CS16102 **COMPUTER PROGRAMMING LABORATORY** **0 0 2 1**

(COMMON TO CSE/ECE /EEE/CHEMICAL/IT)

COURSE OBJECTIVES

- To be familiar with the use of word processing software.
- To get exposure in presentation and visualization tools.
- To understand the problem solving techniques and flow charts.
- To use Arrays, strings, functions, structures and unions.

LIST OF EXERCISES

a) Word Processing **10**

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet **10**

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

C Programming **10**

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions
13. File Handling
14. Pointers

COURSE OUTCOMES

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

- execute the word processing programs.
- execute C programs for simple applications.
- develop recursive programs.
- develop recursive programs.

TOTAL PERIODS: 30

Mapping of Course Outcomes with Programming Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3

EC16203 **CIRCUITS AND DEVICES LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- gain the knowledge about circuit theorem
- learn about characteristics of electronic devices
- understand the characteristics of photo devices

LIST OF EXPERIMENTS

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems
3. Verification of superposition Theorem
4. Verification of Maximum power transfer and reciprocity theorems
5. Frequency response of series and parallel resonance circuits
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac
12. Characteristics of Photodiode and Phototransistor

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- impart knowledge by analyzing and verifying the circuit theorems.
- analyze the characteristics of electronic devices
- acquire the knowledge of Photo devices

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	3	3

EC16301 **ELECTRONIC CIRCUITS I** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts of biasing
- study the concept of small signal Amplifiers
- study the Multistage Amplifiers
- learn various types of Large Signal Amplifiers
- know about rectifiers, filters and power supplies

UNIT I TRANSISTOR BIASING 9

Transistor Biasing, Methods of Transistor Biasing - DC load line, AC load line, Quiescent point, variation due to uncertainty in β, Effect of temperature on the Q-point, Stability factor analysis, Bias compensation techniques, FET Biasing.

UNIT II MID-BAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS 9

Two-Port Networks, Analysis of a Transistor Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, and CB Configuration using Approximate Model, BJT Amplifiers, Small Signal Analysis of Single Stage BJT Amplifiers, Miller's Theorem and its Dual, Design of Single Stage RC Coupled Amplifier using BJT, Differential Amplifiers & Methods of improving CMRR.

UNIT III MULTISTAGE AMPLIFIERS 9

Different Coupling Schemes used in Amplifiers, General Analysis of Cascade Amplifiers, Choice of Transistor Configuration in Cascade Amplifier, Direct Coupled Amplifiers, Two Stage RC Coupled Amplifier, Transformer Coupled Amplifier, Methods of increasing input impedance, Cascode Amplifiers.

UNIT IV HIGH FREQUENCY AND LARGE SIGNAL AMPLIFIERS 9

General Shape of Frequency Response of Amplifiers, High Frequency π model for a Transistor- Large Signal Amplifiers - Introduction, Classification Based on Biasing Condition - Class A, ClassB, Class C Power Amplifiers, Thermal Stability and Heat Sink.

UNIT V POWER SUPPLIES, RECTIFIERS AND FILTERS 9

Linear Mode Power Supply - Rectifiers - Half wave rectifier - Full wave rectifier – Bridge rectifier & Comparison - Filters and its types - Voltage Regulators –Switched Mode Power Supply

TOTAL PERIODS 45

COURSE OUTCOMES

At the end this course, students will be able to

- explain the concept of biasing
- elaborate about the small signal amplifiers

- analyze various multistage amplifiers
- demonstrate the concept of large signal amplifiers
- explain about the power supplies, rectifiers and filter design

TEXT BOOKS

1. L.Schilling Donald, Charles belove, ―Electronic Circuits‖, 3rd edition, McGraw Hill, 1989.
2. Salivahanan.S, Sureshkumar.N, ―Electronic Devices and Circuits‖, 3rd edition, McGraw Hill, 2014

REFERENCES

1. Jacob Millman, Christos C.Halkias, ― Electronic Devices and Circuits‖, Tata McGraw Hill,1991
2. Donald.A.Neamen, ―Electronic Circuit Analysis and Design‖, 2nd edition, Tata McGraw Hill, 2007
3. Adel.S.Sedra, Kenneth C.Smith, ―Micro Electronic Circuits‖, 5th edition, Oxford University Press, 2004.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	3	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	3	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	3	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	-	-	-	3	3	3

EC16302 **DIGITAL ELECTRONICS** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the fundamentals and simplification of digital logic
- design the various combinational circuits
- study and design synchronous sequential circuits
- design and implement asynchronous sequential circuits
- acquire basic knowledge about memory devices and HDL programming

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean functions Minimization of Boolean functions– Karnaugh map Minimization – Tabulation Method - Don't care Conditions. Logic Gates- Implementations of Logic Functions using gates - NAND – NOR implementations - TTL - CMOS - NAND, NOR, NOT – Tristate gates

UNIT II COMBINATIONAL CIRCUITS 9

Design procedure of Combinational circuits: Adders- Subtractors – Parallel and serial adder/ Subtractor - Carry look ahead adder- BCD adder - 2 bit Magnitude Comparator- Multiplexer, Demultiplexer - Encoder, Decoder – Parity generator and checker – Code converter.

UNIT III SEQUENTIAL CIRCUITS 9

Flip flops – Triggering – Realization of flip flop using other flip flops – Asynchronous and Synchronous counters – Classification of sequential circuits – Moore and Mealy - Design of Synchronous counters – Modulo-n counter - Ring counters- Shift registers.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table – state assignment – Excitation table – cycles – Race Free State assignment – ASM Chart - Hazards: Static –Dynamic – Essential – Hazards elimination.

UNIT V MEMORY DEVICES AND INTRODUCTION TO HDL 9

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM EAPROM, RAM – RAM organization – Write operation – Read operation– Memory decoding – memory expansion – Static RAM Cell - Bipolar RAM cell – Dynamic RAM cell. Programmable Logic Devices – PLA – PAL - FPGA - Introduction to HDL – Simple programs Using Verilog HDL

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the realization of boolean functions using various techniques

- design and implement combinational circuits
- design and implement synchronous sequential circuits
- design and study the effect of hazards in asynchronous sequential circuits
- elaborate the concepts of memories and HDL.

TEXT BOOKS

1. M. Morris Mano, ―Digital Design‖, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003 .
2. H. Charles Roth Jr, ―Digital System Design using VHDL‖, Thomson/ Brookscole, 2005.(Unit V)

REFERENCES

1. S. Salivahanan and S. Arivazhagan, ―Digital Circuits and Design‖, 3rd Edition, Vikas Publishing House Pvt.Ltd, New Delhi, 2007.
2. John .M Yarbrough, ―Digital Logic Applications and Design‖, Thomson Publications, New Delhi,2007.
3. Charles H.Roth, ―Fundamentals of Logic Design‖, Thomson Publication Company, 2003.
4. Donald P.Leach and Albert Paul Malvino, ―Digital Principles and Applications‖, 5th edition, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2003.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	2	-	-	-	-	-	3	3	3

EC16303 **SIGNALS AND SYSTEMS** **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- learn the basic concepts of continuous time and discrete time signals and systems
- analyze signals and systems using different transforms
- know about the analysis and realization of LTI Continuous Time systems
- acquire the basic knowledge in Sampling and Z transform
- understand about the analysis and realization of LTI Discrete Time systems

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS **15**

Continuous time signals (CT signals) - Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential, basic operation on signals, classification of CT and DT signals –periodic and aperiodic signals, Energy & Power signals - CT systems and DT systems -Properties - LTI system Properties. **.**

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS **15**

Fourier series - definition, properties and analysis - Fourier transform - definition, properties and analysis - Laplace Transform – definition, ROC, properties and signal Analysis – Unilateral Laplace Transform.

UNIT III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS **15**

Differential Equation - impulse response, Step response and output response - Fourier and Laplace transforms in analysis of continuous time (CT)systems - Block diagram representation - Direct Form I Direct Form II - Cascade and Parallel Realization

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS **15**

Sampling Theorem – Reconstruction – Aliasing - DTFT and properties - z-transform - Region of Convergence - Properties of ROC - Properties of z-transform - Inverse z-transform using Partial fraction expansion.

UNIT V LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS **15**

Difference Equations using Z transform - Impulse response - Analysis of Discrete time systems using DTFT and Z Transform - Block diagram representation -Direct Form I - Direct Form II - Cascade and Parallel Realization.

TOTAL PERIODS **75**

COURSE OUTCOMES

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

- explain the basic concepts of solving problems in continuous time and discrete time signals and systems
- analyze signals and systems using different transforms
- analyze problems and solutions relating to LTI – continuous time systems
- demonstrate the analysis of Sampling and Z transform .
- elaborate about LTI – discrete time systems

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, ―Signals and Systems‖, Pearson, Indian Reprint, 2007

REFERENCES

1. S.K.Poornachandra, ―Signals and Systems, Third edition, Tata McGraw-Hill.
2. B P Lathi, ―Linear Systems and Signals‖, Oxford University Press Inc, Chennai, 2004
3. H P Hsu, Rakesh Ranjan, ―Signals and Systems‖, Schaum's Outlines, Tata McGraw Hill, Indian Reprint 2007.
4. John Alan Stuller, ―An Introduction to Signals and Systems‖, Thomson, 2007

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	2	-	-	-	-	-	3	3	3

EC16304 ELECTRICAL MACHINES AND INSTRUMENTATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the theories of DC machines
- understand concepts and construction of transformers
- study the concepts and construction in electrical generators, motors
- learn the concepts of Electronic measurement systems
- gain knowledge of the importance of digital instruments in measurements

UNIT I DC MACHINES 9

Construction of DC machines – Theory of operation of DC generators – types— emf equation-Characteristics of DC generators - Operating principle of DC motors –-torque equation- Types of DC motors and their characteristics – Speed control of DC motors – Applications.

UNIT II TRANSFORMERS 9

Single phase transformer- construction and principle of operation – EMF equation of transformer- Transformeron no load– Transformer on load –Equivalent circuit of transformer- Transformer losses and efficiency-All day efficiency –open circuit test- short circuit test-auto transformer.

UNIT III AC MACHINES 9

Construction of single-phase induction motors, Types of single phase induction motors—Equivalent circuit-Torque equation- Principles of alternator – Construction- Equation of induced EMF- synchronous motors- V curves applications

UNIT IV MEASUREMENT SYSTEMS 9

Measurement systems –Static and dynamic characteristics –error - moving coil, moving iron meters Multimeter - Bridge measurements: Wheat stone, Maxwell, Hay, Schering, Anderson and Wien bridge

UNIT V DIGITAL INSTRUMENTS AND DATA ACQUISITION SYSTEMS 9

Digital Voltmeter-Digital Multimeter-Digital RLC meters-Digital Storage Oscilloscope Digital frequency meterUniversal counter timer-Digital Data Acquisition System-Overview of PC Based instrumentation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the concept of DC machines
- elaborate the concepts of transformers
- comprehend the concepts of AC machines

- analyze the basic measurement systems and devices
- implement the relevance of digital instruments in measurements and data acquisition system

TEXT BOOKS

1. J Nagarath and Kothari DP, ―Electrical Machines‖, McGraw-Hill Education (India) Pvt Ltd 4th Edition, 2010
2. A.K.Sawhney, ―A Course in Electrical & Electronic Measurements and Instrumentation‖, DhanpatRai and Co, 2004.

REFERENCES

1. Del Toro, ―Electrical Engineering Fundamentals‖ Pearson Education, New Delhi, 2007
2. W.D.Cooper&A.D.Helfrick, ―Modern Electronic Instrumentation and Measurement Techniques‖, 5th Edition, PHI, 2002.
3. Ernest O. Doebelin, ―Measurement Systems-application and Design‖, TMH, 2007
4. jH.S.Kalsi-Electronicj measurements and instrumentation,2nd edition.TataMcGrow Hill 2004,New Delhi

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	-	-	-	-	-	-	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	3	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	3	2	2

IT16303 DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING IN C++ 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the systematic way of solving problems
- understand the different methods of organizing large amounts of data To understand Object oriented concepts in generic programming
- introduce linear, non-linear data structures and their applications
- introduce linear, non-linear data structures and their applications
- efficiently implement the different data structures

UNIT I PRINCIPLES OF OOP 9

Programming Paradigms- Basic concepts and benefits of OOP- Structure of C++ program – Tokens - Data types Dynamic initialization - Reference variables- Scope resolution operator - Member dereferencing operators Memory management operators - Type casting- Function Prototyping- call by value, call by reference- Inline function- Default arguments – Function overloading.

UNIT II CLASSES AND OBJECTS 9

Class specification- Access qualifiers - Static data members and member functions - Array of objects- Objects as function arguments - Friend functions - Returning objects - Local classes - Constructors and Parameterized Constructors - Overloaded Constructors - Constructors with default arguments - Copy constructors – Dynamic constructors - Dynamic initialization using constructors- Destructors - Operator Overloading: Operator function – Overloading unary and binary operator - Type Conversion- this pointer

UNIT III INHERITANCE AND POLYMORPHISM 9

Basic Principle – Use of Inheritance-Defining Derived classes- Single Inheritance-Protected Data with private Inheritance - Multiple Inheritance - Multi level inheritance - Hierarchical Inheritance - Hybrid Inheritance Multipath inheritance - virtual functions - Array of pointer to base class objects - Abstract classes – Virtual destructors – Dynamic Binding - Virtual Base Class – Templates – function templates and class templates Exception handling.

UNIT IV LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT -Evaluating arithmetic expressions

UNIT V NON-LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Binary tree representation and traversals – AVL trees – Graph and its representations Graph Traversals - Representation of Graphs - Breadth first search- Depth first search- Connected components

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design problem solutions using object oriented techniques

- apply the concepts of data abstraction, encapsulation and inheritance for problem solutions
- use the control structures of c++ appropriately
- criticallyanalyze the various algorithms.
- apply the different data structures to problem solutions

TEXT BOOKS

1. E.Balagurusamy, ―Object Oriented Programming with C++‖, Tata McGraw Hill, Sixth Edition, 2013
2. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++‖, Third Edition, AddisonWesley, 200

REFERENCES

1. Bhushan Trivedi, 'Programming with ANSI C++, A Step-By-Step approach', Oxford University Press, 2010.
2. BjarneStroustrup, ―The C++ Programming Language‖, 3rd Edition, Pearson Education, 2007.
3. Ellis Horowitz, SartajSahni and Dinesh Mehta, ―Fundamentals of Data Structures in C++‖, Galgotia Publications, 2007.
4. Goodrich, Michael T., Roberto Tamassia, David Mount, ―Data Structures and Algorithms in C++‖, 7th Edition, Wiley. 2004.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	2	-	-	3	-	-	3	3	3
CO3	3	3	3	3	3	2	-	-	3	-	-	3	3	3
CO4	3	3	3	3	3	2	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	2	-	-	3	-	-	3	3	3

EC16305 ELECTRONIC CIRCUITS – I LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- gain knowledge about frequency response of different types of amplifiers
- learn about transfer characteristics of Differential and power amplifiers
- know about the response of amplifiers
- understand about different types of rectifiers

LIST OF EXPERIMENTS

1. Design of biasing methods using BJT
2. Determination of the Frequency response of any one configuration (CE/CB/CC) of BJT amplifier
3. Determination of the Frequency response of any one configuration (CS/CG/CD) of FET amplifier
4. Design Class A power amplifiers and determination its efficiency
5. Design Class B power amplifiers and determination its efficiency
6. Measurement of CMRR of differential amplifier
7. Determination of the bandwidth of Cascade/Casc0de amplifier
8. Determination of the efficiency and ripple factor of half wave/full wave rectifier

SIMULATION USING PSPICE /MULTISIM/EQUIVALENT SOFTWARE PACKAGE

9. Simulation of BJT amplifier Configurations (CE/CB/CC)
10. Simulation of differential amplifiers

TOTAL PERIODS 60

COURSE OUTCOMES

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

- explain the working condition and frequency response of different types of Amplifiers
- comprehend the Differential and power amplifiers
- analyse the bandwidth of multi-stage, Cascade and Cascode amplifiers elaborate about measurement of CMRR
- determine the efficiency and ripple factor of half and full wave rectifier

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	-	3	3

EC16306 DIGITAL ELECTRONICS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- design and implement Adders and Subtractors
- design and implement code converters
- get the knowledge about design and implementation of combinational and sequentional logic circuits
- acquire the knowledge about simulation of digital circuits with Verilog HDL

List of Experiments

1. Design and implementation of Full and Half Adders and Full and Half Subtractors using logic gates.
2. Design and implementation of code converters using logic gates
   i. BCD to excess-3 code convertors and vice versa.
   ii. Binary to gray code convertors and vice-versa.
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
4. Design and implementation of 2 Bit Magnitude Comparator using logic gates
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using basic logic gates and study of IC 74160 and IC 74164.
7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147.
8. Construction and verification of 4 bit ripple counter and Mod-n Ripple counters.
9. Design and implementation of 3-bit synchronous up (or) down counter.
10. Implementation of 3- bit shift registers using Flip flops
11. Design and Simulation of Full and Half Adders, Full and Half Subtractors, Multiplexer and De-multiplexer.
12. Encoder and Decoder, 4 bit Ripple Counter using Verilog HDL.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design Adders and Subtractors using basic logic gates and karnaugh map
- create code converters using basic logic gates
- analyze the combinational and sequentional logic circuits
- Simulate digital circuits with Verilog HDL

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	-	3	3

IT16306	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING LABORATORY	0 0 4 2

COURSE OBJECTIVES

To enable students to

- be familiarized with good programming design methods, particularly Top- Down design.
- getting exposure in implementing the different data structures using C++
- efficiently implement the different data structures
- analyze solutions for specific problems

LIST OF EXPERIMENTS

1. Write C++ Programs using Classes and Objects.
2. Write C++ classes with static members, methods with default arguments, friend functions.
3. Develop C++ Programs using Operator Overloading.
4. Develop C++ Programs using constructor, destructor, and copy constructor.
5. Develop C++ Programs using Inheritance, Polymorphism and its types.
6. Develop C++ Programs using Templates and Exceptions.
7. Design C++ Program for Array implementation of List Abstract Data Type (ADT).
8. Design C++ Program for Linked list implementation of List ADT.
9. Design C++ Program for Stack ADT - Array and linked list implementations.
10. Design C++ Program for Queue ADT – Array and linked list implementations.
11. Design C++ Program for Search Tree ADT - Binary Search Tree.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- identify and apply object oriented concepts like abstraction, encapsulation, modularity, hierarchy.
- estimate various metrics specific to object oriented development
- design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
- apply the different data structures for implementing solutions to practical problems.

