Continuous Assignments: Implicit Continuous Assignment - Delays: Regular Assignment Delay, Implicit Continuous Assignment Delay, Net Declaration Delay - Expressions, Operators and Operands - Operator Types - Operator Precedence - 4 to1 Multiplexer - 4 bit Full Adder - Ripple Counter. **(9)**

BEHAVIOURAL MODELING

Structured Procedures - Procedural Assignments - Timing Controls - Conditional Statements - Multiway Branching - Loops - Sequential and Parallel Blocks - 4 to 1 Multiplexer - 4 bit Counters - Traffic Signal Controller. **(9)**

TASKS, FUNCTIONS AND SWITCH LEVEL MODELING

Tasks - Functions - Differences between Tasks and Functions - Switch Level Modeling: Switch Level Modeling Elements - MOS Switches - CMOS Switches - Bidirectional Switches - Power and Ground -

Resistive Switches - Delay Specification on Switches - CMOS NOR gate - 2 to 1 Multiplexer - Simple CMOS Flip Flop. **(9)**

TOTAL : 45

TEXT BOOK

1. Samir Palnitkar "VERILOG HDL - A Guide to Digital Design and Synthesis", Pearson Education, 2nd Edition, 2011

REFERENCE BOOKS

1. Stephen D. M. Brown, Zvonko G. Vranesic," Fundamentals of Digital Logic with Verilog Design", McGraw Hill Higher Education, 2nd Edition, 2008
2. T.R. Padmanabhan, B.Bala Tripura Sundari," Design Through Verilog HDL", John Wiley & Sons, 2009
3. Vivek Sagdeo,"The Complete Verilog Book", Kluwer Academic Publishers, 2002
4. Nazeih M. Botros, "HDL Programming VHDL and Verilog", Thomson Delmar Learning, 2009
5. Donald Thomas, Philip Moorby, "The Verilog Hardware Description Language", Springer Science, 5th Edition, 2008

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13ECE10 - VLSI SIGNAL PROCESSING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on the fundamentals of DSP algorithms, iteration bound, pipelining and parallel processing.*
- *to know about retiming, unfolding and systolic architecture design.*
- *to identify, analyze and solve problems in fast convolution and algorithmic strength reduction in FIR filters.*
- *to gain knowledge on pipelining and parallel processing for IIR filters.*
- *to acquire knowledge and understanding of round off noise and numerical strength reduction*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *knowledge on the fundamentals of DSP algorithms, iteration bound, pipelining and parallel processing.*

CO2 : *an in-depth understanding of retiming, unfolding and systolic architecture design.*

CO3 : *an ability to identify and solve problems in fast convolution and algorithmic strength reduction in FIR filters.*

CO4 : *an understanding on pipelining and parallel processing for IIR filters.*

CO5 : *an understanding of round off noise and numerical strength reduction.*

DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING

Introduction To DSP Systems -Typical DSP Algorithms; Iteration Bound - Data Flow Graph Representations, Loop Bound and Iteration Bound, Algorithms for Computing Iteration Bound; Pipelining and Parallel Processing: Introduction - Pipelining of FIR Digital Filters - Parallel Processing - Pipelining and Parallel Processing for Low Power. **(9)**

RETIMING, UNFOLDING AND SYSTOLIC ARCHITECTURE DESIGN

Retiming - Definitions and Properties, Solving Systems of Inequalities; Unfolding - An Algorithm for Unfolding, Properties of Unfolding; Folding- Folding Transformation-Systolic Architecture Design: Introduction - Systolic Array Design Methodology - FIR Systolic Arrays - Selection of Scheduling Vector - Matrix Multiplication and 2D Systolic Array Design - Systolic Design for Space Representations Containing Delays. **(9)**

FAST CONVOLUTION AND ALGORITHMIC STRENGTH REDUCTION

Introduction - CookToom Algorithm - Winogard Algorithm - Iterated Convolution - Cyclic Convolution - Design of Fast Convolution Algorithm by Inspection- Algorithmic Strength Reduction in Filters and

Transforms: 2-Parallel FIR Filter, 2-Parallel Fast FIR Filter, DCT Algorithm Architecture, Parallel Architectures for Rank-Order Filters, Odd- Even Merge- Sort Architecture, Parallel Rank-Order Filters. **(9)**

PIELINED AND PARALLEL RECURSIVE

Pipeline Interleaving in Digital Filters - Look Ahead Pipelining for First Order IIR Filters, Look Ahead Pipelining with Power of Two Decomposition, Clustered Look Ahead Pipelining - Parallel Processing for IIR Filters, Combined Pipelining and Parallel Processing for IIR Filters. **(9)**

ROUNDOFF NOISE AND NUMERICAL STRENGTH REDUCTION

Scaling and Roundoff Noise: Scaling Operation, Roundoff Noise, State Variable Description of Digital Filters, Scaling and Roundoff Noise Computation, Roundoff Noise in Pipelined First-Order Filters; Numerical Strength Reduction: Sub-Expression Elimination, Multiple Constant Multiplications **(9)**

TOTAL : 45

TEXT BOOK

1. Keshab K.Parhi, "VLSI Digital Signal Processing Systems: Design and Implementation", Wiley India, 2011.

REFERENCE BOOKS

1. Randall L. Geiger, Phillip E. Allen and Noel R. Strader, "VLSI Design Techniques for Analog and Digital Circuits", Tata McGraw-Hill, New York, 2010.
2. U. Meyer- Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, 3rd Edition, 2007.
3. Mohammed Isamail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 2001.
4. S. Y. Kung, H. J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1998.
5. Jose E. Franca, Yannis Tsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×							×	×	×	×	×	×	×
2	×		×					×	×	×	×	×	×	×
3	×		×		×			×	×	×	×	×	×	×
4	×		×					×	×	×	×	×	×	×
5	×		×					×	×	×	×	×	×	×

13ECE11 - TESTING OF VLSI CIRCUITS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of functional modeling and simulation of digital VLSI circuits.*
- *to understand fault models and fault simulation techniques for combinational circuits.*
- *to acquire knowledge on functional testing with and without fault models.*
- *to know about various designs for testing VLSI circuits.*
- *to acquire knowledge on built in self test and fault diagnosis in VLSI circuits.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of the basics of functional modeling and simulation of digital VLSI circuits.*

CO2 *: an understanding of the fault models and fault simulation techniques for combinational circuits.*

CO3 *: knowledge on functional testing with and without fault models.*

CO4 *: knowledge about various designs for testing VLSI circuits.*

CO5 *: knowledge on built in self test and fault diagnosis in VLSI circuits.*

FUNCTIONAL MODELING AND LOGIC SIMULATION

Functional Modeling at the Logic Level - Functional Modeling at the Register Level - Structural Models - Types of Simulation - Delay Models - Hazard Detection - Gate Level Event Driven Simulation. **(9)**

FAULT MODELING AND SIMULATION

Logical Fault Models - Fault Detection and Redundancy - Fault Equivalence and Fault Location - Fault Dominance - Single Stuck and Multiple Stuck Fault Model - Serial and Parallel Fault Simulation - Deductive and Concurrent Fault Simulation - Fault Simulation for Combinational Circuits. **(9)**

FUNCTIONAL TESTING

Functional Testing without Fault Models - Exhaustive and Pseudo Exhaustive Testing - Functional Testing with Specific Fault Models. **(9)**

DESIGN FOR TESTABILITY

Testability - Ad-hoc Design - Generic Scan Based Design - Classical Scan Designs - Board Level and System Level DFT Approaches - Boundary Scan Standards. **(9)**

BUILT IN SELF TEST AND FAULT DIAGNOSIS

BIST Concepts - Test Pattern Generation for BIST - BIST Architectures: Built In Evaluation and Self Test (BEST), LSSD On-chip Self Test (LOCST) and Built in Logic Block Observation (BILBO) - Logic Level Diagnosis: Guided Probe Testing, Diagnosis by UUT Reduction, Fault Diagnosis for Combinational Circuits. **(9)**

TOTAL : 45

TEXT BOOK

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

REFERENCE BOOKS

1. M. Bushnell, Vishwani D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. Parag K. Lala, "An Introduction to Logic Circuit Testing", Morgan and Claypool Publishers, 2009.
3. Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, "VLSI Test Principles and Architectures: Design for Testability", Morgan Kaufmann Publishers, 2006.
4. Alfred L. Crouch, "Design for Test for Digital IC's and Embedded Core Systems", Prentice Hall International, 1999.
5. Zainalabedin Navabi, "Digital System Test and Testable Design: Using HDL Models and Architectures", Springer Science and Business Media, 2011.

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	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×		×	×	×	×
2	×	×	×		×			×	×		×	×	×	×
3	×	×	×		×			×	×		×	×	×	×
4	×	×	×		×			×	×		×	×	×	×
5	×	×	×		×			×	×		×	×	×	×

13ECE12 - AUTOMOTIVE ELECTRONICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of Mechanical blocks and Vehicle Systems.*
- *to understand electronic strategies and distribution techniques in Automotive Platform*
- *to acquire knowledge on various automotive sensors and actuators*
- *to know about networking solutions on various protocols and vehicle communication.*
- *to acquire knowledge on legislation act and diagnostics in automotive sector.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an understanding of the basics of Mechanical blocks and vehicle systems in automotive applications*

CO2 : *an understanding of the electronic strategies and distribution techniques in Automotive platform*

CO3 : *knowledge on various designs of automotive sensors and actuators*

CO4 : *knowledge about networking solutions on various protocols and vehicle communication.*

CO5 : *knowledge on implementation of legislation act and diagnostics in automotive sector*

AUTOMOTIVE VEHICLE SYSTEMS

Engine System: 4 Stroke engine operation, Air system, Turbo chargers: Turbine, Variable geometry-Fuel system (carburetor & Gasoline/Diesel Fuel Injection), Ignition-Exhaust system: CO, HC, NOx reduction (SCR, DPF, NSC & 3-way catalyst)-Transmission System: Manual, Automatic Transmission-Differential-Front, Rear & 4Wheel Drive. Braking system: Hydraulic (Drum, Disc), Pneumatic (Drum, Disc)-Steering System: Rack and Pinion, Power steering (hydraulic & electrical)-Cooling & Lubrications-Electronic systems: Starting system, Charging system- Introduction to hybrid vehicles. **(11)**

ELECTRONICS IN AUTOMOTIVE SYSTEMS

Electronic control units: Engine Control Unit (ECU)-Vehicle Control Unit (VCU)- Anti lock Breaking Control (ABS)- Traction Control (TCS)-Electronics Stability Program (ESP)-Safety & Comfort systems: Night Vision, Airbags, Seatbelt pre-tensioner, Cruise Control-Lane-departure-warning, Parking assist. **(8)**

AUTOMOTIVE SENSORS & ACTUATORS

Automotive engine control sensors: Air Flow Rate Sensor, Engine Crankshaft and Camshaft Position Sensor- Throttle Angle Sensor- Intake & Exhaust Temperature- Rail Pressure- Cylinder Pressure & boost pressure Sensors- Sensors for Feedback Control(lambda sensor, Knock Sensors)-Automotive Engine Control Actuators: Throttle actuator-Exhaust Gas Recirculation (EGR)-Oil pump, VVT valve, Injectors(solenoid, Piezo). **(8)**

VEHICLE COMMUNICATION PROTOCOLS

Vehicle Communication Protocols-Introduction to CAN, LIN, FLEXRAY, MOST **(9)**

AUTOMOTIVE LEGISLATIONS AND DIAGNOSTICS

Legislation: Environmental legislation for pollution and safety Norms-Process of Automotive Fault Diagnostics-Vehicle Safety Systems (open-loop and closed-loop)-On and Off Board Diagnostics: OBD-I, OBD-II **(9)**

TOTAL : 45

TEXT BOOK

1. William B. Ribbens, Ph.D, "Understanding Automotive Electronics", Elsevier Publications, 5th Edition, 2003.

REFERENCE BOOKS

1. BOSCH Automotive Handbook, 8th Edition
2. Denton. T, "Automobile Electrical and Electronics Systems", 3rd Edition, SAE (Society for Automobile Engineers) International, 2004.
3. Ronald K. Jurgen, "Automotive Electronics Hand Book", McGraw-Hill Publications, 2nd Edition, 1999.
4. Jack Erjavec, "Automotive Technology: A Systems Approach", Delmar Cengage Learning, 5th Edition, 2009.
5. Barry Hollembeak, "Today's Technician: Automotive Electricity and Electronics (Classroom manual)", Delmar Cengage Learning, 4th Edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×						×	×	×	×	×	×
2	×		×						×	×	×	×	×	×
3	×		×						×	×	×	×	×	×
4	×		×						×	×	×	×	×	×
5	×		×					×	×	×	×	×	×	×