RECOMMENDED SYSTEM/SOFTWARE REQUIREMENTS

Software: Turbo C++.

Hardware: Flavor of any WINDOWS or LINUX and Standalone desktops 30 Nos.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	3
CO2		3	3										3	3
CO3				3	3	3		3					3	3
CO4				3	3		3		3			3	3	3

MA16402 PROBABILITY AND RANDOM PROCESSES 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- acquire knowledge of the random variables and manipulate.
- understand the concepts of standard distributions methods
- analyze the relationship between the two random variables
- provide necessary basic concepts in probability and random processes related to communication engineering domain.
- correlate the function and properties of linear time invariant system

UNIT I RANDOM VARIABLES 15

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

UNIT II STANDARD DISTRIBUTION 15

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

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 15

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression Transformation of random variables.

UNIT IV RANDOM PROCESS AND MARKOV CHAIN 15

Classification – Stationary process – Poisson process – Markov Chain – Transition probabilities – Limiting Distributions

UNIT V CORRELATION AND SPECTRAL DENSITIES 15

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties. Linear time invariant system – System transfer function – Linear systems with random inputs – Autocorrelation and Cross correlation functions of input and output

TOTAL PERIODS 60

COURSE OUTCOMES

- understand the basic probability concepts
- acquire skills in handling situations involving more than one random variable and functions of random variables
- evolve with respect to time in a probabilistic manner
- analyze the response of random inputs to linear time invariant systems
- evaluate correlation and spectral densities of random variables.

TEXT BOOKS

1. T. Veerarajan. ―Probability, Statistics and Random Processes‖, 2nd ed., Tata McGraw- Hill, New Delhi, 2008
2. Ibe.O.C., ―Fundamentals of Applied Probability and Random Processes‖, Elsevier,2nd Indian Reprint, 2010

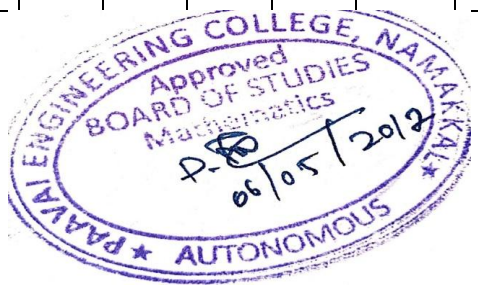
REFERENCES

1. Cooper. G.R., McGillem. C.D., ―Probabilistic Methods of Signal and System Analysis‖, 3rd Indian Edition, Oxford University Press, New Delhi, 2012.
2. Hsu and Hwei, ―Schaum's Outline of Theory and Problems of Probability, Random variables and Random Processes,‖ Tata McGraw – Hill, New Delhi, 2008.
3. Leon-Garcia, Albert, ―Probability and Random Processes for Electrical Engineering,‖2nd ed., Pearson Education, 2008.
4. Venkatachalam G,‖ Probability and Random Process‖, Hitech Publishing Company Pvt.Ltd.,Chennai,3rd Edition, 2012.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	-	3	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	3	-	-	-	-	-	-	3	3
CO3	3	3	3	3	-	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	-	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	3	-	-	-	-	-	-	3	3



EC16401 **ELECTRONIC CIRCUITS II** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- To acquire knowledge about the feedback amplifiers
- To learn about tuned amplifiers
- To study the concepts of oscillator
- To study the wave shaping and multivibrator circuits
- To acquire the basics of blocking oscillators

UNIT I FEEDBACK AMPLIFIERS **9**

Classification of Basic Amplifiers, Basic Concept of Feedback, General Characteristics of Negative feedback Amplifiers, Transfer Gain with Feedback, Effect of Negative Feedback on Input Resistance and Output Resistance, Method of Identifying Feedback Topology, Voltage Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback, Stability of Feedback Amplifiers.

UNIT II OSCILLATORS **9**

Classification of Oscillators, Conditions for Oscillation, General form of an LC Oscillator Hartley Oscillator, Colpitts Oscillator, Clapp Oscillator, RC Oscillators, RC Phase Shift Oscillators, Wien-Bridge Oscillator, TwinT Oscillator, Crystal Oscillators.

UNIT III TUNED AMPLIFIERS **9**

Small Signal Tuned Amplifiers, Effect of Cascading Single Tuned & Double tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Comparison of Tuned Amplifiers, Large Signal Class – C Tuned Amplifiers – Stability of Tuned Amplifiers, Hazeltine Neutralization.

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

Waveform Shaping Circuits - Diode clippers – Clampers – Multivibrators - Triggering Methods for Bistable Multivibrators- Schmitt Trigger

UNIT V BLOCKING OSCILLATORS AND TIME BASE GENERATORS **9**

UJT Sawtooth Generator - Pulse Transformers - Blocking Oscillator and its types –Voltage and Current Time Base Circuits

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the concept of feedback amplifiers
- elaborate the concept of oscillators
- comprehend the concept of tuned amplifiers
- analyse various types of multivibrators
- explain the basic concepts of blocking oscillators

TEXT BOOKS

1. Donald L.Schilling, Charles Belove, ―Electronic Circuits‖, 3rd edition, McGraw Hill, 1989.
2. Salivahanan.S, Sureshkumar.N, ―Electronic Devices and Circuits‖, 3rd edition, McGraw Hill, 2014

REFERENCES

1. JacobMillman, Christos C.Halkias, ―Electronic Devices and Circuits‖, Tata McGraw Hill, 1991.
2. F.Bogart Jr., ―Electronic Devices and Circuits‖, 6th edition, Pearson Education, 2007.
3. Donald.A.Neamen, ―Electronic Circuit Analysis and Design‖, 2nd edition, Tata McGraw Hill, 2007.
4. Adel.S.Sedra, Kenneth C.Smith, ―Micro Electronic Circuits‖, 5th edition, Oxford University Press, 2004.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	3	3	-	-	3	-	-	-	-	-	-	-	3	3

EC16402 COMMUNICATION THEORY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know the basics of communication
- understand various Amplitude modulation and demodulation systems
- acquire knowledge about various Angle modulation and demodulation systems
- know the working of transmitters and receivers.
- understand the effect of noise on communication systems.

UNIT I AMPLITUDE MODULATION 9

Elements of an Electrical communication system-Communication channel and their characteristics Need for modulation- Amplitude Modulation – Definition- single tone modulation-Phasor representations- power relations in AM waves- Generation of AM waves- Detection of AM Waves DSB MODULATION : Double side band suppressed carrier modulators- time domain and frequency domain description-Generation of SSB AM Modulated Wave - Demodulation of SSB Waves-principles of Vestigial Side Band modulation, comparison of AM system.

UNIT II ANGLE MODULATION 9

Basic concepts- Frequency Modulation & Phase Modulation: Single tone frequency modulation Spectrum Analysis of Sinusoidal FM Wave- Narrow band FM- Phasor representation - Wide band FM Constant Average Power- Transmission bandwidth of FM Wave - Generation of FM Waves: Direct and Indirect FM- Detection of FM Waves: Balanced Slope detector- Foster Seeley discriminator- Ratio detector- Phase locked loop method of FM detection- Comparison of FM and AM.

UNIT III RADIO TRANSMITTERS AND RECEIVERS 9

Radio Transmitter - Classification of Transmitter: AM Transmitter- FM Transmitter – Variable reactance type and phase modulated FM Transmitter- frequency stability in FM Transmitter-Radio Receiver - Receiver Types - Tuned radio frequency receiver- Super heterodyne receiver- RF section and Characteristics - Frequency changing and tracking- Intermediate frequency- AGC- FM Receiver Amplitude limiting- Comparison with AM Receiver.

UNIT IV NOISE 9

Noise sources and types -Noise figure- Calculation of noise figure- noise bandwidth- Equivalent noise resistance - Noise figure of cascaded stages-noise figure measurement- Noise temperature- Available Noise Power Noise in Analog communication System- Noise in DSB, SSB, AM and FM Systems Threshold effect in FM System- Pre-emphasis & De-Emphasis in FM.

UNIT V INFORMATION THEORY 9

Entropy - Discrete Memory less channels - Channel Capacity - Hartley - Shannon law - Source coding theorem - Huffman & Shannon - Fano codes.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the basics of AM communication systems
- design Angle modulated communication systems

- elaborate the transmission and reception concept of communication system
- analyze the noise performance of AM and FM systems
- explainthe concepts of Discrete Memoryless channels

TEXT BOOKS

1. Wayne Tomasi, "Electronic Communication Systems Fundamentals through Advanced", 5th Edition, Pearson Education Inc, 2004.

REFERENCES

1. H Taub& D.Schilling, Gautam Sahe, "Principles of Communication Systems", Tata McGraw Hill, 3rd Edition, 2007.
2. Simon Haykin, "Communication Systems", John Wiley, 5th Edition, 2009.
3. B.P.Lathi, "Communication Systems", BS Publication, 2006.

WEB LINKS

1. http://nptel.ac.in/video.php?subjectId=117102059
2. https://www.youtube.com/watch?v=GqBSyLRHDeE
3. https://www.youtube.com/watch?v=Z-Hw3CpPVj0

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	3	-	3	3
CO2	3	3	-	-	-	-	-	-	-	-	3	-	3	3
CO3	3	3	-	-	-	-	-	-	-	-	3	-	3	3
CO4	3	3	-	-	-	-	-	-	-	-	3	-	3	3
CO5	3	3	-	-	-	-	-	-	-	-	3	-	3	3

EC16403 LINEAR INTEGRATED CIRCUITS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know the basics of operational amplifier
- learn linear and nonlinear applications of operational amplifier
- study the applications of analog multiplier and PLL
- understand the theory of analog and digital conversion
- know basic knowledge of special function IC's

UNIT I INTEGRATED CIRCUIT FABRICATION AND BASICS OF OPERATIONAL AMPLIFIER 9

Integrated Circuit classification, Fundamentals of Monolithic IC Technology, Basic Fabrication process Fabrication of a typical circuit – Active and passive components of ICs - Operational amplifier – Basic information of Op-Amps – Ideal Op Amp –operational amplifier Internal circuit– Examples of IC Op-Amps - DC, AC Characteristics of Op-Amp –virtual ground, frequency compensation techniques - slew rate.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Basic Op-Amp applications (sign changer, scale changer, voltage follower, adder and subtractor) – Instrumentation amplifier – Voltage-to-Current and Current-to-Voltage converter – Logarithmic amplifier - Anti-logarithmic amplifiers Differentiator - Integrator - Comparator – Schmitt trigger – Active filters – Design of Low pass, high pass and band pass filters – Precision rectifiers.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analog multiplier IC – applications - Analysis of four quadrant and variable Trans-conductance multipliers –PLL: Basic principles-Phase Detector/Comparator- Voltage controlled Oscillator – Monolithic PLL - PLL applications – Frequency multiplier - AM, FM and FSK demodulators - Frequency synthesizers – Frequency translation.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Introduction - basic DAC techniques: Binary weighted resistor type – R-2R ladder type – sample and hold circuits – Analog to-Digital converters: Flash type ADC – Counter type ADC –Successive approximation register type ADC- Dual slope ADC – DAC / ADC Specifications.

UNIT V SPECIAL FUNCTION ICS 9

Waveform generators – Basic principles of sine wave oscillators – Astable and monostable multivibrators using Op-Amp ICL8038 Function Generator – 555 timer: description of functional diagram – Astable, monostable operation – IC 723 general purpose voltage regulator – switching regulator – Switched capacitor filter – LM380 audio amplifier – Opto couplers and fiber optic ICs.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the basic concepts of operational amplifier
- elaborate the working and applications of operational amplifier

- explain about PLL applications in modulator circuits
- elaborate the working of analog and digital communication circuits
- demonstrate the working of special function IC's

TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., Fourth edition 2010.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill, 3rd edition 2007.

REFERENCES

1. William D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 2004.
2. David L.Terrell, "Op Amps-Design, Application, and Troubleshooting", Elsevier publications 2005.
3. Ramakant A. Gayakwad, "OP - AMP and Linear IC's", Prentice Hall, 1994.
4. Botkar K.R., "Integrated Circuits", Khanna Publishers, 1996.

WEB LINKS

1. http://www.ee.iisc.ernet.in/new/people/faculty/prasantg/downloads/opamp_circuits.pdf
2. http://cc.ee.ntu.edu.tw/~lhlu/eecourses/Electronics1/Electronics_Ch2.pdf
3. http://www.electronics.dit.ie/staff/ypanarin/Lecture%20Notes/DT0214/7AnalogMultipliers%284p%29.pdf
4. http://astro.temple.edu/~silage/Chapter8MS.pdf

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	3	3	-	-	3	-	-	-	-	-	-	-	3	3

EC16404 CONTROL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge on control system modelling
- understand the concept of time domain analysis of control systems
- Tacquire knowledge about the frequency response analysis using various plots
- study methods to analyze the stability of control systems
- know the concept of state variable analysis in control systems

UNIT I CONTROL SYSTEM MODELING 9

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation – Transfer function concept- Modelling of Electric systems, Translational and rotational mechanical systems – Block diagram reduction Techniques – Signal flow graph – Mason's gain formula

UNIT II TIME RESPONSE ANALYSIS 9

Standard Test Signals - Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Nichol's Chart in Control System Analysis Series, Parallel, seriesparallel Compensators

UNIT IV STABILITY ANALYSIS 9

Stability-Location of roots in S plane for stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Nyquist Stability Criterion.

UNIT V STATE VARIABLE ANALYSIS 9

State space representation of Continuous Time systems – State equations- Transfer function from state Variable representation – Solutions of the state equations- Concepts of Controllability and Observability

TOTAL PERIODS 45

COURSE OUTCOMES

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

- determine the models of control systems and their representation
- Learn time domain techniques to design a control system
- understand the basic frequency response plots
- identify the major causes that affect the stability of a control system

- know the concept of state variable analysis of control systems

TEXT BOOKS

1. J.Nagrath and M.Gopal, ―Control System Engineering‖, New Age International Publishers, 5th Edition, 2007.
2. Katsuhiko Ogata, ―Modern Control Engineering‖, second edition, Prentice Hall of India Private Limited, New Delhi, 1995.

REFERENCES

1. Benjamin.C.Kuo, ―Automatic control systems‖, Prentice Hall of India, 7th Edition,1995
2. M.Gopal, ―Control System – Principles and Design‖, Tata McGraw Hill, 2nd Edition, 2002
3. Schaum's Outline Series, ―Feedback and Control Systems‖, Tata McGraw-Hill, 200
4. John J.D'azzo& Constantine H.Houpis, ―Linear control system analysis and design‖, Tata McGraw-Hill Inc., 1995
5. Richard C. Dorf& Robert H. Bishop, ―Modern Control Systems‖, Addidon –Wesley, 1999

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	-	3	-	-	-	-	-	-	-	-	3	3

EC16405 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the fields and potentials due to static charges
- know about static magnetic fields
- understand how materials affect electric and magnetic fields
- learn the relation between the fields under time varying situations
- gain the knowledge of the propagation of uniform plane waves

UNIT I ELECTRICSTATIC FIELDS 9

Co-ordinate systems, Vector differential operators, Coulombs law, Divergence theorem, Stokes theorem, Electric field intensity – charge distribution, electric flux density –Applications of Gauss's law, Electric potential, Electric dipole, Energy and Energy density.