13ECE13 - ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand basic concepts and issues of Electromagnetic Interference and Compatibility.*
- *to know the principles and methods of EMI measurements and related instruments.*
- *to know about various national and international standardizing organizations and EMI/EMC standards.*
- *to acquire knowledge about EMI control methods, EMC Compliant design and Interconnection methods.*

COURSE OUTCOMES

On completion of this course, the students will

CO1 : *have an understanding of basic concepts and issues of Electromagnetic Interference and Compatibility.*

CO2 : *know about the principles and methods of EMI measurements and related instruments.*

CO3 : *know about various national and international standardizing organization and EMI/EMC standards.*

CO4 : *acquire knowledge about EMI control methods, EMC Compliant design and Interconnection methods.*

BASIC CONCEPTS

Definition of EMI and EMC with examples - Classification of EMI/EMC - CE, RE, CS, RS, Units of Parameters - Sources of EMI - EMI coupling modes - CM and DM, ESD Phenomena and effects - Transient phenomena and suppression. **(9)**

EMI MEASUREMENTS

Basic principles of RE, CE, RS and CS measurements - EMI measuring instruments : Antennas, LISN, Feed through capacitor, current probe - EMC analyzer and detection technique : open area site, shielded anechoic chamber, TEM cell. **(9)**

EMC STANDARDS AND REGULATIONS

National and International standardizing organizations : FCC, CISPR, ANSI, DOD, IEC, CENEEC - FCC CE and RE - standards : CISPR, CE and RE Standards, IEC/EN, CS standards - Frequency assignment - spectrum conversation. **(10)**

EMI CONTROL METHODS AND FIXES

Shielding - Grounding - Bonding - Filtering - EMI gasket - Isolation transformer - opto isolator. **(8)**

EMC DESIGN AND INTERCONNECTION TECHNIQUES

Cable routing and connection - Component selection and mounting - PCB design - Trace routing - Impedance control - decoupling - Zoning and grounding. **(9)**

TOTAL : 45

TEXT BOOKS

1. Prasad Kodali.V, "Engineering Electromagnetic Compatibility", S.Chand & Co, NewDelhi, 2000.
2. Clayton R. Paul , " Introduction to Electromagnetic Compatibility ", John Wiley & Sons, 2nd Edition,2006.

REFERENCE BOOKS

1. Clayton R. Paul, Keith W. Whites, S. A. Nasar," Introduction to Electromagnetic Fields", McGraw-Hill Higher Education, 3rd Edition ,1998.
2. Keiser, "Principles of Electromagnetic Compatibility", Artech House, 3rd Edition,1994.
3. Bruce R. Archambeault, Omar M. Ramahi, Colin Brench, "EMI/EMC Computational Modeling Handbook", 2nd Edition,2012.
4. Richard Lee Ozenbaugh, Timothy M. Pullen,"EMI Filter Design", CRC Press, 3rd Edition, 2011.
5. Xingcun Colin Tong,"Advanced Materials and Design for Electromagnetic Interference Shielding",CRC Press, 1st Edition,2008.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×				×			×	×	×	×	×		×
2	×				×			×	×		×	×	×	×
3	×				×			×	×		×	×	×	×
4	×				×			×	×	×	×	×		×

13ECE14 - MEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of MEMS and Micro fabrication*
- *to acquire knowledge about properties of essential materials and mechanisms used in MEMS*
- *to acquire knowledge of Electro Static and Electromagnetic Design of MEMS and system issues*
- *to know various MEMS Application*
- *to know about Optical and RF MEMS.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: gained basic understanding of MEMS and Micro Fabrication.*

CO2 *: knowledge of properties of essential material and mechanisms used in MEMS*

CO3 *: an ability to design and analyze Micro mechanisms and system based on Electro Static and electromagnetic concepts*

CO4 *: knowledge on various MEMS Application.*

CO5 *: knowledge on Optical and RF MEMS*

INTRODUCTION TO MEMS

MEMS and Micro systems - Miniaturization - Typical products - Micro sensors - Micro actuation- MEMS with micro actuators- Micro accelerometers - Micro Fluidics - MEMS materials - Micro fabrication **(9)**

MECHANICS FOR MEMS DESIGN

Elasticity: Stress, Strain and material properties - Bending of thin plates - Spring configurations - Torsional deflection - Mechanical Vibration: Resonance - Thermo mechanics - Actuators - Force and response time - Fracture and thin film mechanics. **(9)**

ELECTROSTATIC AND ELECTROMAGNETIC DESIGN AND SYSTEM ISSUES

Electrostatics : Basic theory, Electro Static Instability - Surface Tension-Gap and finger pull up - Electro static actuators - Comb generators - Gap closer - Rotary motors - Inch worms - Electromagnetic actuators - Bistable actuators - Electronic interfaces - Feedback system - Noise - Circuit and system issues. **(9)**

MEMS APPLICATION

Case studies - Capacitive accelerometer - Piezo Electric pressure sensor - Micro fluidics application - Modeling of MEMS Systems - CAD for MEMS. **(9)**

INTRODUCTION TO OPTICAL AND RF MEMS

Optical MEMS - System design basics: Gaussian optics, Matrix operations, Resolution - Case studies - MEMS Scanners and Retinal Scanning display - Digital Micro Mirror Devices - Optical switches -RF MEMS: Design basics, Case study, capacitive RF MEMS switch, Performance issues. **(9)**

TOTAL : 45

TEXT BOOKS

1. Stephen Santeria, "Micro systems design", Kluwer publishers, 2001.
2. N.P. Mahalik, "MEMS", Tata McGraw Hill, 2007

REFERENCE BOOKS

1. Vijay K. Varadan, K.J. Vinoy, K.A.Jose, "RF MEMS" and their Application" Published by John Wiley & sons Ltd, England, reprinted April 2003
2. Nadim Maluf and Kirt William, "An introduction to Micro Electromechanical system Engineering", 2nd Edition, Artech House, 2004
3. Mohamed Gad-el-Hak, "The MEMS Hand book-Application", CRC press, 2nd Edition,2006
4. Tai Ran Hsu, "MEMS & Micro systems Design, Manufacture and Nano scale Engineering" John Wiley and sons, New Jersey, 2nd Edition, 2008
5. Jan G. Korvink, Oliver Paul, "MEMS a practical guide of design, analysis and applications", William Andrew, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×						×	×	×	×	×	×
2	×		×						×	×	×	×	×	×
3	×		×						×	×	×	×	×	×
4	×		×						×	×	×	×	×	×
5	×		×						×	×	×	×	×	×