UNIT II ELECRIC FIELDS IN MATERIAL SPACE 9

Conductors – Polarization in dielectrics, Dielectric constant and strength, Uniqueness theorem - continuity equation, Boundary conditions, Poisson's and Laplace's equation – General procedure for solving Poisson's and Laplace's equation– Resistance and Capacitance, Method of images.

UNIT III MAGNETOSTATIC FIELDS 9

Biot – Savart's law, Ampere's circuit law - Magnetic flux Density and Field intensity – applications of Ampere's Law –Magnetic scalar and vector potentials -Force due to magnetic fields -Magnetic Torque and moment, Magnetization in materials, magnetic boundary conditions, Inductors and Inductances magnetic Energy – magnetic circuits.

UNIT IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS 9

Faradays law, Transformer and motional electromotive forces, The equation of continuity for time varying fields – Inconsistency of Ampere's Law - Maxwell's equation, Displacement current, time varying potentials – time harmonic fields – Electromagnetic spectrum.

UNIT V ELECTROMAGNETIC WAVE PROPAGATION 9

Wave propagation in lossy dielectric – plane waves in lossless dielectrics-plane waves in free space-plane waves in good conductors-power and the Poynting vector-Reflection of plane waves at normal incidence\ Reflection of plane wave at oblique incidence- Transmission line analogy-Application Note- microwaves.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze field potentials due to static changes
- analyze the effect of field on materials

- analyze field intensity due to static magnetic fields
- analyze the relation between the fields under time varying situations
- explain the principles of propagation of uniform plane waves

TEXT BOOKS

1. Mathew.N.O.Sadiku, ―Principles of Electromagnetics‖, Oxford UniversityPress,2011
2. E.C. Jordan and K.G. Balmain, ―Electromagnetic Waves and Radiating Systems‖, Printice-hall of India/PHI , 2nd edition, 2007.

REFERENCES

1. Kraus, Fleisch, ―Electromagnetics with Applications‖, McGraw-Hill, 2005
2. David .K.Cheng, ―Field and wave Electromagnetics‖, 2nd edition, Pearson education, 2004.
3. Karl E.Longman and Sava V.Savov, ―Fundamentals of Electro-Magnetics‖, Prentice Hall of India, 2006
4. W.H.Hayt and A.Buck, ―Engineering ElectroMagnetics‖, 7th Edition, McGraw Hill, 2006

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	3	3	-	-	3	-	-	-	-	-	-	-	3	3

EC16406 ELECTRONIC CIRCUITS – II LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- gain hands on experience in designing feedback amplifiers
- acquire the knowledge about the design of oscillators
- learn the simulation software used for circuit design
- understand the concepts of Multivibrators

LIST OF EXPERIMENTS

1. Design of Feedback amplifier circuits
2. Frequency response of class C tuned amplifier
3. Design of integrator and differentiator
4. Design of RC oscillators (RC Phase shift / Wien bridge/Twin-T)
5. Design of LC oscillators (Hartley /Colpitts /Clapp)
6. Design of multivibrators (Astable / monostable / bistable)
7. Design of clippers and clampers

SIMULATION USING PSPICE /MULTISIM/EQUIVALENT SOFTWARE PACKAGE

1. Simulation of clippers and clampers
2. Simulation of Multivibrators
3. Simulation of integrator and differentiator

TOTAL PERIODS 60

COURSE OUTCOMES

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

- Analyze feedback amplifiers
- Learn about differential and power amplifiers
- Design of oscillators and Multivibrators for the given specifications
- Analyze electronic circuits through simulation

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	3	3	-	3	3	-	-	-	-	-	-	3	3
CO2	-	3	3	-	3	3	-	-	-	-	-	-	3	3
CO3	-	3	3	-	3	3	-	-	-	-	-	-	3	3
CO4	-	3	3	-	3	3	-	-	-	-	-	-	3	3

EC 16407 LINEAR INTEGRATED CIRCUITS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- study the application of operational amplifier
- know the design of multivibrators using operational amplifier and 555 timer
- design oscillators and active filters in various applications.
- simulate the Op-Amp application circuits using PSPICE software

LIST OF EXPERIMENTS

Design and testing of

1. Inverting, Non inverting amplifier and differential amplifier
2. Instrumentation amplifier
3. Integrator and Differentiator
4. Active low pass, High pass and band pass filters.
5. Astable, Monostable Multivibrators and Schmitt trigger (using IC 741)
6. Phase shift Oscillator and Wien bridge oscillators (using IC 741)
7. Astable and monostable Multivibrators using NE555 Timer
8. Frequency multiplier using PLL IC
9. Voltage regulation using LM317 and LM723

Simulation Experiments

10. Simulation of (i) Instrumentation amplifier,(ii) Integrator and Differentiator,(iii) Active low pass, High pass and band pass filters, (iv) Astable, Monostable Multivibrators and Schmitt trigger (using IC 741), (v) Phase shift Oscillator and Wien bridge oscillators (using IC 741)

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design and test the Op-amp applications
- design oscillators and multivibrators for various applications
- analyze the working of power supply
- simulate circuits using Op-amp

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	-	3	3	-	-	-	-	-	-	3	3	3
CO3	3	3	-	3	3	-	-	-	-	-	-	3	3	3
CO4	3	3	-	3	3	-	-	-	-	-	-	3	3	3

EC16501 **MICROPROCESSOR AND MICROCONTROLLER** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the architecture of 8086 microprocessor.
- learn the design aspects of I/O and Memory Interfacing circuits.
- acquire the knowledge about programming of 8086 microprocessor.
- study the architecture of 8051 microcontroller.
- know the concepts of interfacing microcontroller

UNIT I 8086 MICROPROCESSOR **9**

Introduction to microprocessor - Bus-Address bus- Data bus and Control bus- 8086 Microprocessor architecture - Pipelining - Memory Segmentation - Addressing modes - Instruction set and assembler directives – Connecting Microprocessor and I/O devices - Interrupts - Assembly language programming.

UNIT II 8086 SYSTEM BUS STRUCTURE **9**

8086 signals - Basic configurations - System bus timing - System design using 8086 - I/O programming Multiprogramming - Multiprocessor configurations - Closely coupled and loosely Coupled configurations Coprocessor.

UNIT III I/O INTERFACING **9**

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard /display controller - Interrupt controller - DMA controller Programming and applications Case studies: Traffic Light control- Washing Machine and Stepper Motor.

UNIT IV 8051 MICROCONTROLLER **9**

Architecture of 8051 - Special Function Registers (SFRs) - Ports of 8051 - Addressing modes - Instruction set Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER **9**

Keyboard Interfacing - ADC- DAC Interfacing - External Memory Interface - Case studies: Traffic light controller Stepper Motor - Washing Machine.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- synthesize programs in 8086 microprocessor.

- analyze and design multiprocessor system
- apply the concept of I/O devices.
- evaluate the memory interfacing circuits.
- examine the 8051 microcontroller based systems.

TEXT BOOKS

1. Krishna Kant- "Microprocessors and Microcontrollers Architecture- programming and system design using 8085- 8086- 8051 and 896". PHI 2007.
2. Kenneth J.Ayala- "The 8051 Microcontroller Architecture- Programming and applications"- Second edition- Penram International

REFERENCES

1. Mohamed Ali Mazidi- Janice GillispieMazidi- RolinMcKinlay- "The 8051 Microcontroller and Embedded Systems: Using Assembly and C"- Second Edition- Pearson education- 2011
2. DoughlasV.Hall- "Microprocessors and Interfacing- Programming and Hardware"-TMH-2012
3. Yu-Cheng Liu- Glenn A.Gibson- "Microcomputer Systems: The 8086 / 8088 Family Architecture- Programming and Design"- Second Edition- Prentice Hall of India- 2007.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO2	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO3	3	1	1	2	1	-	2	-	-	-	1	1	2	1
CO4	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO5	3	1	1	2	1	-	2	-	-	-	1	1	2	1

EC16502 DIGITAL SIGNAL PROCESSING 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- learn discrete Fourier transform and its properties
- know the characteristics of IIR filters- learn the design of infinite impulse response filters for filtering the undesired signals
- know the characteristics of FIR filters- learn the design of finite impulse response filters for filtering the undesired signals
- understand Finite word length effects
- study the concept of Digital signal processors and applications

UNIT I DISCRETE FOURIER TRANSFORM 15

DFT and its properties- Relation between DTFT and DFT- Radix-2 FFT algorithms - butterfly diagram – DFT computation using Decimation in time and Decimation in frequency algorithms- Overlap-add and save Methods.

UNIT II INFINITE IMPULSE RESPONSE FILTER DESIGN 15

Design of analogue Butterworth and Chebyshev Filters- Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform – pre warping - Realization of IIR Digital filters- Realization using direct- cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE FILTER DESIGN 15

Linear phase FIR filters - Design using Rectangular- Hamming- Hanning and Blackmann Windows – Frequency sampling method - Realization of FIR filters - Direct form I and II- and Lattice structure.

UNIT IV FINITE WORDLENGTH EFFECTS IN DIGITAL FILTERS 15

Fixed point and floating point number representations - Comparison - Quantization - Quantization Error Quantization Noise Power - Zero input Limit Cycle Oscillations - Overflow Limit Cycle Oscillations – Signal Scaling.

UNIT V DIGITAL SIGNAL PROCESSORS AND APPLICATION 15

Overview of Digital Signal Processors - Selecting Digital Signal Processors - Applications of PDSPs – Von Neumann Architecture - Harvard Architecture - VLIW Architecture - Multiply Accumulate Unit (MAC) - Pipelining - Architecture of TMS320C50.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- apply DFT for the analysis of digital signals and systems
- analyze the design of IIR filters

- synthesize the design of IIR filters
- characterize finite word length effect in filters
- understand the working of digital signal processors

TEXT BOOKS

1. John G. Proakis &Dimitris G.Manolakis- "Digital Signal Processing-Principles- Algorithms & Applications"- Fourth Edition- Pearson Education / Prentice Hall- 2007.
2. P.Ramesh Babu" Digital Signal Processing"- Fourth Edition- Scitech-2007.

REFERENCES

1. Emmanuel C.Ifeachor- &Barrie.W.Jervis- "Digital Signal Processing"- Second Edition- Pearson Education / Prentice Hall- 2002.
2. Sanjit K. Mitra- "Digital Signal Processing-A Computer Based Approach"- Tata McGraw Hill- 2007.
3. A.V.Oppenheim- R.W. Schafer and J.R. Buck-"Discrete-Time Signal Processing"- 8th Indian Reprint- Pearson- 2004.
4. Andreas Antoniou- "Digital Signal Processing"- Tata McGraw Hill- 2006.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	-	-	-	-	-	-	1	2	1
CO2	3	1	2	2	1	-	-	-	-	-	-	1	2	1
CO3	3	1	2	2	1	-	2	-	-	-	1	1	2	1
CO4	3	1	2	2	-	-	-	-	-	-	-	1	2	1
CO5	3	1	2	-	-	-	2	-	-	-	1	1	2	1

EC16503 COMPUTER NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the network functionalities of different layers.
- be familiar with flow and error control protocols and techniques.
- know about the routing protocols
- learn the concepts of congestion control algorithms and Quality of Service
- study about various applications and network security.

UNIT I DATA COMMUNICATION AND PHYSICAL LAYER 9

Data Communication - Components - Data flow; Networks - Criteria- Physical Structure - Topology - OSI Model- Transmission Impairment- Transmission media: Guided media -Twisted pair cable- Coaxial cable- Fiber optic cable- Unguided media - Switching - Circuit switching networks - Packet switching networks.

UNIT II DATA LINK LAYER 9

Services- Link-Layer Addressing - Framing- Noiseless Channels - Noisy channel protocols - HDLC- CSMA/CD- CSMA/CA- IEEE 802.3- IEEE802.11- Bluetooth.

UNIT III NETWORK LAYER 9

Services- Performance - IPV4 addresses - Classful Addressing- Classless Addressing- DHCP- ICMP- IGMP- IPV6- Routing algorithm - Distance-Vector Routing- Link-State Routing - Unicasting - RIP- OSPF. Multicast routing DVMRP- PIM.

UNIT IV TRANSPORT LAYER 9

Services - Connectionless and Connection - Oriented Protocols - Port Numbers- UDP- TCP: Flow Control- Error Control- TCP Congestion control. QoS-Token bucket and Leaky bucket

UNIT V APPLICATION AND NETWORK SECURITY 9

Domain Name Space- E-Mail - SMTP- POP- IMAP - WWW- HTTP- Network Security - Categories- Symmetric- Key Cryptography- Asymmetric-Key Cryptography.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the different types of layers in a networks.
- elaborate flow and error control techniques to send data in a network.

- acquire knowledge about the routing algorithms.
- synthesize the congestion control techniques.
- elucidate about the various applications and security issues.

TEXT BOOKS

1. Behrouz A. Foruzan- Data communications and Networking- The McGraw-Hill Companies Inc. 4th edition. (2013)
2. William Stallings- Data and Computer Communication- (2010).

REFERENCES

1. Larry L.Peterson&S.Peter Davie- Computer Networks- Harcourt- (2008).
2. James F.Kurose& Keith W.Ross- Computer Networking A Top-down Approach Featuring the Internet- PHI- (2007).
3. Andrew S.Tannenbaum- Computer Networks- PHI- (2010).

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	3	2	1	-	-	1	1	1	2	1
CO2	2	1	-	-	3	2	1	-	-	1	1	1	2	1
CO3	2	1	-	-	3	2	1	-	-	1	1	1	2	1
CO4	2	1	-	-	3	2	1	-	-	1	1	1	2	1
CO5	2	1	-	-	3	2	1	-	-	1	1	1	2	1

CH16501 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3
(Common to ECE & MCT Branches)

COURSE OBJECTIVES

To enable the students to

- know the constituents of the environment and the precious resources in the environment
- conserve all biological resources
- understand the role of human being in maintaining a clean environment and useful environment for the future generations
- maintain the ecological balance and preserve bio-diversity.
- the role of government and non-government organizations in environment management.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment: Definition- scope - importance - need for public awareness. Forest resources: Use –over exploitation- deforestation - case studies- mining - effects on forests and tribal people. Water resources -Use over utilization of surface and ground water- floods - drought - conflicts over water. Mineral resources Use - exploitation - environmental effects of extracting and using mineral resources - Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture -fertilizer-pesticide problems - water logging - salinity. Energy resources: Growing energy needs - renewable and non-renewable energy sources- Role of an individual in conservation of natural resources

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers -decomposers –energy flow in ecosystem-- ecological succession - food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem aquatic ecosystems (lakes- rivers- oceans- estuaries). Biodiversity: Introduction- definition (genetic – species ecosystem) diversity. Value of biodiversity: Consumptive use - productive use - social values - ethical values aesthetic values. Biodiversity level: Global - national - local levels- India as a mega diversity nation- hotspots of biodiversity. Threats to biodiversity: Habitat loss - poaching of wildlife - man wildlife conflicts - endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

UNIT III POLLUTION 9

Pollution: Définition -air pollution - water pollution - soil pollution - marine pollution - noise pollution – thermal pollution - nuclear hazards. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - pollution. Disaster management: Floods – earthquake cyclone - landslides. Electronic waste-Sources-Causes and its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

Sustainable development : Unsustainable to sustainable development - urban problems related to energy. Water conservation - rain water harvesting - watershed management- Resettlement and rehabilitation of people. Environmental ethics: Issues - possible solutions - climate change - global warming and its effects on flora and fauna - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust - Environment protection act: Air (Prevention and Control of Pollution) act - water (Prevention and control of Pollution) act - wildlife protection act - forest conservation act - issues involved in enforcement of environmental legislation.

UNIT V HUMAN POPULATION AND ENVIRONMENT 9

Human population: Population growth - variation among nations - population explosion - family welfare programme and family planning - environment and human health - Human rights - value education - HIV/AIDS

Swine flu - women and child welfare. Role of information technology in environment and human health.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- know the relationship between the human population and environment.
- understand the basic concepts of environment studies and natural resources
- gain the knowledge about ecosystem and biodiversity.
- have knowledge about causes- effects and control measures of various types of pollution.
- understand the social issues and various environmental acts.

TEXT BOOKS

1. Raman Sivakumar- Introduction to Environmental Science and Engineering- 2nd Edn- Tata McGraw Hill Education Private Limited- New Delhi-(2010).
2. Benny Joseph- "Environmental Science and Engineering"- Tata McGraw Hill- (2010).

REFERENCES

1. S. Divan- Environmental Law and Policy in India- Oxford University Press- New Delhi- 2001.
2. A.K.De- Environmental Chemistry- VI edition-2015 NewAge International (P) ltd publication- NewDelhi.
3. C.S.Rao- Environmental Pollution and Control engineering- Vedition-NewAge International (P) ltd Publication- New Delhi 110002
4. Clair Nathan Sawyer- Perry L. McCarty- Gene F. Parkin- "Chemistry for Environmental Engineering and Sciences- V Edition-2013-Tata M'cGraw Hill pub-Newdelhi110008

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	3	3	-	-	-	2	1	2	1
CO2	2	1	-	-	2	3	3	-	-	-	2	1	2	1
CO3	2	1	-	-	2	3	3	-	-	-	2	1	2	1
CO4	2	1	-	-	2	3	3	-	-	-	2	1	2	1
CO5	2	1	-	-	2	3	3	-	-	-	2	1	2	1

EC16151 TRANSMISSION LINES AND WAVEGUIDES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- be familiar with propagation of signals through lines.
- understand signal propagation with suitable properties.
- study the filters for network system.
- know the radio propagation in guided systems.
- learn about resonators.