13ECE15 - MULTIMEDIA COMPRESSION TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

To enable the students

- *to acquire knowledge about basic concepts in Information theory.*
- *to acquire knowledge about the concepts, techniques and standards of text, audio, image and video compression*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth understanding about basic concepts in Information theory.*

CO2 *: knowledge about the concepts, techniques and standards of text compression.*

CO3 *: knowledge about the concepts, techniques and standards of audio compression.*

CO4 *: knowledge about the concepts, techniques and standards of image and video compression.*

INTRODUCTION

Overview of Information Theory - Redundancy - Overview of human codes, Visual System -Taxonomy of compression techniques - Overview of source coding - Source models - Scalar quantization - Rate distortion - Vector quantization - Structure quantizer - Error analysis and methodologies. **(9)**

TEXT COMPRESSION

Compaction techniques - Static Huffman coding - Dynamic Huffman coding - Arithmetic coding - Lempel-Ziv coding - Lempel-Ziv Welsh coding. **(9)**

AUDIO COMPRESSION

Audio compression techniques - Frequency domain and filtering - Basic sub band coding - Application to speech coding - G.722 - Application of audio coding: MPEG audio - Silence compression - Speech compression techniques - Vocoders - Linear predictive coder. **(9)**

IMAGE COMPRESSION

Approaches to image compression - Predictive techniques - PCM, DPCM, Graphics Interchange Format, Tagged image file format, Digitized documents, Digitized pictures, JPEG, Quad tree - DCT coding - Wavelet methods - Filter banks - EZW coding - SPIHT coding - JPEG 2000 standards. **(9)**

VIDEO COMPRESSION

Video signal representation - Video compression techniques - MPEG1,2,4 - Motion estimation - H.261, H.263 - Overview of wavelet based compression- PLV performance - Real time compression. **(9)**

TEXT BOOKS

1. Fred Halsall, James F. Kurose, "Multimedia communication - Applications, Networks, Protocols and standards", Pearson Education Limited, 2004
2. Sayood Khaleed, "Introduction to Data Compression", Morgan Kauffman, 4th Edition, 2012.

REFERENCE BOOKS

1. Jerry D. Gibson, "Multimedia Communications: Directions and Innovations", Morgan Kaufmann, 2nd Edition,2001.
2. David Solomon, "Data Compression the complete reference", Springer, 4th Edition, 2007.
3. Gibson.J.D. Berger.T, Lookbaugh.T, Linbergh.D, R.L.Baker, "Digital compression for multimedia : Principle & standards", Morgan Kaufmann,1998.
4. Mark Nelson and Gally Jen, "The Data compression book", BPB Publishers,1996.
5. Jan Ozer, Video compression for multimedia, AP professional, NewYork, 1995.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
2	×	×	×		×				×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×	×	×	×	×	×

13ECE16 - 3D IMAGING TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the concepts of 3D image modeling .*
- *to acquire basic knowledge and understanding of texture mapping ,depth cues and disparity.*
- *to introduce the concepts and techniques of reconstruction of 3D images.*
- *to understand stereo correspondence algorithms.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *basic knowledge on 3D image modeling.*

CO2 : *in depth understanding of texture mapping, depth cues and disparity.*

CO3 : *an understanding of the concepts and techniques of reconstruction of 3D images.*

CO4 : *an understanding of stereo correspondence algorithms.*

CO5 : *an ability to develop algorithms for real applications such as medical images , cryptography and video processing.*

INTRODUCTION TO 3D IMAGE MODELING

Images model and geometry-3D rendering pipeline, 3D Geometry primitives - Bezier, B-splines, NURBS, fractals, Particles systems,3D transforms - Deform modifiers, Solid modeling - poly modeling, Surface modeling - tessellation Extruded shapes - Mesh approximations to smooth objects - sphere, cylinder Hierarchical modeling -Physically based modeling. **(9)**

TEXTURE MAPPING

Procedural and Bitmap textures -Texture mapping an image - Bump mapping Environment mapping - Interpolation - Magnification and Minification, Mipmapped texture-Adding texture on to curved surfaces-Animated texture, Tilling - Rendering textures. **(9)**

DEPTH CUES AND DISPARITY

Basics issues and terms in depth perception-Recovering three dimensions - Monocular and Binocular information - Extra retinal sources of depth information - Depth analysis using real aperture camera-depth from defocused images - Depth cues - Disparity Stereograms and other 3D correspondence problem. **(9)**

3D OBJECT RECOGNITION

3D reconstruction - Epipolar geometry - stereo calibration - Rectification of stereo images - Modeling and Recognizing Classes of Shapes - 3D Object Recognition from stereo images data - 3D object recognition from range data. **(9)**

STEREO CORRESPONDENCE ALGORITHMS

Colour SAD window - based technique - disparity range estimation - pyramid level reduction - Zero Mean Normalized cross correlation (ZNCC) similarity measure - Vergence angle control - Speed issues - Power issues. **(9)**

TOTAL : 45

TEXT BOOKS

1. Bernd Girod, Gunther Greiner, Heinrich Niemann, "Principles of 3D Images Analysis and Synthesis", Kluwer academic Publishers, 2000.
2. Mark Giambruno, "3D Graphics and Animation", 2nd Edition, New Riders Publishing ,2002.

REFERENCE BOOKS

1. John F.Huges, Andries van Dam, Morgan Mcguire, et al., "Computer Graphics, Principles and Practice", Pearson Education, 3rd Edition, 2013.
2. S.Chaudhuri and A.N. Rajagopalan, "Depth from Defocus: A Real Aperture Imaging Approach", Springer Verilag, 1999.
3. Boguslaw Cyganek, J. Paul Siebert, "An Introduction to 3D Computer Vision Techniques and Algorithms", Wiley Publications, January 2009.
4. Nick Pears, Yonghuai Lui, Peter Bunting , "3D Imaging, Analysis and Applications" Springer-Verlag, 2012.
5. B.K.P.Horn, "Robot Vision", MIT Press, 1986.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×				×	×	×	×	×	×
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3	×	×	×		×				×	×	×	×	×	×
4	×	×	×		×				×	×	×	×	×	×
5	×	×	×		×				×	×	×	×	×	×

13ECE17 - RF MICROELECTRONICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to understand the basics of RF characteristics of passive components*
- *to know about Fundamentals of MOS characteristics at RF*
- *to acquire knowledge about Amplifier Design*
- *to know various types of mixers*
- *to know about concepts of oscillators and phased locked loop*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: basic understanding of RF characteristics of passive components*

CO2 *: knowledge on Fundamentals of MOS characteristics at RF*

CO3 *: an ability to design and analyze Amplifier design*

CO4 *: knowledge on various types of mixers*

CO5 *: knowledge on oscillators and phased locked koop*

RF CHARACTERISTICS OF PASSIVE COMPONENTS

RF characteristics of chip resistor, capacitor and inductors-semiconductor realization of resistors, capacitors, inductors, transformers, Coaxial, stripline, and microstrip line design guidelines and behavior at RF. **(9)**

MOS CHARACTERISTICS AT RF

Long and Short channel approximations- bandwidth estimation techniques-open and short circuit time constant procedures- high frequency amplifiers. **(9)**

AMPLIFIER DESIGN

Series shunt amplifiers-tuned amplifiers- neutralization- feedback and RF stability Criteria- gain and phase margins- compensation techniques Class A,B,C,D,E,F power amplifier definitions- PA characteristics- RF PA design examples. **(9)**

LNAS AND MIXERS

Noise definitions and noise models-two port noise parameters of MOSFET-LNA Topologies- noise match and power match design considerations- linearity and large signal performance of LNAs,Mixer fundamentals-nonlinear mixers-multiplier based mixers-sub-sampling mixers. **(9)**

OCSILLATORS, PHASE LOCKED LOOPS

Colpitts oscillator-Ring Oscillators- VCOs, Linearized PLL models- noise properties of PLLs-phase detectors- loop filters- charge pumps- PLL design examples- detailed considerations of phase noise.**(9)**

TOTAL : 45

TEXT BOOKS

1. Thomas Lee, "The Design of Radio Frequency CMOS Integrated Circuits", Cambridge University Press, 2nd Edition 2004
2. Behzad Razavi, "RF Micro Electronics", Prentice Hall, 2011.

REFERENCE BOOKS

1. Ken Kuang, Franklin Kim, Sean S. Cahill,"RF and Microwave Microelectronics Packaging", Springer New York, 2009.
2. Serge Luryi, Jimmy Xu, Alex Zaslavsky, "Future Trends in Microelectronics: Up the Nano Creek", John Wiley & sons, 3rd Edition, 2007.
3. Marian k.kazimerczuk,"RF power amplifiers" prentice hall,2008
4. Guillermo bistue, Carlos quemada, Inigo adin, "Design Methodology for RF CMOS phase locked loops",Artech house,2009
5. Chengzhi zhou,"RF passives and Antennas on three -dimensional metalized substrates",2007

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×						×	×	×	×	×	×
2	×	×	×						×	×	×	×	×	×
3	×		×		×				×	×	×	×	×	×
4	×		×		×				×	×	×	×	×	×
5	×	×	×		×				×	×	×	×	×	×

13ECE18 - NANO ELECTRONICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

To enable the students

- *to understand the basics of Nanotechnology*
- *to know about Fundamentals of Nano Electronics*
- *to acquire knowledge about Silicon MOSFETS and Quantum transport devices*
- *to know various types of nano tubes*
- *to know about Molecular electronics*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: basic understanding of Nanotechnology*

CO2 *: knowledge on Fundamentals of Nano electronics*

CO3 *: an in-depth knowledge on Silicon MOSFETS and Quantum devices*

CO4 *: knowledge on various types of Nano tubes*

CO5 *: knowledge on Molecular electronics*

INTRODUCTION TO NANOTECHNOLOGY

Background to nanotechnology: Types of nanotechnology and nanomachines - periodic table - atomic structure- molecules and phases - energy - molecular and atomic size - surface and dimensional space - top down and bottom up - Molecular Nanotechnology: Electron microscope - scanning electron microscope - atomic force microscope - scanning tunneling microscope - nanomanipulator - nanotweezers - atom manipulation - nanodots- self assembly - dip pen nanolithography - Nanomaterials: preparation - plasma arcing - chemical vapor deposition - sol-gels - electro deposition - ball milling - applications of nanomaterials. **(9)**

FUNDAMENTALS OF NANOELECTRONICS

Fundamentals of logic devices:- Requirements - dynamic properties - threshold gates; physical limits to computations; concepts of logic devices:- classifications - two terminal devices - field effect devices - coulomb blockade devices - spintronics - quantum cellular automata - quantum computing - DNA computer; performance of information processing systems:basic binary operations, measure of performance processing capability of biological neurons - performance estimation for the human brain, Ultimate computation: power dissipation limit- dissipation in reversible computation - the ultimate computer. **(9)**

SILICON MOSFETs & QUANTUM TRANSPORT DEVICES

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules - silicon-dioxide based gate dielectrics - metal gates - junctions & contacts - advanced MOSFET concepts-Quantum transport devices based on resonant tunneling - Electron tunneling - resonant tunneling

diodes -resonant tunneling devices; Single electron devices for logic applications:- Single electron devices - applications of single electron devices to logic circuits. **(9)**

CARBON NANOTUBES

Carbon Nanotube: Fullerenes - types of nanotubes - formation of nanotubes - assemblies - purification of carbon nanotubes - electronic propertics - synthesis of carbon nanotubes - carbon nanotube interconnects -carbon nanotube FETs - Nanotube for memory applications - prospects of an all carbon nanotube nanoelectronics. **(9)**

MOLECULAR ELECTRONICS

Electrodes & contacts - functions - molecular electronic devices - first test systems - simulation and circuitdesign - fabrication, Future applications: MEMS - robots - random access memory - mass storage devices. **(9)**

TOTAL : 45

TEXT BOOK

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, "Nanotechnology: Basic Science and Emerging Technologies", Chapman & Hall / CRC, 2002