UNIT I TRANSMISSION LINE THEORY AND PARAMETERS 9

Introduction to different types of transmission lines - Transmission line Equation -Solution -Infinite line concept - Distortion less line -Loading -Input impedance- Losses in Transmission lines-Reflection loss Insertion loss-Return loss- Transmission line parameters at radio frequencies.

UNIT II IMPEDENCE MATCHING AND TRANSFORMATION 9

Reflection Phenomena -Standing waves -λ/8- λ/4 & λ/2 lines- λ/4 Impedance transformers- Stub Matching Single and Double Stub -Smith Chart and Applications - Solution of Problems using smith chart.

UNIT III FILTER DESIGN 9

Characteristic impedance of symmetrical networks - Filter fundamentals- Design of filters: Constant K LPF-HPF and BPF Filter design- m-derived filters - Composite filters-Fundamentals of Attenuators and Equalizers.

UNIT IV RECTANGULAR WAVEGUIDES 9

Waves between Parallel Planes -Characteristic of TE - TM and TEM waves -Velocities of propagation Solution of wave Equation in Rectangular guides -TE and TM modes - Dominant Mode- Attenuation Mode Excitation-Rectangular cavity resonator.

UNIT V CYLINDRICAL WAVE GUIDES 9

Solution of wave equation in circular guides- TE and TM wave in circular wave guides- Wave impedance Attenuation- Phase velocity and Group velocity - Mode excitation- Formation of cylindrical cavity- Cavity resonator and Q for dominant mode.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the propagation of signals through transmission lines.
- analyse the signal propagation with suitable properties.

- synthesis knowledge about filter system
- apply the concept of radio propagation in guided systems.
- evaluate waveguides and cavity resonators in several applications.

TEXT BOOKS

1. John D Ryder "Networks lines and fields`` Prentice Hall of India- 2005.
2. G.S.N Raju "Electro Magnetic Field Theory and Transmission Lines " Pearson Education- First edition 2005.

REFERENCES

1. Reinhold Ludwig and Gene Bogdanov- "RF Circuit Design: Theory and Applications"- Pearson Education Inc.2011
2. Bhag Guru &Hiziroglu-"Electromagnetic Field Theory Fundamentals`` Second edition Cambridge University press-2005

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	1	1	1	1
CO2	3	2	2	-	2	2	2	-	-	-	1	1	1	1
CO3	3	2	2	-	2	2	2	-	-	-	1	1	1	1
CO4	3	2	2	-	-	-	2	-	-	-	1	1	1	1
CO5	3	2	2	-	-	-	2	-	-	-	1	1	1	1

EC16152 INFORMATON THEORY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of error-control coding.
- analyze the encoding and decoding of digital data streams
- learn the methods for the generation of codes and decoding techniques.
- acquire the knowledge of compression and decompression techniques
- gain the knowledge of concepts in multimedia communication.

UNIT I INFORMATION THEORY 9

Uncertainty- Information and Entropy - Source coding Theorem - Huffman coding -Shannon Fano coding Discrete Memory less channels - channel capacity - channel coding Theorem - Channel capacity Theorem.

UNIT II DATA AND VOICE CODING 9

Differential Pulse code Modulation - Adaptive Differential Pulse Code Modulation - Adaptive sub band coding - Delta Modulation - Adaptive Delta Modulation - Coding of speech signal at low bit rates (Vocoders- LPC).

UNIT III ERROR CONTROL CODING 9

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

UNIT IV COMPRESSION TECHNIQUES 9

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

UNIT V AUDIO AND VIDEO CODING 9

Linear Predictive coding - code excited LPC - Perceptual coding- MPEG audio coders - Dolby audio coders - Video compression - Principles - Introduction to H.261 & MPEG Video standards.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine an application with error-control.
- apply the audio and video compression techniques
- analyse text and image compression techniques
- compare compression and decompression techniques.
- synthesize the concepts of multimedia communication

TEXT BOOKS

1. Simon Haykin- "Communication Systems"- 4th Edition- John Wiley and Sons- 2001.
2. Fred Halsall- "Multimedia Communications- Applications Networks Protocols and Standards"- Pearson Education- Asia 2002; Chapters: 3-4-5.

REFERENCES

1. Mark Nelson- "Data Compression Book"- BPB Publication 1992.
2. Watkinson J- "Compression in Video and Audio"- Focal Press- London- 1995.
3. K Sayood- "Introduction to Data Compression" 3/e- Elsevier 2006
4. S Gravano- "Introduction to Error Control Codes"- Oxford University Press 2007
5. Amitabha Bhattacharya- "Digital Communication"- TMH 2006

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	2	-	-	-	-	-	-	-	1	1
CO2	3	1	2	-	1	-	-	-	-	-	-	-	1	1
CO3	3	2	2	-	2	2	-	-	-	-	-	-	1	1
CO4	3	1	2	-	1	-	-	-	-	-	-	-	1	1
CO5	2	3	-	-	2	-	-	-	-	-	-	-	1	1

IT16403 OPERATING SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the basic concepts and functions of operating systems.
- understand the structure and functions of OS.
- learn about Processes- Threads and Scheduling algorithms.
- understand the principles of concurrency and Deadlocks.
- learn various memory management schemes.

UNIT I INTRODUCTION 9

Uncertainty- Information and Entropy - Source coding Theorem - Huffman coding -Shannon Fano coding- Discrete Memory less channels - channel capacity - channel coding Theorem - Channel capacity Theorem.

UNIT II PROCESS MANAGEMENT AND DEADLOCK 9

CPU Scheduling: Scheduling criteria - Scheduling algorithms - Multiple - processor scheduling - Real time scheduling - Algorithm Evaluation. Process Synchronization: The critical-section problem -Synchronization hardware - Semaphores - Classic problems of synchronization - Monitors. Deadlock: System model - Deadlock Characterization - Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance -Deadlock detection - Recovery from deadlock. Case Study: Process scheduling in Linux.

UNIT III MEMORY MANAGEMENT 9

Main Memory: Background - Swapping - Contiguous memory allocation - Paging - Segmentation with paging. Virtual Memory: Background -Demand paging - Page replacement - Allocation of frames -Thrashing. Case Study: Memory management in windows and Solaris.

UNIT IV FILE SYSTEMS 9

File-System Interface: File concept - Access methods - Directory structure - File system mounting - File sharing - Protection. File-System Implementation: Directory implementation- Allocation methods-Free-space management efficiency and performance - recovery - Network file systems. Case studies: File system in Windows XP.

UNIT V I/O SYSTEMS AND MASS STORAGE MANAGEMENT 9

I/O Systems - I/O Hardware - Application I/O interface - kernel I/O subsystem -streams - performance. Mass-Storage Structure: Disk attachment - Disk scheduling - Disk management -Swap-space management - RAID - stable storage. Case study: I/O in Linux.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine various scheduling algorithms.
- apply the principles of concurrency.
- design deadlock- prevention and avoidance algorithms.
- compare and contrast various memory management schemes.
- synthesize and manage the disk effectively .

TEXT BOOKS

1. Silberschatz- Galvin- and Gagne- "Operating System Concepts"- Ninth Edition- Wiley India Pvt Ltd- 2013.
2. William Stallings- "Operating Systems - internals and design principles"- Prentice Hall- 7thEdition- 2011.

REFERENCES

1. Andrew S. Tanenbaum- "Modern Operating Systems"- Fourth Edition- Pearson Education- 2014.
2. Gary J.Nutt- "Operating Systems"- Pearson/Addison Wesley- 3rd Edition- 2004.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	2	-	-	-	-	-	2	1
CO2	3	2	2	-	1	-	2	-	-	-	-	-	2	1
CO3	3	2	2	-	2	2	2	-	-	-	-	-	2	1
CO4	3	2	2	-	1	-	2	-	-	-	-	-	2	1
CO5	3	3	-	-	2	-	2	-	-	-	-	-	2	1

EC16504 DIGITAL SIGNAL PROCESSING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- generate the basic types of signals using MATLAB
- implement Linear and Circular Convolution using MATLAB
- implement FIR and IIR filters
- know the generation and convolution of signals using TMS320C5X/TMS320C 67XX DSP processors.

LIST OF EXPERIMENTS: MATLAB /SCILAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of Signals
2. Linear Convolution
3. Circular Convolution
4. Spectrum Analysis using DFT
5. FIR filter design
6. IIR filter design

DSP PROCESSOR TMS320C5X/TMS320C 67XX BASED IMPLEMENTATION

1. Study of Digital Signal Processor architecture
2. Waveform generation
3. Linear convolution
4. Circular convolution

TOTAL PERIODS 60

COURSE OUTCOMES

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

- generate the basic types of signals using MATLAB
- analyze Linear and Circular Convolution using MATLAB
- implement FIR and IIR filters
- generate and convolute the signals using TMS320C5X/TMS320C 67XX DSP processors.

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO2	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO3	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO4	1	1	-	2	3	-	-	-	-	-	2	1	2	-

EC16505 MICROPROCESSOR AND MICROCONTROLLER LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- introduce ALP concepts and features
- write ALP for arithmetic and logical operations in 8086 and 8051
- differentiate Serial and Parallel Interface
- interface different I/O s with Microprocessors

8086 Programs using kits

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion and decimal arithmetic.
4. String manipulations- Sorting and Searching
5. Counters and Time Delay

8086 Programs using MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. String manipulations- Sorting and Searching

Peripherals and Interfacing Experiments

1. Traffic light control
2. Stepper motor control
3. Key board and Display Control
4. Serial interface and Parallel interface
5. A/D- D/A interface and Waveform Generation

8051 Experiments using kits

1. Basic arithmetic and Logical operations
2. A/D- D/A interface and Waveform Generation

TOTAL PERIODS 60

COURSE OUTCOMES

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

- write ALP Programs for fixed- Floating Point and Arithmetic
- interface different I/O s with processor
- generate waveforms using Microprocessors
- execute Programs in 8051

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO2	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO3	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO4	1	1	-	2	3	-	-	-	-	-	2	1	2	-

EC16601 DIGITAL COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the basics of different digital communication techniques.
- acquire the concept of various waveform coding.
- study the concept of Eye pattern to analyze ISI.
- learn the performance of various digital modulation techniques.
- understand the error control coding techniques for data transmission.

UNIT I BASEBAND FORMATTING TECHNIQUES 9

Sampling process - Impulse sampling- Natural sampling- Sampler implementation - Aliasing – Quantization Uniform Quantization- Non-Uniform Quantization-Logarithmic Companding of speech signal - Pulse Code Modulation - Noise Consideration in PCM Systems - Time Division Multiplexing.

UNIT II WAVEFORM CODING TECHNIQUES 9

Pulse Amplitude Modulation - Pulse Width Modulation - Pulse Position Modulation - Prediction filtering and Differential Pulse Code Modulation - Delta Modulation - Adaptive Differential Pulse Code Modulation and Adaptive Delta Modulation - Linear Predictive Coding.

UNIT III BASEBAND TRANSMISSION 9

Properties of Line Codes - Power Spectral Density of Unipolar / Polar RZ and NRZ - Bipolar NRZ – ISI Nyquist criterion for distortion less transmission - Pulse shaping - Correlative coding - Eye Pattern Equalizers: Linear and Non Linear Equalizers - Adaptive Equalization - LMS Algorithm.

UNIT IV DIGITAL MODULATION TECHNIQUES 9

Signaling scheme- Generation- Detection- Probability of error and Power Spectral Density of Coherent Modulation Techniques: BPSK- BFSK- QPSK- QAM - Non Coherent Binary Modulation Technique: FSK Differential Phase Shift Keying.

UNIT V ERROR CONTROL CODING 9

Channel coding theorem - Linear Block Codes: Hamming Codes - Cyclic Codes: Systematic Cyclic Codes Non- Systematic Cyclic Codes - Convolution Codes - Viterbi Algorithm- Trellis Coded Modulation – Turbo Codes

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concept of sampling and pulse code modulation for analog signals.
- examine the concept of various coding techniques.
- synthesize the concept of Eye pattern to analyze in ISI.
- analyze knowledge about different types of digital modulation technique.
- evaluate various error control coding

TEXT BOOKS

1. Simon Haykin- "Digital Communication"- John Willey- student reprint- 2006.
2. John G.Proakis- "Digital Communication"- McGraw Hill Fourth Edition- 2008.

REFERENCES

1. Bernard Sklar- "Digital Communication- Fundamentals and Applications" - Pearson Education Asia- Second Edition- reprint- 2002.
2. B.P.Lathi- "Modern Digital and Analog Communication Systems"- Third Edition- Oxford Press- 2007.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	2	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	1	-	-	-	-	-	-	1	1	-
CO4	3	2	1	2	1	-	-	-	-	-	-	1	1	-
CO5	3	2	2	2	2	-	-	-	-	-	-	1	1	-

EC16602 ANTENNAS AND RADARS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the antenna basic concepts.
- know the radiation characteristics of different types of antennas.
- acquire the knowledge of antenna arrays.
- study about the special antennas and their measurements.
- understand the RADARs at different frequencies.

UNIT I ANTENNA FUNDAMENTALS 9

Antenna parameters - Gain and Directivity- Radiation intensity- Beam solid angle -Effective aperture- Radiation Resistance- Beam width- Input Impedance. Reciprocity Principle- Polarization- Antenna noise Temperature- Radiation from Hertzian dipole- Half wave dipole.

UNIT II APERTURE AND LENS ANTENNAS 9

Radiation from rectangular apertures- Uniform and Tapered aperture- Horn antenna- Reflector antenna Types and feed systems- Dielectric lens and metal plane lens antennas- Slot antennas.

UNIT III ANTENNA ARRAYS 9

N element linear array- Broadside and End fire array - Concept of Phased arrays- Adaptive array- Basic principle of antenna Synthesis-Binomial array.

UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS 9

Special Antennas: Helical- Log periodic- Yagi-Uda and Micro-strip patch antenna and its application. Antenna Measurements- Radiation Pattern- Gain & Directivity Measurements.

UNIT V INTRODUCTION TO RADARS 9

Basic Introduction of Radar and Simple form of Radar Equation-Radar Block Diagram and its Frequencies. Introduction to Doppler effect-CW Radar- FMCW Radar-MTI Radar-Delay- Line Cancellers -Applications of Radar.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare the various types of radiations.

- synthesize about aperture and lens antennas.
- analyze the various antenna arrays.
- examine special antennas and their measurements.
- evaluate the different types of radars

TEXT BOOKS

1. John D Kraus-" Antennas for all Applications"- 3rd Edition- McGraw Hill- (2005).
2. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India- 2006.

REFERENCES

1. K.D. Prasad- "Antennas and Wave Propagation"- Sathyaprakasan Tech India Publications- New Delhi 2015.
2. Peyton Z. Peebles- "Radar Principles"- John wiley- 2004.
3. J.C Toomay- "Principles of Radar"- 2nd Edition -Prentice Hall of India- 2004.
4. RajeswariChatterjee- "Antenna Theory and Practice" Revised Second Edition New Age International Publishers- 2006.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	-	2	2	-	-	-	-	-	-	1	1	-
CO3	3	2	-	2	1	-	-	-	-	-	-	1	1	-
CO4	3	2	-	2	1	-	-	-	-	-	-	1	1	-
CO5	3	2	-	2	2	-	-	-	-	-	-	1	1	-

EC16603 **VLSI DESIGN** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the MOS circuit realization and various processing technologies.
- study the transistor circuit level design and realization for digital operation.
- learn the circuit characteristics and performance estimation.
- gain the knowledge about testing of CMOS.
- acquire the basics of Verilog in different types of Modeling.

UNIT I MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY 9

NMOS and PMOS transistors -Threshold voltage -Body effect -MOS device design equations-Second order effects -MOS models and small signal AC characteristics -Basic CMOS Technology.

UNIT II INVERTERS AND LOGIC GATES 9

NMOS and CMOS inverters - Stick diagram -Inverter ratio -DC characteristics -Transmission gates – CMOS logic structures -Static CMOS design -Dynamic CMOS design.

UNIT III CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION 9

Resistance estimation - Capacitance estimation- Inductance - Switching characteristics - Transistor sizing – Power dissipation and design margining -Charge sharing -Scaling.

UNIT IV CMOS TESTING 9

Need for testing-Fault models-observability- controllability- fault coverage-Design for testability- Ad-Hoc testing- Scan based test techniques-self test techniques-Boundary scan.

UNIT V VERILOG HARDWARE DESCRIPTION LANGUAGE 9

Overview of digital design with Verilog HDL -Hierarchical modeling concepts-Modules and port definitions - Gate level modeling- Data flow modeling - Behavioral modelling - HDL programs for simple combinational and sequential circuits.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will able to

- apply the basic concepts of MOS transistor logic.
- compare different CMOS designs.