REFERENCE BOOKS

1. T. Pradeep, "NANO: The Essentials - Understanding Nanoscience and Nanotechnology", TMH, 2007
2. Rainer Waser (Ed.), "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley-VCH, 2003
3. Geroge W. Hanson, "Fundamentals of nano electronics" 1st edition, Pearson education, publishing as Prentice hall, 2008
4. Shunri oda, David Ferry, "Silicon nano electronics", taylor and francis group, CRC 2005.
5. Karl goser, Peter glosekotter, Jan Dienstahl, "Nano electronics and nano system: From transistors to molecular and quantum", Springer 2004

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×						×	×	×	×		×
2	×		×						×	×	×	×	×	×
3	×	×	×		×				×	×	×	×	×	×
4	×		×						×	×	×	×	×	×
5	×		×						×	×	×	×	×	×

13ECE19 - MEDICAL ELECTRONICS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge about bioelectric potential, electrodes and recorders.*
- *to gain knowledge about Bio -chemical and non electrical parameter measurements.*
- *to understand the principles of operation of physiological assist devices and medical imaging systems.*
- *to know about the principles of operation of physical medicine and biotelemetry.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: basic knowledge about bioelectric potential, electrodes and recorders.*

CO2 *: knowledge about Bio -chemical and non electrical parameter measurements*

CO3 *: an understanding of principles of operation of physiological assist devices and medical systems.*

CO4 *: knowledge about principles of operation of physical medicine and biotelemetry.*

ELECTRO-PHYSIOLOGY AND BIOPOTENTIAL RECORDING

Origin of Biopotentials-Biopotential Electrodes-Biological amplifiers- ECG, EEG,EMG, PCG, EOG,ERG - lead systems and recording methods, typical waveforms and signal characteristics. **(10)**

BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENTS

pH, pO2, pCO2, pHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters. **(9)**

PHYSIOLOGICAL ASSIST DEVICES

Cardiac pacemakers, Artificial heart valves-DC Defibrillators- Dialyser- Heart-Lung machine- Hearing aids-Nerve and muscle stimulators. **(9)**

MEDICAL IMAGING

X-Ray and Computer Axial Tomography-Positron Emission Tomography- MRI and NMR-Ultrasonic Imaging systems-Medical Thermograph. **(9)**

PHYSICAL MEDICINE AND BIO-TELEMETRY

Diathermies - Short-wave, ultrasonic and microwave type and their applications, Telemetry principles, frequency selection, Bio-telemetry, radiopill and tele-stimulation, electrical safety. **(8)**

TOTAL : 45

TEXT BOOKS

1. Leslie Cromwell, “Biomedical Instrumentation and Measurements”, Pearson Education, New Delhi, 2nd Edition, 2007.
2. R.S.Khandpur, "Hand Book of Bio-Medical instrumentation”, Tata McGraw Hill Publishing Co Ltd., 2004.

REFERENCE BOOKS

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th ed., Singapore: Pearson Education, Inc., 2001.
2. John G.Webster, "Medical Instrumentation Application and Design", 4th Edition, John Wiley and Sons, (Asia) Pvt.Ltd, 2010.
3. L.A.Geddes, L.E.Baker, “Principles Of Applied Biomedical Instrumentation”, 3rd Edition, Wiley India Pvt. Ltd, 2008.
4. Venkataraman, "Biomedical Electronics and Instrumentation", Galgotia Publications, 2nd Edition, 2003.
5. Dr.M.Arumugam, "Biomedical Instrumentation", Anuradha Agencies, Kumbakonam, 2nd Edition, 2006

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×			×	×		×	×	×	×
2	×		×		×			×	×		×	×	×	×
3	×		×		×			×	×		×	×	×	×
4	×		×		×			×	×		×	×	×	×

13ECE20 - ADVANCED MEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge in Magnetic resonance physics and imaging.*
- *to acquire basic knowledge and understanding of fibre optics in medicine.*
- *to know about Neonatal instrumentation and Anesthesia machine.*
- *to acquire basic knowledge and understanding of Prosthetics and Orthotics*
- *to acquire knowledge about the principles of laser applications in medicine and biology.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an understanding of Magnetic resonance physics and imaging.*

CO2 *: an in-depth understanding of fibre optics in medicine.*

CO3 *: knowledge on the concepts of Neonatal instrumentation and Anesthesia machine.*

CO4 *: an in-depth understanding of Prosthetics and Orthotics.*

CO5 *: an understanding of the principles of laser applications in medicine and biology.*

MAGNETIC RESONANCE IMAGING

Magnetic resonance physics: Larmor precession, RF excitation and detection, Physics of transmitted signal, Signal detection and detectors - Pulse sequences: Gradient echo, spin echo.

Imaging: Image quality - Equipment - CT: Artifacts, Application & limitation of projection CT image formation - Spiral or Helical CT: Slip Ring Technology, CT Angiography. **(9)**

FIBRE OPTICS IN MEDICINE

Fiber optics in diagnosis - Transmission of signals, light, and construction details of optical fiber, types of medical fiber optic scopes - Gastroscope - Bronchoscope - Cystoscope - Colonoscope - Enteroscope - Lithotripsy. **(9)**

NEONATAL INSTRUMENTATION & ANESTHESIA MACHINE

Incubator - Physiological heat balance - Heat loss methods - Apnea detection - Photo therapy devices - Gas supply and delivery - Vapor delivery - Patient breathing circuit - Complete schematic of anesthesia machine. **(9)**

PROSTHETICS AND ORTHOTICS

Artificial heart and circulatory assist devices - Engineering design - Haemocompatibility - Orthopedic Prosthesis: Fundamentals, Design considerations, Intelligent prosthetic knee, Hierarchically controlled prosthetic hand, Self-aligning orthotic knee joint - Sensory augmentation and substitution - Visual system: Visual Augmentation, Tactual vision substitution, Auditory vision substitution - Auditory system: Auditory

Augmentation, Visual Auditory Substitution, Tactual Auditory Substitution - Tactual System: Tactual Augmentation, Tactual Substitution. **(10)**

PRINCIPLES OF LASER APPLICATIONS IN MEDICINE AND BIOLOGY

Fundamentals of photo medicine and photo biology - Photo Dermatology - Photo Dynamic Therapy - Laser Therapy of lesions, ulcers and tumors - Laser systems for biomedical applications - General laser surgery : laser surgery of eye and other organs - Lasers in diagnostic applications - Laser hazards and precautions. **(8)**

TOTAL : 45

TEXT BOOKS

1. Bronzino J.D. "Biomedical Engineering Handbook", CRC Press LLC, 2000.
2. Webster J.G. "BioInstrumentation", Wiley Publications, 2007.

REFERENCE BOOKS

1. Thomas Surry, Jumer E.Dowdey, Robert C Murry, "Physics of Diagnostic Radiology", Williams and Wilkins, 4th Edition, 1990.
2. John G.Webster, "Encyclopedia of Medical Devices and Insturumentation", Wiley Publications, 1988.
3. Khandpur R.S, "Hand Book of Biomedical Instrumentation", TataMcGraw Hill Publication, New Delhi, 2nd Edition, 2005.
4. Wolbasrsht. M. L, "Laser Application in Medicine and Biology", Plenum Press NewYork, 1989.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×			×	×		×	×	×	×
2	×		×		×			×	×		×	×	×	×
3	×		×		×			×	×		×	×	×	×
4	×		×		×			×	×		×	×	×	×
5	×		×		×			×	×		×	×	×	×

13ECE21 - RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire basic knowledge and understanding of linear programming, transportation and assignment models.*
- *to identify, formulate and solve design problems in duality and dynamic programming models.*
- *to gain knowledge and understanding of replacement theory.*
- *to understand widely used project scheduling techniques.*
- *to know about concepts of Queuing models.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of linear programming, transportation and assignment models.*

CO2 : *an ability to formulate and solve problems in duality and dynamic programming models.*

CO3 : *an understanding of Replacement theory.*

CO4 : *an ability to use widely used project scheduling techniques for planning and scheduling complex projects.*

CO5 : *knowledge about contemporary issues associated with Queuing models.*

LINEAR PROGRAMMING

Development of operations research - Modelling - Structure of mathematical models - Definition and properties of linear programming problems - Canonical and standard forms - Graphical solution of two variable linear programming problems - Simplex method - Optimality and feasibility conditions - Computational procedure. **(7)**

DUALITY THEORY AND APPLICATIONS

Definition of dual problem - Primal and dual properties - Assignment models - Hungarian Technique - Transportation problem - Initial solution - Vogels approximation method - Balanced and unbalanced problems - Degenerate solutions. **(8)**

DYNAMIC PROGRAMMING

Characteristics of dynamic programming model - Bellman's principle of optimality - Formulation of dynamic programming model - Forward and backward computations. Applications - Stage coach problem - Resource allocation problem - Cargo loading problem. **(8)**

INVENTORY CONTROL

Need for the inventory - Costs involved in inventory - Concepts of average inventory, economic order quantity - Deterministic model: Fixed ordering quantity models - EOQ model with uniform demand, finite

/ infinite replacement with / without shortages - Inventory control - Buffer stock - Determination of optimum buffer stock - EOQ system of ordering - Multi item order model - ABC analysis. **(10)**

REPLACEMENT THEORY

Replacement theory - Equipment replacement policies in deterministic cases - Replacement in anticipation of failure - Group Replacement Policy. **(7)**

NETWORK SCHEDULING

Scheduling techniques - Network diagrams - Network calculations - Critical path method - PERT calculations - Optimistic, Pessimistic and most likely time - Cost analysis - Least Cost Schedule. **(8)**

QUEUING THEORY AND SIMULATION

Queuing Theory (waiting line model) - Introduction to Queuing system - Characteristics of queuing systems - Single server - Performance evaluation - Simulation - Monte-carlo method - Application to queuing problems. **(7)**

TOTAL : 45

TEXT BOOKS

1. HamdyA.Taha, "Operations Research - An Introduction", Pearson Publications, 7th Edition, Third Indian Reprint, 2004.
2. S.D.Sharma "Operations Research", KedarNath Ram Nath&Co., Publishers,1996.
3. A.P. Verma, "Operation Research", S.K. Kataria& Sons, 3rd Edition, 2006.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	
2	×	×	×		×			×	×	×	×	×	×	
3	×	×			×			×	×	×	×	×	×	
4	×	×	×		×			×	×	×	×	×	×	×
5	×		×		×			×	×	×	×	×		×

13ECE22 - JAVA PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge on JAVA fundamentals.*
- *to gain knowledge on Exception handling, threads, Applets in JAVA*
- *to acquire knowledge about network programming in JAVA.*
- *to design an object for a specific application using JAVA .*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: an in-depth understanding of JAVA fundamentals.*

CO2 *: knowledge on Exception handling, threads, Applets in JAVA.*

CO3 *: an ability to develop network programming in JAVA.*

CO4 *: an ability to design an object for a specific application using JAVA..*

INTRODUCTION TO JAVA

Java Introduction - Java and Internet - Byte Code- Features of Java - Java Development Environment- Java Programmimg: Methods and Classes - Constructor- Garbage Collection -Overloading- Inheritance- Overriding- Packages and Interfaces - Java IO systems- String Handling : String and String Buffer. **(12)**

EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - user defined Exceptions. **(5)**

THREADS

Multithreaded Programming : Thread Model - Thread properties - Thread priorities - Synchronization- Inter thread communication-Deadlock. **(8)**

NETWORKING

Networking : Inet address - Datagrams - Sockets - URL connections. **(8)**

APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit -Applet class - HTML applet tags - Parameter passing -Audio clip interface- Event class: Keyboard and Mouse events handling- Data Base Connectivity : basic structure of JDBC API. **(12)**

TOTAL : 45

TEXT BOOK

1. Herbert Schilt :" Java 2 - Complete Reference ", Tata Mcgraw Hill, 8th Edition, 2007.

REFERENCE BOOK

1. Deitel H.M and Deitel P.J , " Java - How To Program", Prentice Hall Of India, 9th Edition, 2012.

Mapping of Course Outcomes and Programme Outcomes

COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×	×	×		×			×	×	×	×	×	×	×
2	×	×	×		×			×	×	×	×	×	×	×
3	×	×	×		×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×

13ECE23 - DATA STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to acquire knowledge in data structures concepts, related algorithms.*
- *to gain knowledge in data structures such as lists, stacks, queues, and trees to represent real world problems.*
- *to identify, formulate and design algorithms for a specified application*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 *: knowledge in data structures concepts, related algorithms.*