- analyze the performance of CMOS circuits.
- synthesize the testing methods of CMOS.
- examine the modeling concepts of hardware description language.

TEXT BOOKS

1. Neil H. E. Weste and Kamran Eshraghian- "Principles of CMOS VLSI Design"-2nd edition- Pearson Education.
2. Wayne Wolf- "Modern VLSI Design System on chip"- Pearson Education- 2002.

REFERENCES

1. John P. Uyemura- "Introduction to VLSI Circuits and Systems"- John Wiley and Sons- Inc.- 2002.
2. Samir Palnitkar- "Verilog HDL"- 2nd Edition- Pearson Education- 2004.
3. Pucknell- "Basic VLSI Design"- Prentice Hall of India Publication- 1995.
4. Bhasker J.- "A Verilog HDL Primer"- 2nd Edition- B. S. Publications- 2001.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	2	-	-	-	-	-	-	-	1	1	-
CO2	3	-	2	2	2	-	-	-	-	-	-	1	1	-
CO3	3	-	2	2	2	-	-	-	-	-	-	1	1	-
CO4	3	-	2	2	2	-	-	-	-	-	-	1	1	-
CO5	3	-	2	2	2	-	-	-	-	-	-	1	1	-

BA16151 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basic human values for a professional.
- discuss the significance of ethics in engineering and the theories related to it.
- familiarize oneself with the role of engineer as responsible experimenters.
- expose the students to their roles and responsibilities in assessing safety and reducing risks.
- describe the global issues in ethics and role of engineers as manager and consultants.

UNIT I HUMAN VALUES 9

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

UNIT II ENGINEERING ETHICS 9

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

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining confidentiality - conflicts of interest - occupational crime - professional rights - employee rights Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE),India, etc.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Describe the basic human values for a professional.

- Understand the significance of ethics in engineering and the theories related to it.
- Be familiar with the role of engineer as responsible experimenters.
- Acquire knowledge about their roles and responsibilities in assessing safety and reducing risks.
- Discuss the global issues in ethics and role of engineers as manager and consultants.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics -Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001).
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics - An Indian Perspective",Biztantra, New Delhi, (2004).
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	2	3	-	2	-	1	1	-
CO2	3	-	-	-	-	-	2	3	-	2	-	1	1	-
CO3	3	-	-	-	-	-	2	3	-	2	-	1	1	-
CO4	3	-	-	-	-	-	2	3	-	2	-	1	1	-
CO5	3	-	-	-	-	-	2	3	-	2	-	1	1	-

EC16251 WIRELESS SENSOR NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the state of the art in wireless sensor network- architectures and applications
- study the functions of different wireless architectures
- learn the various aspects of MAC protocols
- know the concept of Infrastructure Establishment
- gain various tools and platform in the networks

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Challenges for Wireless Sensor Networks - Characteristics requirements- required mechanisms Applications of sensor networks - Enabling Technologies for Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single Node Architecture - Hardware Components - Energy Consumption of Sensor - Nodes – Operating Systems and Execution Environments - Network Architecture - Sensor Network Scenarios – Optimization Goals and Figures of Merit - Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations - MAC Protocols for Wireless Sensor Networks – Low Duty Cycle Protocols and Wakeup Concepts - S-MAC - The Mediation Device Protocol – Wakeup Radio Concepts - Address and Name Management - Assignment of MAC Addresses - Routing Protocols Energy Efficient Routing - Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control - Clustering - Time Synchronization - Localization and Positioning - Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Operating Systems for Wireless Sensor Networks - Sensor Node Hardware - Berkeley Motes Programming Challenges - Node level software platforms - Node level Simulators - State centric programming.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various wireless sensor networking strategies.
- evaluate the different types of architecture used in sensor networks.

- analyze the technical issues related to networking of sensors.
- synthesize knowledge to control the sensor network.
- design and build a wireless sensor network using simulators.

TEXT BOOKS

1. Holger Karl & Andreas Willig- " Protocols And Architectures for Wireless Sensor Networks" - John Wiley- 2005.
2. Feng Zhao & Leonidas J. Guibas- "Wireless Sensor Networks- An Information Processing Approach"- Elsevier- 2007.

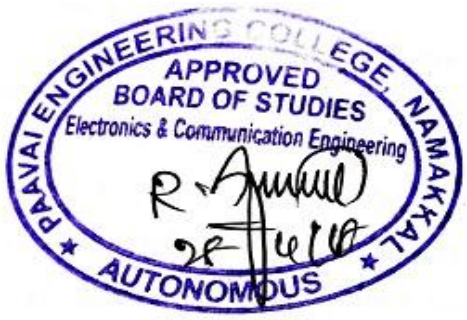
REFERENCES

1. KazemSohraby- Daniel Minoli- and TaiebZnati- "Wireless Sensor Networks- Technology- Protocols- And Applicaions"- John Wiley- 2007
2. Anna Hac- "Wireless Sensor Network Designs"- John Wiley- 2003.
3. BhaskarKrishnamachari- "Networking Wireless Sensors"- Cambridge Press-2005

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO2	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO3	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO4	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO5	3	-	2	2	-	-	-	-	-	-	-	-	1	1



EC16252 DIGITAL SWITCHING AND TRANSMISSION SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the basic concepts in switching system.
- acquire the fundamentals of telecommunication switching systems
- understand the development of telecommunication switching systems
- learn multiplexing in digital switching systems
- study the concept of telecommunication traffic

UNIT I BASICS OF SWITCHING SYSTEMS 8

Distribution systems- Basics of crossbar systems- Electronic switching- Digital switching systems.

UNIT II FUNDAMENTALS OF TELECOMMUNICATION SWITCHING SYSTEMS 9

Introduction - purpose of analysis- Basic central office linkage- outside plant versus inside plant- Switching system hierarchy- Evolution of digital switching systems- Building blocks of digital switching systems- Basic call processing.

UNIT III DEVELOPMENT OF TELECOMMUNICATION SWITCHING SYSTEMS 9

Switching functions- Space Division Switching- Time Division Switching- Two dimensional switching : STS switching- TST switching- No.4 ESS Toll switch- Digital cross-connect systems- Digital switching in an analogue environment. Elements of SS7 signalling.

UNIT IV MULTIPLEXING 9

Transmission Systems- FDM Multiplexing and Modulation- Time Division Multiplexing- Digital Transmission and Multiplexing: Pulse Transmission- Line Coding- Binary N-Zero Substitution- Digital Bi phase- Differential Encoding- Time Division Multiple Loops and Rings.

UNIT V TELECOMMUNICATION TRAFFIC 10

Network traffic load and parameters- grade of service and blocking probability - Traffic Characterization: Arrival Distributions- Holding Time Distributions- Loss Systems- Network Blocking Probabilities: End- to End Blocking Probabilities -Overflow Traffic- Delay Systems: Exponential service Times-Constant Service Times - Finite Queues.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the basic concepts in switching system.

- examine the fundamentals concept in telecommunication switching systems.
- synthesize knowledge about telecommunication switching systems
- acquire in-depth knowledge on the concepts of multiplexing.
- know about telecommunication traffic.

TEXT BOOKS

1. J. Bellamy- "Digital Telephony"- John Wiley- 2003- 3rd Edition.
2. JE Flood- "Telecommunications Switching- Traffic and Networks"- Pearson.

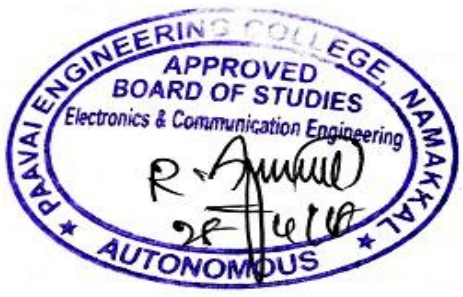
REFERENCES

1. W. Stalling- " Data and Computer Communications"- Prentice Hall- 1993.
2. T.N.Saadawi- M.H.Ammar- A.E.Hakeem- "Fundamentals of Telecommunication Networks"- Wiley Interscience- 1994.
3. Viswanathan. T.- "Telecommunication Switching System and Networks"- Prentice Hall of India Ltd.- 1994.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO2	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO3	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO4	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO5	3	-	2	2	-	-	-	-	-	-	-	-	1	1



EC16253 ADVANCED MICROPROCESSORS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the concepts of Architecture and Assembly language programming of ARM Processor.
- study the concepts of 32 bit processor
- understand the concepts of Pentium processor
- learn the concepts of RISC processor
- acquire the relevance of Motorola processors

UNIT I OVERVIEW OF 16 BIT PROCESSOR 9

Need of advanced microprocessors: 80186 Microprocessor Architecture - Segmented Memory – Addressing Modes - Instruction Set - 80186 Assembly Language Programming - co-processor 80187 Data Processor Architectural details -Data types - Floating point Operations - 80187 Instructions.

UNIT II INTEL 32 BIT PROCESSOR 9

Architectural details of 80386 Microprocessor - Special registers - Memory management-Operation in protected mode and virtual 80386 mode - Memory paging mechanism -Special instructions of 80386 Architectural details of 80486 - Special registers - Additional instructions - Comparison of 80386 and 80486 processors.

UNIT III HIGH PERFORMANCE CISC ARCHITECTURE - PENTIUM 9

Introduction to Pentium Processor - Architectural features - Comparison with the workstations – Branch prediction logic - cache structure. - Special Pentium Registers. Memory management - virtual mode of operation - Comparison with the previous processors- Features of Pentium-II- Pentium-III and Pentium Pro processors.

UNIT IV RISC PROCESSOR 9

RISC Microprocessors - RISC vs CISC - RISC Properties - DEC Alpha AXP Architecture - Power PC Architecture - Programming Model - Data Types -Addressing Modes - Instruction Set. Sun SPARC Architecture - Data Types - Instruction Sets - Features of MIPS- AMD Microprocessors.

UNIT V MOTOROLA PROCEESORS 9

Motorola Microprocessors - 68000 Microprocessor - Architecture - Registers -Addressing Modes – Features of 68020 - 68030 - 68040 Microprocessors.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concept of 16-bit processor
- examine the concepts of 32-bit processor
- evaluate sound knowledge about PENTIUM processors and CPU cores.

- synthesize knowledge in RISC processors
- analyse the concept of Motorola processors

TEXT BOOKS

1. Barry B Brey "Intel Microprocessors : 8086/88- 80186/188- 80286- 80386- 80486-Pentium- Pentium - II- Pentium - III and Pentium - IV- Architecture- Programming and Interfacing"- Pearson Education- 2003
2. Steve Furber- ARM System on Chip Architecture- Addison -Wesley Professional- 2000. "A Course in Electrical and Electronic Measurements and Instrumentation"- DhanpatRai and Co- 2004.

REFERENCES

1. Jason Andrews- o-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)-ewnes- BK and CD-ROM- Aug 2004.
2. L. James Antonakos- The Pentium Microprocessor- Pearson Education- 2000.
3. Daniel Tabak- Advanced Microprocessors- McGraw Hill- 2001.
4. A.K. Ray & K.M. Bhurchandi- "Advanced Microprocessors & Peripherals- Architecture- Programming and Interfacing"- Tata McGraw Hill.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO2	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO3	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO4	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO5	3	-	2	2	-	-	-	-	-	-	-	-	1	1

BA 16253 TOTAL QUALITY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- describe the basic concepts in Quality Management, Customer orientation and retention.
- facilitate the understanding of Quality Management principles and process.
- discuss the techniques in Six Sigma, Bench marking and FMEA.
- understand the basic concepts in Quality Function Development and TPM.
- become familiar with Quality System, Quality Auditing in manufacturing.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing – QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Discuss the basic concepts in Quality Management, Customer orientation and retention.
- Describe the principles and process of Quality Management.
- Implement the quality control techniques in Six Sigma, Bench marking and FMEA.
- Explain the basic concepts in Quality Function Development and TPM.

- Understand the elements in Quality System, Quality Auditing in manufacturing.

TEXT BOOKS

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.
2. D.R Kiran, "Total quality Management", Butterworth-Heinemann, 2016.

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
4. Dennis AuBuchon, Understanding the Concept of Quality, Pronoun, 2017.
5. Donna C. S. Summers, Quality, Pearson, 5th edition, 2009.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	2	1	2	-	1	-	2	-	-	1	-
CO2	3	-	2	2	1	2	-	1	-	2	-	-	1	-
CO3	3	-	2	2	1	2	-	1	-	2	-	-	1	-
CO4	3	-	2	2	1	2	-	1	-	2	-	-	1	-
CO5	3	-	2	2	1	2	-	1	-	2	-	-	1	-

EC16901 MICROCONTROLLER BASED SYSTEM DESIGN 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of PIC microcontroller
- know the operation of timer and interrupts
- study the various methods of interfacing
- acquire the knowledge of ARM
- learn the concepts of ARM Pipeline

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller-PIC 16C6x and PIC16C7x Architecture-PIC16cxx - Pipelining - Program Memory considerations - Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming-Loop time subroutine – Timers Timer Programming- Front panel I/O-Soft Keys- State machines and key switches- Display of Constant and Variable strings

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access- Bus operation-Bus subroutines- Serial EEPROM - Analog to Digital Converter-UART-Baud rate selection-Data handling circuit-Initialization - LCD and keyboard Interfacing ADC- DAC- and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

ARM Architecture -ARM programmer's model -ARM Development tools- Memory Hierarchy-ARM Assembly Language Programming-Simple Examples-Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization- 5-Stage Pipeline ARM Organization-ARM Instruction Execution-ARM Implementation-ARM Instruction Set-ARM Coprocessor Interface-Architectural Support for High Level Languages- Embedded ARM Applications.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine architecture- instruction set and addressing modes of PIC microcontroller

- evaluate the programming of interrupts and timer
- analyse the interfacing concepts
- apply the ARM processor basic programming
- synthesize systems using ARM

TEXT BOOKS

1. Peatman-J.B.- "Design with PIC Micro Controllers"- Pearson Education-3rd Edition-2004.
2. Furber-S.- "ARM System on Chip Architecture" Addison Wesley trade Computer Publication- 2000.

REFERENCES

1. Mazidi- M.A.-"PIC Microcontroller" Rollin Mckinlay- Danny causey Prentice Hall of India- 2007.
2. Mohamed Ali Mazidi- Janice GillispieMazidi- RolinMcKinlay- "The 8051 Microcontroller and Embedded Systems: Using Assembly and C"- Second Edition- Pearson education- 2011
3. DoughlasV.Hall- "Microprocessors and Interfacing- Programming and Hardware"- TMH-2012
4. Yu-Cheng Liu- Glenn A.Gibson- "Microcomputer Systems: The 8086 / 8088 Family Architecture- Programming and Design"- Second Edition- Prentice Hall of India- 2007.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO2	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO3	3	1	1	2	1	-	2	-	-	-	1	1	2	1
CO4	3	1	1	2	-	-	-	-	-	-	-	1	2	1
CO5	3	1	1	2	1	-	2	-	-	-	1	1	2	1

EC16902 BIOMEDICAL INSTRUMENTATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the fundamentals of biomedical engineering
- learn the non-electrical parameters measurement and diagnostic procedures.
- study about the electrical parameters acquisition.
- acquire the knowledge of imaging modalities
- understand the methods of life assisting- therapeutic and robotic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure - Resting and Action Potential - Nervous system and its fundamentals – Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs Physiological signals and transducers - Transducers - selection criteria - Piezo electric- ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements- spirometer - Photo Plethysmography- Body Plethysmography - Blood Gas analysers- pH of blood - measurement of blood pCO2- pO2-finger-tip oxymeter-ESR- GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes - Limb electrodes -floating electrodes - propelled disposable electrodes - Micro- needle and surface electrodes - Amplifiers- Preamplifiers- differential amplifiers- chopper amplifiers -Isolation amplifier - ECG - EEG- EMG - ERG - Lead systems and recording methods - Typical waveforms - Electrical safety in medical environment- shock hazards - leakage current-Instruments for checking safety Parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques - Computer tomography - MRI - Ultrasonography – Endoscopy Thermography - Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems -Analysis of digital images.

UNIT V LIFE ASSISTING- THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers - Defibrillators - Ventilators - Nerve and muscle stimulators - Diathermy - Heart - Lung machine -Audio meters - Dialysers - Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery Advanced 3D surgical techniques- Orthopaedic prostheses fixation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the concept Bio system and how the transducers plays a role on it.

- evaluate the different types of measurements in Non-electrical parameter.
- analyse the electrical parameters acquisition
- compare different digital images .
- synthesize the life assisting and robotic devices

TEXT BOOKS

1. Leslie Cromwell - Fred J.Weibell and Erich A.Pfeiffer - Biomedical Instrumentation Prentice Hall New Delhi 2000.
2. Khandpur R.S Hand Book of Biomedical Instrumentation - Tata McGraw Hill publication - New Delhi 2nd edition 2003.

REFERENCES

1. Albert M Cook and Webster J G - Therapeutic medical devices Prentice Hall Nee York 1982
2. Jacobson B and Webster J G Medical and Clinical Engineering - Prentice Hall of India New Delhi 1999
3. Wolbasrsht . M. L- Laser Application in Medicine and Biology plenum press NewYork 1989.
4. Heinz Kresse - Handbook of Electro medicine. John Wiely& Sons - Chrchester- 1985

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO2	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO3	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO4	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO5	3	-	-	2	2	-	-	-	-	-	-	1	2	1

EC16903 **5G TECHNOLOGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about the drivers for 5G
- learn the basics of 5G Internet.
- study about the small cells and mobile clouds for 5G
- acquire the knowledge about cognitive radio for 5G wireless networks
- understand the security issues and basics of self-Organizing Network for 5Gcommunication

UNIT I DRIVERS FOR 5G **9**

Historical trend of wireless communication - Evolution of LTE technology to beyond 4G - 5G roadmap – 10 pillars of 5G - 5G Architecture

UNIT II THE 5G INTERNET **9**

Internet of Things - Networking Reconfiguration and Virtualization support - Mobility - Quality of Service control - Emerging approach for resource over- provisioning

UNIT III SMALL CELLS AND MOBILE CLOUDS FOR 5G **9**

Small Cells -WiFi and femtocells - Capacity limits and achievable gains - Mobile data demand - Small cell Challenges - The Mobile cloud - Mobile cloud enablers - Network coding

UNIT IV COGNITIVE RADIO FOR 5G WIRELESS NETWORKS **9**

Overview of Cognitive Radio technology in 5G wireless - Spectrum optimization using cognitive Radios Spectrum Optimization literature in 5G - Cognitive Radio and Carrier Aggregation - Energy efficient Cognitive Radio technology.

UNIT V SECURITY AND SELF ORGANIZING NETWORK FOR 5G COMMUNICATION **9**

System Architecture - security issues and challenges in 5G communication -SON in UMTS and LTE – Need for SON in 5G - Evolution towards small cell dominant HetNets.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- analyze the drivers for 5G
- describe the basics of 5G Internet.

- elucidate about small cells and mobile clouds for 5G
- synthesize cognitive radio for 5G wireless networks
- identify the security issues and basics of self-Organizing Network for 5Gcommunication

TEXT BOOKS

1. Jonathan Rodriguez- “Fundamentals of 5G Mobile Network”- John Wiley- First Edition- 2015.
2. Yang Yang- Jing Xu- “ 5G wireless Systems- Simulation and Evaluation Techniques”- Springer- 2015

REFERENCES

1. SassanAhmadi- "LTE-Advanced: A Practical Systems Approach to Understanding 3GPP LTE Releases 10 and 11 Radio Access Technologies" 1st Edition -Elsevier
2. Vincent W.S. Wong “ Key Technologies for 5G Wireless systems”- ISBN -13:978-1107172418.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO2	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO3	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO4	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO5	3	-	-	2	2	-	-	-	-	-	-	1	2	1

EC16604 **NETWORKS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- know the various networking protocol simulation
- understand the basic techniques for error detection
- learn to simulate various Flow control and Error Control protocols
- study and implement the various routing algorithms

A.Networks Experiments

1. To create scenario and study the performance of CSMA/CD protocol NetSim
2. To create scenario and study the performance of token bus and token ring protocol using NetSim
3. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
4. Implementation of Error Detecting Codes.
5. Implementation of Stop and wait protocol
6. Implementation of Go-back-N protocol
7. Implementation of Selective repeat protocol
8. Implementation of Data encryption and decryption.
9. Simulation and analysis of Distance vector routing protocol
10. Simulation and analysis of Link state routing protocol

TOTAL PERIODS **60**

COURSE OUTCOMES

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

- design and implement various LAN protocols.
- implement error detecting codes.
- simulate the Flow control and Error control protocols.
- implement various routing algorithms.

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO2	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO3	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO4	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO5	1	1	-	2	3	-	-	-	-	-	2	1	2	-

EC16605 VLSI LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- study the basics of combinational and sequential circuits
- know the design of combinational and sequential circuits using FPGA
- learn the implementation of real time clock using FPGA
- study and implement CMOS circuits using Microwind.

List of Experiments

1. Design and Simulation of Combinational circuits
2. Design and Simulation of Sequential Circuits
3. Implementation of Combinational circuits using FPGA
4. Implementation of Sequential Circuits using FPGA
5. Design and Implementation of Combinational circuits using Schematic entry
6. To study pin assignment- placement and routing using FPGA
7. Implementation of Real time clock using FPGA
8. Design and Simulation of Inverter using Microwind
9. Design and Simulation of basic logic gates using Microwind
10. To study the characteristics of CMOS sequential circuits using Microwind

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design various Combinational and Sequential Circuits
- analyze pin assignment- placement and routing using FPGA
- implement Real time clock using FPGA
- acquire the knowledge about CMOS circuits and basic logic gates using Microwind

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO2	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO3	1	1	-	2	3	-	-	-	-	-	2	1	2	-
CO4	1	1	-	2	3	-	-	-	-	-	2	1	2	-

PAVAI ENGINEERING COLLEGE, NAMAKKAL
APPROVED
BOARD OF STUDIES
Electronics & Communication Engineering
AUTONOMOUS

EC15701 WIRELESS NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know the challenges in Wireless Networks.
- study the WLANs standards
- acquire the generations of WWANs
- learn the necessity of Adhoc and sensor networks.
- gain the knowledge of advancements in wireless networks.

UNIT I CHALLENGES IN WIRELESS NETWORKS 09

Medium Access Alternatives, Fixed Assignment for Voice Oriented Networks, Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.

UNIT II WIRELESS LANs 09

Wireless LANs, IEEE 802.11b WLAN, Architecture and Services, Installation of WLAN, Other IEEE 802.11 standards and a,g,n, HIPERLAN, Wi–Fi and Wi-Max standards.

UNIT III WIRELESS WANs 09

First Generation Analog, Second Generation TDMA, GSM, GPRS, Second Generation CDMA, IS-95, Third Generation Systems WCDMA, CDMA 2000.

UNIT IV ADHOC AND SENSOR NETWORKS 09

Characteristics of MANETs, Table–driven and Source initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks, Classification, Routing protocols, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery and quality of a Sensor Network.

UNIT V ADVANCES IN WIRELESS NETWORKS 09

Introduction of 4G vision, 4G features and challenges, Applications of 4G, Bluetooth, ZigBee, Ultra wide Band Radio communication, Optical wireless Networks, Software Defined Radio, Cognitive Radio.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the challenges in Wireless Networks.
- analyze the different concept of WLAN standards.
- design the generations of WWANs
- evaluate the necessity of Adhoc and sensor networks.
- apply the concept of advancements in wireless networks.

TEXT BOOKS

1. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks: A unified approach", Prentice Hall, 2002.
2. Dharma Prakash Qing–AnZeng & Agrawal, “Introduction to Wireless and Mobile Systems”, 4thEdition,Thomson India Edition, 2015.

REFERENCES

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, 2007.
2. Clint Smith, P.E. & Daniel Collins, “3G Wireless Networks”, 3rd Edition, Tata McGraw Hill, 2014.
3. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Prentice Hall, 2003.

WEB LINKS

1. http://williamstallings.com/Wireless/Wireless2e.html
2. http://www.isi.edu/nsnam/ns/tutorial/

Mapping of Course Objectives with Programme Outcomes:

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO2	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO3	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO4	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO5	2	2	2	2	2	2	-	-	1	-	-	2	2	2

EC15702 MICROWAVE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basics required for circuit representation of RF networks
- know the issues in the design of microwave amplifier.
- impart knowledge on the properties of various microwave components
- study the various methods of microwave generation.
- describe the microwave generation and microwave measurement techniques

UNIT I TWO PORT NETWORK THEORY 09

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT II MICROWAVE AMPLIFIER AND PARAMETRIC AMPLIFIER 09

Microwave amplifier – characteristics, Amplifier power relations, Stability considerations, Gain Considerations, Parametric amplifier - Manley-Rowe relations, Linearized equations for parametric amplifiers, Parametric up-converter.

UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES 09

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Circulator, Isolator, Transferred Electron Devices - Gunn diodes, IMPATT diode, TRAPATT diode.

UNIT IV MICROWAVE GENERATION 09

Review of conventional Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, and Magnetron Oscillator.

UNIT V MICROWAVE MEASUREMENTS AND APPLICATIONS OF MICROWAVES 09

Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Attenuation, S-parameters, Microwave radar systems, Microwave communication systems, Industrial applications of microwaves.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare the different active, passive microwave devices and components used in Microwave communication systems
- elaborate the usage of multi- port RF networks and RF transistor amplifiers
- apply the concepts of microwave amplifiers in circuit design
- examine the generation of microwave signals
- analyze the microwave signal parameters.

TEXT BOOKS

1. Samuel Y.Liao, “Microwave Devices and Circuits”, Pearson Education Inc.2011
2. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2005.

REFERENCES

1. Reinhold Ludwig and Gene Bogdanov, “RF Circuit Design: Theory and Applications”, Pearson Education Inc.2011
2. Robert E Colin, “Foundations for Microwave Engineering”, John Wiley & Sons Inc, 2005
3. Thomas H Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
4. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India, 2006.

WEB LINKS

1. http://nptel.ac.in/courses/117105130/
2. http://nptel.ac.in/courses/117105130/5
3. http://nptel.ac.in/courses/117105130/13

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
Programme Outcomes														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	1	-	-	2	-	-	2	1	1
CO2	3	2	1	1	2	-	-	-	2	-	-	2	1	1
CO3	3	-	-	1	2	1	-	-	-	-	-	2	1	1
CO4	3	-	-	1	2	-	-	-	-	-	-	2	1	1
CO5	3	2	1	1	2	1	-	-	2	-	-	2	1	1

EC15703 **OPTICAL COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- gain the knowledge about optical fiber sources and transmission techniques
- learn the principle of light propagation through optical fibers
- understand signal distortion mechanisms in the fiber
- study optical transmitters and receivers for fiber /free space links
- acquire optical network concepts and components involved.

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Evolution of fiber optic system - Element of an Optical Fiber Transmission link - Total internal reflection - Acceptance angle - Numerical aperture - Skew rays Ray Optics - Optical Fiber Modes and Configurations - Mode theory of Circular Wave guides - Overview of Modes - Key Modal concepts - Linearly Polarized Modes Single Mode Fibers - Graded Index Fiber structure.

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS 9

Attenuation - Absorption losses - Scattering losses - Bending Losses - Core and Cladding losses - Signal Distortion in Optical Wave guides - Information Capacity determination - Group Delay -Material Dispersion - Wave guide Dispersion - Signal distortion in SM Fibers - Polarization Mode dispersion - Intermodal dispersion - Pulse Broadening in GI Fibers - Mode Coupling - Design Optimization of SM Fibers - RI profile and cut -off wavelength.

UNIT III FIBER OPTICAL SOURCES AND COUPLING 9

Direct and indirect Band gap materials - LED structures - Light source materials - Quantum efficiency and LED power - Modulation of a LED - lasers Diodes -Modes and Threshold condition - Rate equations - External Quantum efficiency - Resonant frequencies - Laser Diodes - Temperature effects - Introduction to Quantum laser - Fiber amplifiers - Power Launching and coupling - Lencing schemes - Fiber -to- Fiber joints - Fiber splicing - Signal to Noise ratio - Detector response time.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS 9

Fundamental receiver operation - Pre amplifiers - Error sources - Receiver Configuration - Probability of Error - Quantum limit. Fiber Attenuation measurements - Dispersion measurements - Fiber Refractive index profile measurements - Fiber cut - off Wave length Measurements - Fiber Numerical Aperture Measurements - Fiber diameter measurements.

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9

Basic Networks: SONET / SDH - Broadcast and select WDM Networks - Wavelength Routed Networks - Non linear effects on Network performance - Link Power budget - Rise time budget - Noise Effects on System Performance -Operational Principles of WDM Performance of WDM + EDFA system - Solutions - Optical CDMA -Ultra High Capacity Networks.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various optical fiber modes - configurations.
- evaluate the various signal degradation factors associated with Optical fiber.
- apply the various optical sources and optical detectors and their use in the optical communication system.
- compare the fiber optic receiver and measurements.
- analyze the digital transmission and its associated parameters on system performance.

TEXT BOOKS

1. Gerd Keiser - "Optical Fiber Communication" McGraw -Hill International - 4th Edition - 2010.
2. John M.Senior - "Optical Fiber Communication" - Second Edition - Pearson Education - 2007.

REFERENCES

1. Ramaswami - Sivarajan and Sasaki "Optical Networks" - Morgan Kaufmann - 20 9.
2. J.Senior - "Optical Communication - Principles and Practice" - Prentice Hall of India - 3rd Edition - 2008.
3. J.Gower - "Optical Communication System" - Prentice Hall of India - 2001.

WEB LINKS

1. http://www.sosmath.com/matrix/matrix.html

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	-	-	3	3	3

EC15704 TELEVISION SIGNAL PROCESSING AND DISPLAY SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- gain the knowledge about the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes.
- familiarize principles and operation of Studio Equipment.
- learn the principles of Transmission and Propagation Systems.
- understand the various Digital Television Standard.
- acquire the concept of Modern Technology of Television.

UNIT I FUNDAMENTALS OF TELEVISION 09

Television System and Scanning Principles: Sound and Picture Transmission, Video Signals, Characteristics of Human Eye, Aspect Ratio and Rectangular Scanning, Persistence of Vision and Flicker, Vertical Resolution, Kell factor, Horizontal Resolution and Video Bandwidth, Interlaced Scanning. Camera Tubes: Vidicon, Plumbicon, Silicon Diode Array Vidicon, CCD-Solid State Image Scanners.

UNIT-II TELEVISION STANDARDS AND STUDIO EQUIPMENTS 09

Composite Video Signal- Horizontal and Vertical Synchronous, Blanking Standards, Reception of VSB Signals, TV Broadcast Channels, CCIR-B Standards. Various TV Broadcast Systems: NTSC, PAL and SECAM System.

UNIT-III TELEVISION TRANSMISSION SYSTEM, PROPAGATION AND ANTENNA 09

Requirements of TV Broadcast Transmission, Block diagram of TV Transmitters, Transmitting Antennas, Propagation Phenomena, Space Wave Propagation, Line of Sight Range, Shadow Zones, Co-Channel Interference, Ghost Images Interference Problems, Parasitic Elements, Receiving Antennas.

UNIT-IV DIGITAL TELEVISION 09

Digital TV: Introduction, Digital System Hardware ,Signal Quantization and Encoding, Digital Satellite Television, Direct to Home Satellite Television ,Digital TV Receivers, Merits of Digital TV Receivers,Geo Stationary Satellite, Satellite Communication Systems,Colour picture Tube- PIL-Delta Gun –Trinitron – Operation.

UNIT-V MODERN TV TECHNOLOGIES 09

Stereo Sound Systems, Projection Television, Flat panel Display TV receivers,3-D Television Picture,EDTV,HDTV, CATV, Cable signal Processing, Cable signal Distribution , Displays devices -LCD-LED -OLED –Operation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes
- analyze principles and operation of Studio Equipment.

- evaluate the principles of transmission and propagation systems.
- compare Various Digital Television Standards.
- synthesize the modern technologies of Television.

TEXT BOOKS

1. R-R-Gulati-"Modern Television Practice -Technology and Servicing – Third Edition – New age International publishes -2012.
2. R-R-Gulati-"Monochrime and Colour Television – Second Edition – New age International publishes - 2009.

REFERENCES

1. A-M-Dhake-" Television and video Engineering" Second Edition TMH 2003..
2. R.G.Gupta, "Television Engineering and Video systems," First Edition, TMH India 2007. 3. S-P-Bali-" Colour Television -Theory and practice "- TMH 1994
3. Bernard Grob," Basic Television Principles and Servicing"- Second Edition, New age International Publisher 2004.

WEB LINKS

1. http://nptel.iitm.ac.in/
2. https://electronics.howstuffworks.com/home-audio-video-channel.htm
1. http://nifrasmail.weebly.com/uploads/2/1/6/7/2167487/analog_telev

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	-	-	3	3	3

ELECTIVE IV

EC15451 MOBILE ADHOC NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn the different types of MAC protocols.
- know about different types of adhoc routing protocols.
- study about the TCP issues in adhoc networks.
- gain the knowledge of architecture and protocols of wireless sensor networks.
- acquire knowledge advanced networks

UNIT I ADHOC NETWORKS 09

Introduction to adhoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models.

UNIT II MEDIUM ACCESS PROTOCOLS 09

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas.IEEEstandards:802.11a, 802.11b, 802.11g, and 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS 09

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

UNIT IV END-END DELIVERY AND SECURITY 09

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G 09

Cross layer Design: Need for cross layer design, cross layer optimization, Parameter optimization techniques, Cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the concepts, network architectures and applications of ad hoc and wireless sensor networks.
- analyze the protocol design issues of ad hoc and sensor networks.
- design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issue.
- evaluate the QoS related performance measurements of ad hoc networks
- examine cross layer design of adhoc network

TEXT BOOKS

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

2. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks: A unified approach", Prentice Hall, 2002.