CO2 *: knowledge in data structures such as lists, stacks, queues and trees to represent real world problems*

CO3 *: the ability to identify, formulate and design algorithms for a specified application.*

DATA, INFORMATION AND ALGORITHM ANALYSIS

Data Vs Information - Representation of numbers: Integer, Real, Representation of Characters - Definition of an algorithm - Basic steps in development of an algorithm - Algorithm notations - Sparks - Algorithm complexity - Space and Time complexity - Order notations - Definition of NP Hard - NP complete. **(6)**

LINEAR LIST

Definition - Arrays: Representation and Characteristics - Array of structures - Polynomial representation - Multidimensional arrays. **(4)**

STACKS AND QUEUES

Fundamentals of Stacks, Queues and Dequeues - Application of stacks: Recursion - Conversion of infix to postfix and prefix expressions - Evaluation of postfix expressions - Application of Queues: Wire routing - Priority queue - Multiple stacks and queues. **(7)**

LINKED LISTS

Singly and doubly linked lists: Basic operations - Linked stacks and queues - Polynomial manipulation - Multiprecision arithmetic. **(6)**

TREES

Definition - Binary Trees: Representations, Traversal, Properties - Threaded binary trees - Copying and Equivalence of binary trees - Binary tree representation of general trees - Application of trees: Decision Trees, Game Trees, Search Trees. **(7)**

GRAPHS

Terminology and Representations - Warshall algorithm - Traversals - Biconnectivity - Connected components - Spanning Trees - Shortest path - Transitive closure - Activity networks -Topological sort - Critical paths - Enumerating all paths - Euler and Hamiltonian paths. **(7)**

FILES

External storage devices - Definitions and Concepts - Record organization - Sequential files - Indexed sequential files: Structure and Processing - Other method of file organizations: VSAM - Multiple Key Access: Multilist, Inverted list, Cellular partitions **(8)**

TOTAL : 45

TEXT BOOK

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures in C", Galgotia Publications, 2008.

REFERENCE BOOKS

1. Satraj Sahani, "Data structures, Algorithms and applications in C++", McGraw Hill, International Edition, 2005.
2. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill, 2nd edition, 2008.

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COs	Mapping of COs and POs													
	POs													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	×		×		×				×			×	×	
2	×	×	×		×				×		×	×	×	×
3	×		×		×				×			×	×	

13ECE24 - ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

This course will enable the students

- *to gain knowledge about robotics, safety measures and homogeneous transformation.*
- *to understand the concepts of mechanical drives in robotics.*
- *to acquire knowledge about the features and functionalities of the sensors.*
- *to learn about robotics programming, classifications and its applications.*
- *to understand the concepts of robot task planning and problem solving techniques.*

COURSE OUTCOMES

On completion of this course, the students will have

CO1 : *an in-depth understanding of robotics, safety measures and homogeneous transformation.*

CO2 : *an understanding of the concepts of mechanical drives in robotics.*

CO3 : *an understanding of the features and functionalities of the sensors.*

CO4 : *an understanding of robotics programming, classifications and it applications.*

CO5 : *an understanding of basic concepts in robot task planning and problem solving techniques.*

ROBOT KINEMATICS

Introduction - Robotics and programmable automation - Historical background - Laws of Robotics - Robot definitions - Robotics system and Robot anatomy - Specifications of Robots - Safety measures in Robotics. Robot kinematics - forward and reverse kinematics of three and four degrees of freedom robot arm - Homogeneous transformation - Kinematics equations using homogeneous transformation. **(9)**

ROBOTIC DRIVERS AND CONTROLS

Robot drives, actuators and control - Functions of drive systems - General types of fluids - Pump classification - Pneumatic systems - Electrical drives - DC motors - Stepper motors - Drive mechanism. Robot end effectors - Classification - Drive system for grippers - Mechanical grippers - Magnetic grippers - Vacuum grippers - Adhesive grippers - Gripper force analysis and gripper design. **(9)**

LOW LEVEL AND HIGH LEVEL SENSORS

Sensors and intelligent robots. Artificial intelligence and automated manufacturing - AI and robotics - Need for sensing systems - Sensory device - Types of sensors - Robot vision systems - Low level vision and high level vision. **(9)**

ROBOTIC LANGUAGE AND PROGRAMMING

Robot language and programming. Robot language - Classification of Robot languages - Computer control and robot software - VAL system and language. Application of Robots : Capabilities of Robots - Robotics applications - Obstacle avoidance. **(9)**

ANALYSIS AND TASK PLANNING

Robot intelligence and task planning - State space search problem reduction - Use of predicate logic - Means and Ends analysis - Problem solving - Robot learning - Robot task planning - Basic problems in task planning **(9)**

TOTAL : 45

TEXT BOOKS

1. Satya Ranjan Deb, “Robotics Technology and Flexible Automation”, Tata McGraw Hill, 2nd Edition, 2012.
2. Mikell P. Groover, M. Weiss, R.N. Nagal, N.G. Odrey, “Industrial Robotics”, McGraw Hill International, 1989.

REFERENCE BOOKS

1. Fairhurst, Michaeloc, “Computer Vision for Robotics systems - An introduction”, Prentice Hall, 1990.
2. Mikell P. Groover, “Automation Production System and Computer Integrated Manufacturing”, Prentice Hall of India, New Delhi, 2004.
3. Nello Zuech, “Understanding and Applying Machine Vision”, Marcell Dekker Inc., 2nd Edition, 2000.
4. Ramesh Jain, Rangachar Kasturi, and Brain G. Sehunk, “Machine Vision”, Mc Graw Hill International Edition, 1995.

Mapping of Course Outcomes and Programme Outcomes

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1	×	×			×			×	×	×	×	×	×	×
2	×				×			×	×	×	×	×	×	×
3	×				×			×	×	×	×	×	×	×
4	×	×	×		×			×	×	×	×	×	×	×
5	×	×	×		×			×	×	×	×	×	×	×

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE - 641 014, TAMILNADU, INDIA

GOLDEN JUBILEE

(1956 - 2006)

Department of Electronics and Communication Engineering

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Curriculum and Syllabi

THIRD TO EIGHTH SEMESTER

(For the students admitted during 2013-2014 onwards)

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