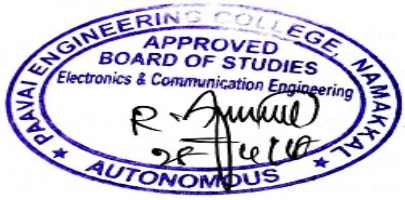
REFERENCES

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Charles E. Perkins, Adhoc Networking, Addison –Wesley,2000
3. Azzedine Boukerche, “Algorithms and protocols for wireless and Mobile Adhoc networks”, Wiley-IEEE press, Nov 2008.

WEB LINKS

1. http://nptel.ac.in/courses/106105160/3
2. http://nptel.ac.in/courses/106105160/4
3. https://www.youtube.com/watch?v=LXSkpB35cjw

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
Programme Outcomes														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	1	2	3	3	1	3	-	-	1	-	3	3	2	2
CO2	1	2	3	3	1	3	-	-	1	-	3	3	2	2
CO3	1	-	-	3	1	3	-	-	1	-	3	3	2	2
CO4	1	-	-	3	1	3	-	-	1	-	3	3	2	2
CO5	1	2	3	3	1	3	-	-	1	-	3	3	2	2



EC15452 MOBILE APPLICATION DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand system requirements for mobile applications
- know the suitable design using specific mobile development frameworks
- study the mobile application design
- learn the design using specific mobile development frameworks
- acquire the principles of mobile applications in marketplace for distribution

UNIT I MOBILE APPLICATIONS 09

Introduction to mobile operating systems , Embedded systems, Market and Business drivers for mobile applications, Publishing and delivery of mobile applications, Requirements gathering and validation for mobile applications

UNIT II EMBEDDED DESIGN 09

Introduction to basics of embedded systems design, Embedded Operating Systems , Design constraints for mobile applications both hardware and software related, Architecting mobile applications, user interfaces for mobile applications , Touch events and gestures, Achieving quality constraints , performance, usability, security, availability and modifiability

UNIT III ADVANCED DESIGN 09

Designing applications with multimedia and web access capabilities, Integration with GPS and social media networking applications, Accessing applications hosted in a cloud computing environment, Design patterns for Mobile applications.

UNIT IV ANDROID TECHNOLOGY 09

Establishing the development environment, Android architecture, Activities and views, Interacting with UI, Persisting data using SQLite, Packaging and deployment, Interaction with server side applications, Using Google Maps, GPS and Wifi, Integration with social media applications.

UNIT V iOS TECHNOLOGY 09

Introduction to Objective C, iOS features, UI implementation , Touch frameworks , Data persistence using Core Data and SQLite, Location aware applications using Core Location and Map Kit, Integrating calendar and address book with social media application, Using Wifi, iPhone marketplace

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the requirements for mobile applications
- evaluate the challenges in mobile application design and development
- develop design for mobile applications for specific requirements
- apply the design using Android SDK

- analyze the design using Objective C and iOS

TEXT BOOKS

1. Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3rd Edition
2. Zigurd Mednieks, Laird Dornin.G, Blake Meike and Masumi Nakamura, - Programming Android, O"Reily, 2011.

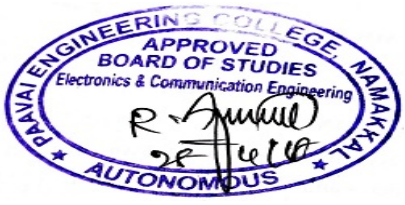
REFERENCES

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Dream Tech, 2012
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.

WEB LINKS

1. http://developer.android.com/develop/index.html
2. https://www.letsnurture.com/services/mobile.html
3. https://onlinecourses.nptel.ac.in/noc18_cs05

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2	1	1	-	-	-	-	3	1	2
CO2	3	2	2	2	2	1	1	-	2	-	-	-	3	3
CO3	3	3	2	1	2	1	1	-	-	-	-	-	3	3
CO4	3	3	3	2	2	1	1	-	-	-	-	3	3	3
CO5	3	2	3	2	2	1	1	-	2	-	-	3	3	3



EC15453 **INFORMATION THEORY** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand the concepts of error–control coding.
- Know the encoding and decoding of digital data streams
- learn the methods for the generation of codes and decoding techniques.
- acquire the knowledge of compression and decompression techniques.
- gain the knowledge of concepts in multimedia communication.

UNIT I INFORMATION THEORY **09**

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

UNIT II DATA AND VOICE CODING **09**

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates –Vocoders- Linear Predictive Coders.

UNIT III ERROR CONTROL CODING **09**

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

UNIT IV COMPRESSION TECHNIQUES **09**

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

UNIT V AUDIO AND VIDEO CODING **09**

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders– Video compression Principles – H.261, H.263, MPEG 1, 2, 4 Video standards.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- examine an application with error–control.
- apply the audio and video compression techniques
- analyze text and image compression techniques
- compare compression and decompression techniques.
- synthesize the concepts of multimedia communication

TEXT BOOKS

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5.

REFERENCES

1. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
2. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.
3. K Sayood, “Introduction to Data Compression” 3/e, Elsevier 2006

WEB LINKS

1. http://nptel.ac.in/courses/117105083/
2. www.cs.uml.edu/~glchen/cs414-564/handouts/chapter7.pdf
3. https://www.voip-info.org/wiki/view/What+is+VOIP

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	3	1	-	-	3	-	1	1	2	2
CO2	3	2	1	1	3	-	-	-	3	-	1	1	2	2
CO3	3	-	-	1	3	1	-	-	3	-	1	1	2	2
CO4	3	-	-	1	3	-	-	-	3	-	1	1	2	2
CO5	3	2	1	1	3	1	-	-	3	-	1	1	2	2

EC15454 **SPACE-TIME COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- acquire the knowledge on coding schemes for space-time Wireless Communications.
- understand transmission and decoding techniques of Wireless Communications.
- learn the Diversity performance in extended channels
- gain knowledge in coding of multiple antenna and receivers
- study the Spread Spectrum and MIMO Multiuser Detection

UNIT I MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION **09**

Wireless channel, Scattering model in macro cells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST Multiuser and ST interference channels, ST channel estimation..

UNIT II CAPACITY OF MULTIPLE ANTENNA CHANNELS **09**

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of Rician fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

UNIT III SPATIAL DIVERSITY **09**

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space – time -frequency selective fading channel..

UNIT IV MULTIPLE ANTENNA CODING AND RECEIVERS **09**

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers(SISO,SIMO,MIMO), Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre - filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

UNIT V ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION **09**

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO-OFDM,SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO-SS. MIMO-MAC, MIMO-BC, Outage performance for MIMO-MU, MIMO- MU with OFDM, CDMA and multiple antennas.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- examine the coding schemes for space-time Wireless Communications..

- evaluate the transmission and decoding techniques of Wireless Communications.
- synthesize the Diversity performance in extended channels
- compare the coding of multiple antenna and receivers
- analyze the concepts of Spread Spectrum and MIMO Multiuser Detection

TEXT BOOKS

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005

2. Paulraj, RohitNabar, Dhananjay Gore., "Introduction to Space Time Wireless Communication Systems", Cambridge University Press, 2003

REFERENCES

1. Andre Viterbi " Principles of Spread Spectrum Techniques" Addison Wesley 1995
2. Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University press, 2005.
3. Sergio Verdu " Multi User Detection" Cambridge University Press, 1998

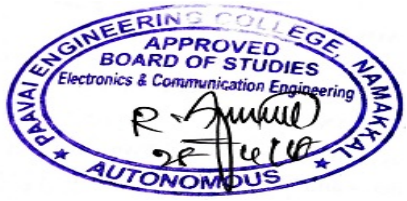
WEB LINKS

1. http://nptel.ac.in/courses/117105132/5
2. https://dokumente.unibw.de/pub/bscw.cgi/d1223037/paper_ssd05.pdf
3. https://arxiv.org/ftp/arxiv/papers/0909/0909.3342.pdf

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	3	1	-	-	3	-	1	1	2	2
CO2	3	2	1	1	3	-	-	-	3	-	1	1	2	2
CO3	3	-	-	1	3	1	-	-	3	-	1	1	2	2
CO4	3	-	-	1	3	-	-	-	3	-	1	1	2	2
CO5	3	2	1	1	3	1	-	-	3	-	1	1	2	2



ELECTIVE V

EC15551 INTERNET AND JAVA 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the concepts and architecture of the World Wide Web
- practice markup languages
- study the web design
- acquire basic concepts of Java programming
- impart knowledge on web services

UNIT I INTRODUCTION TO WWW 09

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.

UNIT II HTML BASICS 09

Markup Language (HTML5):Basics of Html - Syntax and tags of Html -Introduction to HTML5 - Semantic/Structural Elements - HTML5 style Guide and Coding Convention – Html API‟s -Audio & Video - Drag/Drop - Local Storage - Web socket API – Debugging and validating Html

UNIT III CASCADING STYLE SHEET 09

Cascading Style Sheet (CSS3): The need for CSS – Basic syntax and structure Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS -Responsive Web Design.

UNIT IV JAVA BASICS 09

Introduction to Java – Test - driving a java application - Input / Output and operators -Classes, Objects, Methods and strings - control statements - Methods: A deeper look - Arrays and Array Lists - classed and objects: A deeper look - Inheritance - polymorphism and Interfaces - Exception handling

UNIT V XML AND WEB SERVICES 09

Xml – Introduction-Form Navigation-XML Documents – DTD - Namespace - XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the technologies used in Web Programming.
- create a basic website using HTML
- design and implement simple web page using Cascading Style Sheets
- analyze the salient features of Java over C++ and write programs using fundamental concepts
- build web based application and to present data in XML format

TEXT BOOKS

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World wide web - How to Program", Fifth Edition, Pearson Education, 2011
2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.

REFERENCES

1. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013
2. Michael Morrison XML Unleashed Tech media SAMS.
3. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
4. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010

WEB LINKS

1. http://nptel.ac.in/courses/106105031/
2. http://nptel.ac.in/courses/106105031/4
3. http://nptel.ac.in/courses/106105031/7

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
Programme Outcomes														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO10	PO1 1	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	3	-	3	3	3

EC15552 CRYPTOGRAPHY AND NETWORK SECURITY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about OSI security architecture and classical encryption techniques
- acquire fundamental knowledge on the concepts of finite fields and number theory
- understand various block cipher and stream cipher models
- study the principles of public key cryptosystems, hash functions and digital signature
- know about web security

UNIT I NUMBER THEORY 09

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques -Symmetric cipher model, substitution techniques, transposition techniques, steganography. Finite Fields And Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem-Discrete logarithms

UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 09

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard -Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 09

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT IV SECURITY PRACTICES AND SYSTEM SECURITY 09

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT V WEB SECURITY 09

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload Internet Key Exchange - Phases of IKE, ISAKMP/IKE Encoding. Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare various Cryptographic Techniques
- analyze the design of secure applications

- evaluate Inject secure coding in the developed applications
- apply the E-mail Security.
- examine the Web Security

TEXT BOOKS

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013
2. Behrouz A. Foruzan, Data communications and Networking, The McGraw-Hill Companies, Inc. 5th edition. (2013)

REFERENCES

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Charles P Fleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
3. Andrew S.Tannenbaum, Computer Networks, PHI, (2010).

WEB LINKS

1. http://nptel.ac.in/courses/106105031/
2. http://nptel.ac.in/courses/106105031/4
3. http://nptel.ac.in/courses/106105031/7

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	1	2	1	3	-	3	2	3	-	-	-	3	1	2
CO2	-	2	2	3	-	3	-	2	-	-	-	2	1	1
CO3	-	2	1	3	-	3	-	2	-	-	-	1	1	1
CO4	-	1	2	2	-	2	1	2	-	-	-	1	1	1
CO5	-	1	2	2	-	1	1	2	-	-	-	1	1	1

EC15553 **BIO SIGNAL PROCESSING** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- study the characteristics of biomedical signals
- acquire the principles of noise filtering and Interference cancellation
- learn the event detection and extraction techniques
- know the modeling of biomedical systems
- understand the pattern classification and diagnostic decision

UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS **09**

Introduction to Biomedical Signals - ECG, EEG, EMG, ENG etc. Event related potentials- Biomedical Signal Analysis - Computer Aided Diagnosis. Concurrent, coupled and correlated processes - illustration with Case studies

UNIT II NOISE FILTERING **09**

Random noise structured noise and physiological interference- noise and artifacts in ECG. Time domain filters- Frequency domain filters- Principles of adaptive filters- Winer Filtering- Steepest Descent algorithms- Widrow Hopf, Least mean square adaptive algorithms- Adaptive noise canceller- Interference cancellation in Electrocardiography- noise cancellation in electro surgery

UNIT III EVENT DETECTION AND EXTRACTION **09**

Detection of P, QRS and T waves in ECG- EEG rhythms- Detection of EEG spike and wave complexes- density- Homomorphic filtering. Analysis of event related potential – Morphological analysis of ECG waves- Envelope extraction and analysis- Analysis of activity: zero crossing rates. Fourier Spectrum, Estimation of power spectral moments and spectral power ratio.

UNIT IV MODELING OF BIOMEDICAL SYSTEMS **09**

Point processes- Parametric system modeling- All-pole, pole zero modeling, electromechanical models of signal generation. Analysis of non-stationary signals: Characterization- Fixed segmentation- Short Time Fourier Transform- Adaptive segmentation- Adaptive filters for segmentation- RLS and Lattice Filter.

UNIT V PATTERN CLASSIFICATION AND DIAGNOSTIC DECISION **09**

Supervised and unsupervised pattern classification- Probabilistic models and statistical decisions- Logistic of regression analysis- training and test steps neural networks- Measures of diagnostic accuracy and cost- Reliability classifiers and decisions. Application: Normal versus Ectopic ECG beats- Detection of Knee Joint cartilage Pathology.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the basics of biomedical signals
- compare the noise filtering techniques

- analyze event detection and extraction of bio signals
- apply the different models of biomedical systems.
- evaluate the pattern classification and decision making techniques.

TEXT BOOKS

1. Rangaraj M. Rangayyan, „Biomedical Signal Analysis-A case study approach, Wiley- Interscience/IEEE Press, 2002
2. D.C.Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005.

REFERENCES

1. Metin Akay, "Biomedical Signal Processing", Academic press, Inc
2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001
3. Khandpur R.S, "Hand Book of Biomedical Instrumentation", Tata McGraw Hill publication , New Delhi 2nd edition 2003.

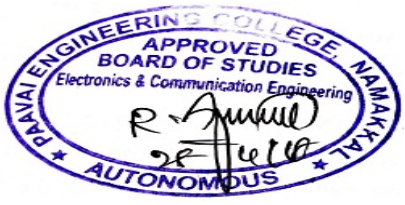
WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc18_ec02/preview
2. https://www.sciencedirect.com/journal/biomedical-signal-processing-and-control
3. https://www.journals.elsevier.com/biomedical-signal-processing-and-control

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	-	-	-	-	2	-	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	2	-	-	3	3	3



EC15554 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know about the basics of EMI and EMC Environment
- study about EMI and EMC Coupling Principles
- acquire about EMI used in instrumentation system
- understand the control techniques involved in Electromagnetic Interference
- learn the EMI Specification Standards and Limit

UNIT I EMI ENVIRONMENT 09

Concepts of EMI and EMC and definitions - Sources of EMI – Celestial Electromagnetic noise- Lightning discharge- Switches Electrostatic Discharge- Electromagnetic Pulse - Electromagnetic emissions - Noise from relays and- Nonlinearities in Circuits

UNIT II EMI COUPLING PRINCIPLES 09

Capacitive coupling - Inductive coupling- Common impedance ground coupling- Ground loop coupling-Transients in power supply lines- Radiation coupling, Conduction coupling-Common – mode and Differential mode.

UNIT III EMI MEASUREMENTS 09

Open area test site measurements-Measurement precautions – Open area test site- Anechoic Chamber-TEM Reverberating TEM-GTEM cell – Comparisons

UNIT IV EMI CONTROL TECHNIQUES 09

EMC Technology- Grounding-Shielding-Electrical Bonding-Power line filter-CM filter – DM filter- EMI suppression Cables- EMC Connectors -Isolation transformer.

UNIT V EMI AND EMC STANDARDS 09

Introduction- Standards for EMI/EMC- MIL-STD-461/462-IEEE/ANSI standard-CISPR/IEC standard- FCC regulations-British standards-VDE standards-Euro norms-Performance standards-some comparisons

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concepts of EMI and EMC
- synthesize solutions to EMI Sources
- evaluate the measurements in EMI
- examine, test and implement EMI system
- compare the different EMI and EMC standards

TEXT BOOKS

1. Prasad Kodali – “Engineering Electromagnetic Compatibility – Principles, Measurements, and

Technologies", IEEE press.

2. Clayton R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley Publications, 2008.

REFERENCES

1. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1987
3. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006.

WEB LINKS

1. https://www.nasa.gov/.../639521main_EMI-EMC_User_Test_Planning_.
2. www.irpel.org/pdf.../electromagnetic-interference-and-compatibility.pdf
3. www.rfwireless-world.com/Terminology/EMI-vs-EMC.html

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	-	-	-	-	2	-	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	2	-	-	3	3	3

EC15705 ELECTRONIC SYSTEM DESIGN LAB 0 0 4 2

COURSE OBJECTIVES

To enable students to

- know the design of AC/DC voltage regulator using SCR
- study the Microprocessor/Micro Controller based system design
- understand the design of Data acquisition and storage of signals through Serial / Parallel port to PC
- implement the Simulation Experiments

List of Experiments:

1. Design of AC/DC voltage regulator using SCR
2. Design of Process Control Timer
3. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using LVDT.
4. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Strain gauge and Pressure Transducer.
5. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Photocell / LDR.
6. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Temperature measurement using RTD-Thermo couples.
7. DC motor speed control using digital logic circuits/Microprocessor/PC
8. Simulation Experiments (using MATLAB)
   a. DTMF generation & detection
   b. Multirate Processing
9. Simulation Experiments (using MATLAB)
   a. Echo Cancellation
   b. Error Detection coding
10. PCB Layout design using CAD

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design and test the SCR applications
- synthesize the working and applications of process control timer
- design of Data acquisition and storage of signals through Serial / Parallel port to PC
- implement the Simulation Experiments

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 2**
CO1	3	3	3	2	-	3	-	-	-	-	2	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	3	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	2	3	3	3

EC15706 **OPTICAL AND MICROWAVE LAB** **0 0 4 2**

COURSE OBJECTIVES

To enable students to

- understand the working principle of optical sources, detector, fibers and microwave components
- gain knowledge about simple optical communication link.
- learn about the characteristics and measurements in optical fiber
- know about the behavior of microwave components.

OPTICAL EXPERIMENTS

1. DC Characteristics of LED and PIN Photo diode
2. Mode Characteristics of Fibers
3. Measurement of connector and bending losses
4. Fiber optic Analog and Digital Link- frequency response(analog) and eye diagram (digital)
5. Numerical Aperture determination for Fibers
6. Attenuation Measurement in Fibers

MICROWAVE EXPERIMENTS

1. Reflex klystron or Gunn diode characteristics and basic microwave parameter measurement such as VSWR, frequency, wavelength.
2. Directional Coupler Characteristics.
3. Radiation Pattern of Horn Antenna.
2. S-parameter Measurement of the following microwave components (Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee)
3. Attenuation and Power Measurement

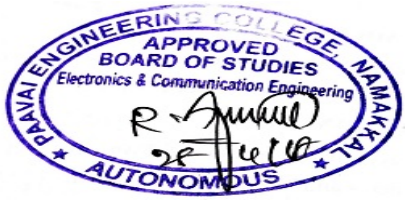
TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze the performance of simple optical link.
- examine the microwave and optical components.
- synthesize the mode characteristics of fiber
- compare the radiation of pattern of antenna.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	3	-	-	-	-	2	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	3	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	2	3	3	3



EC15707 **PROJECT WORK PHASE I** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- gain knowledge on literature review
- categorize the requirements for the project
- develop hardware solutions for simple applications.
- learn to work in a team.

Every student will be required to undertake a suitable project work in the Department during VII semester, in consultation with the Head of the Department and the guide. Every student will have to prepare and submit the literature review and simulated output of their project at the end of the semester within the stipulated time as announced by the Institute/Department

COURSE OUTCOMES

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

- apply knowledge of basic science and engineering to Electronics and Communication engineering problems.
- analyze the requirements for the project.
- identify, formulate simple problem statements and find solutions.
- implement the hardware and test.

TOTAL PERIODS 60

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO2	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO3	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO4	3	2	3	2	3	2	1	1	2	2	3	1	3	2

EC15801 **MOBILE COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the fundamental cellular concepts.
- learn the different ways of radio propagation models.
- study various modulation and equalization techniques.
- gain the knowledge about multiple access and speech coding techniques.
- know the generation of wireless networks and wireless standards.

UNIT I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9

Introduction to wireless communication systems: Evolution of mobile radio communications - mobile radio systems - Examples. Cellular Concept: Frequency reuse - channel assignment and hand off strategies - Interference and system capacity - trunking and grade of service - Improving Coverage and capacity in Cellular systems

UNIT II MOBILE RADIO PROPAGATION 9

Free space propagation model - reflection - diffraction - scattering - link budget design - Outdoor Propagation models - Indoor propagation models - Small scale Multipath propagation - Small scale Multipath measurements - parameters of Mobile multipath channels - types of small scale fading.

UNIT III MODULATION TECHNIQUES AND EQUALIZATION 9

Modulation Techniques: Minimum Shift Keying - Gaussian MSK - M-ary QAM - M-ary FSK - Orthogonal Frequency Division Multiplexing - Spread spectrum modulation techniques Equalization: Survey of Equalization Techniques - Linear Equalization - Non -linear Equalization. Diversity Techniques - RAKE receiver.

UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES 9

Coding: Vocoders - Linear Predictive Coders - Selection of Speech Coders for Mobile Communication - GSM Codec - USDC Codec. Multiple Access Techniques: FDMA - TDMA - CDMA - SDMA - Capacity of Cellular CDMA and SDMA.

UNIT V WIRELESS SYSTEMS AND STANDARDS 9

AMPS and ETACS -Global system for mobile -CDMA digital cellular standard (IS-95) -Digital European cordless telephone.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various standards used in Wireless communication.
- evaluate the different radio propagation models.

- compare different equalization and diversity techniques.
- synthesize different multiple access techniques.
- analyze different wireless standards and generations.

TEXT BOOKS

1. T.S.Rappaport - “Wireless Communications: Principles and Practice - Second Edition – Pearson B Education/ Prentice Hall of India - Third Indian Reprint 2003.
2. W.C.Y.Lee - "Mobile Communications Engineering: Theory and applications - Second Edition - McGraw -Hill International - 1998.

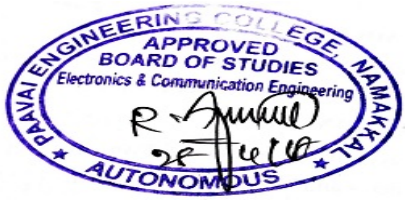
REFERENCES

1. R. Blake - “Wireless Communication Technology” - Thomson Delmar - 2003.
2. Kaveh Pahlavan - Prashant Krishnamurthy - "Principles of Wireless Networks: A unified approach" - Prentice Hall - 2002.
3. Stephen G. Wilson - “Digital Modulation and Coding” - Pearson Education - 2003.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3



EC15651 **WIRELESS SENSOR NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the state of the art in wireless sensor network - architectures and applications
- study the functions of different wireless architectures
- learn the various aspects of MAC protocols
- know the concept of infrastructure establishment
- gain knowledge about various tools and platform in the networks

UNIT I INTRODUCTION OF WIRELESS SENSOR NETWORKS 9

Introduction - Background of WSN Technology - Sensor Network Standards - RF Technologies for WSN - Difference between mobile adhoc and sensor networks - Applications of sensor networks - Challenges for Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single Node Architecture - Hardware Components - Energy Consumption of Sensor Nodes - Operating systems and Execution Environments - Network Architecture - Sensor Network Scenarios - Optimization Goals and Figures of Merit - Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations - MAC Protocols for Wireless Sensor Networks - Low Duty Cycle Protocols and Wakeup Concepts - SMAC - Address & Name Management – Assignment of MAC Addresses - Routing Protocols - Energy Efficient Routing - Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT AND POWER CONTROL 9

Topology Control - Clustering - Time Synchronization - Localization and Positioning - Sensor Tasking and Control - Power Consumption in Sensor Nodes – Power Control at different protocol Layers - Physical Layer Power Conservation Mechanisms – Higher Layer Power Conservation Mechanisms.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Operating Systems for Wireless Sensor Networks - Sensor Node Hardware – Hardware Platforms for WSNs:Mica2 -MicaZ -Btnode - and Sun SPOT – WSN Simulation Platform - Node Level Simulators : NS2 - TOSSIM - Middleware Architecture for WSN –Open Issues in software Technologies

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various wireless sensor networking strategies.
- evaluate the different types of architecture used in sensor networks.

- analyze the technical issues related to networking of sensors
- synthesize knowledge to control the sensor network.
- design and build a wireless sensor network using simulators

TEXT BOOKS

1. Holger Karl & Andreas Willig - "Protocols And Architectures for Wireless Sensor Networks" - John Wiley - 2005.
2. Kaveh Pahlavan - Prashant Krishnamurthy - "Principles of Wireless Networks: A unified approach" - Prentice Hall - 2002.

REFERENCES

1. Kazem Sohraby - Daniel Minoli - &Taieb Znati - "Wireless Sensor Networks -Technology - Protocols - And Applications" - John Wiley - 2007
2. Anna Hac - "Wireless Sensor Network Designs" - John Wiley - 2003.
3. Feng Zhao & Leonidas J. Guibas - "Wireless Sensor Networks - An Information Processing Approach" Elsevier - 2007.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO2	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO3	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO4	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO5	3	3	-	-	3	-	3	-	-	-	-	3	3	3

EC15652 **SATELITE COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- study the overview of satellite systems in relation to other terrestrial systems
- gain knowledge about the earth segment and space segment components
- learn the satellite access by various users
- gain the concept of earth segment
- Know the DTH and compression standards

UNIT I SATELLITE ORBITS **9**

Kepler's Laws - Newton's law - Orbital parameters - Orbital perturbations - Station keeping - Geo stationary and Non –Geo stationary orbits – Look Angle Determination - Limits of visibility – Eclipse - Sub satellite point – Sun transit outage - Launching Procedures - Launch vehicles and propulsion

UNIT II SPACE SEGMENT AND SATELLITE LINK DESIGN **9**

Spacecraft Technology - Structure - Primary power - Attitude and Orbit control - Thermal control and Propulsion - Communication Payload and supporting subsystems - Telemetry - Tracking and Command. Satellite uplink and downlink - Analysis and Design - Link budget - E/N calculation - Performance impairments - System noise - Inter modulation and interference - Propagation Characteristics and Frequency considerations - System reliability and design lifetime.

UNIT III SATELLITE ACCESS **9**

Modulation and Multiplexing: Voice - Data - Video - Analog – Digital transmission system - Digital video Broadcast - Multiple access: FDMA - TDMA - CDMA - Assignment Methods - Spread Spectrum Communication - Compression – Encryption

UNIT IV EARTH SEGMENT **9**

Earth Station Technology - Terrestrial Interface - Transmitter and Receiver - Antenna Systems TVRO - MATV - CATV - Test Equipment Measurements on G/T - C/No - EIRP - Antenna Gain.

UNIT V SATELLITE APPLICATIONS **9**

INTELSAT Series - INSAT - VSAT - Mobile satellite services: GSM - GPS - INMARSAT - LEO - MEO - Satellite Navigational System. Direct Broadcast satellites - Direct to home Broadcast - Digital audio broadcast - World space services - Business TV - GRAMSAT - Specialized services – E–mail - Video conferencing - Internet.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- evaluate the earth segment and space segment
- analyze the design of various satellite applications. .
- apply the various multiple access techniques

- analyze the design of various satellite applications.

TEXT BOOKS

1. Dennis Roddy - "Satellite Communication" - McGraw Hill International - 4th Edition - 2006
2. Gerard Maral and Michel Bousquet - "Satellite Communication Systems – Techniques and Technologies" – Wiley - 5th Edition.

REFERENCES

1. N.Agarwal - "Design of Geosynchronous Space Craft" - Prentice Hall - 1986.
2. Bruce R. Elbert - "The Satellite Communication Applications" - Hand Book - Artech House Bostan London - 1997.
3. M.Richharia - "Satellite Communication System Design Principles" - Macmillan 2003.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes(POs)													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	3
CO2		3	3										3	3
CO3				3	3	3		3					3	3
CO4				3	3		3		3			3	3	3
CO5		3	3	3	3				3	3	3	3	3	3

EC15653 **NANO-ELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the overview of Nano electronics and Nano computer architecture
- study the concepts Fabrication and Measurement Techniques
- know about the properties of Nano electronics
- acquire knowledge about Nano electronic architectures.
- learn about Logic Devices and Applications

UNIT I NANO ELECTRONICS FOUNDATIONS **9**

Overview of basic Nano Electronics - Recent past - the present and its challenges - Future of Nano Electronics - Nano computer architectures: Introduction to Nano computers– Nano computer Architecture - Quantum DOT Cellular Automata - QCA circuits - single electron circuits - molecular circuits.

UNIT II FABRICATION AND MEASUREMENT TECHNIQUES **9**

Growth – fabrication and measurement techniques for Nanostructures - Bulk crystal and hetero structure growth - Nanolithography - etching and other means for fabrication of Nanostructures and Nano devices - Techniques for characterization of Nano structures - Spontaneous formation and ordering of Nanostructures - Clusters and Nano crystals - Methods of Nano tube growth - Chemical and biological methods for Nano scale fabrication

UNIT III PROPERTIES OF NANO ELECTRONICS **9**

Dielectrics – Ferroelectrics - Electronic Properties and Quantum Effects - Magneto electronics - Magnetism and Magneto transport in Layered Structures - Organic Molecules - Electronic Structures - Properties and Reactions -Neurons - The Molecular Basis of their Electrical Excitability - Circuit and System Design - Analysis by Diffraction and Fluorescence Methods - Scanning Probe Techniques.

UNIT IV NANO ELECTRONIC ARCHITECTURES **9**

Nanofabrication - Nano patterning of Metallic/Semiconducting Nanostructures - e-beam/X -ray - Optical Lithography - STM/AFM -SEM and Soft -lithography-Nano phase materials – Self assembled Inorganic/Organic layers.

UNIT V LOGIC DEVICES AND APPLICATIONS **9**

Logic Devices - Silicon MOSFETs - Ferroelectric Field Effect Transistors - Quantum Transport Devices Based on Resonant Tunneling – Single Electron Devices for Logic Applications - Superconductor Digital Electronics - Quantum Computing Using Superconductors - Carbon Nanotubes for Data Processing - Molecular Electronics.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the concepts of Nano electronics and Nano computer architectures.
- evaluate the techniques for characterization of Nano structures
- compare and utilize various properties of Nano materials

- analyze the architecture of Nano electronics.
- apply the concepts of Logic Devices and its applications.

TEXT BOOKS

1. Karl Goser - JanDienstuhl - "Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices" -
2. K.Goser - P.Glosekotter and J.Diestuhi - " Nanoelectronics and Nano systems" - Springer - 2004

REFERENCES

1. Vladimir V. Mitin - Viatcheslav A. Kochelap - Michael A. Stroscio - "Introduction to Nanoelectronics: Science - Nanotechnology - Engineering - and Applications" - Cambridge University Press 2011.
2. Supriyo Datta - "Lessons from Nanoelectronics: A New Perspective on Transport" - World Scientific 2012.
3. Dr. H.C. Marcel Van de Voorde - "Nanoelectronics: Materials - Devices - Applications" - Wiley 2017.

WEB LINKS

1. https://www.youtube.com/watch?v=0_FjPqBqPec
2. https://www.youtube.com/watch?v=tW1 -fSRiAdc
3. www.nptel.ac.in/syllabus/117108047/

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15654 **RF MICROELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know the concepts in RF design.
- understand the communication concepts in microelectronics
- learn about transceiver architecture
- gain knowledge on the concepts and types of PLL
- study the power amplifiers concepts in microelectronics.

UNIT I CONCEPTS IN RF DESIGN **9**

Introduction to RF - Design challenges of RF - General consideration - Effects of Nonlinearity - Noise - Sensitivity and dynamic range - Passive impedance Transformation - Scattering parameters - Analysis of Nonlinear dynamic systems - Volterra series.

UNIT II COMMUNICATION CONCEPTS **9**

General consideration - Analog and Digital modulation - Spectral regrowth - Mobile RF communications - Multiple access techniques - Wireless standards.

UNIT III TRANSCEIVER ARCHITECTURE **9**

Receiver architecture: - Basic heterodyne receivers - Modern heterodyne receivers - Direct conversion receivers - Image reject receivers - Low IF Receivers. Transmitter architectures: Direct conversion transmitters - Modern direct conversion transmitters - Heterodyne Transmitters - Other TX architectures - OOK transceivers.

UNIT IV PHASE -LOCKED LOOPS **9**

Basic concepts - Type I PLLs - Type II PLLs - PFD/CP Non idealities - Phase noise in PLLs - Loop Bandwidth - Design procedure.

UNIT V POWER AMPLIFIERS **9**

General considerations - Classification of power amplifiers - High efficiency power amplifiers - Cascode output Stages – Large signal impedance matching - Basic Linearization Techniques - Polar modulation - Out phasing - Doherty power amplifier - Design Examples

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concepts in RF design.

- analyze the communication concepts in microelectronics.
- compare various transceiver architecture.
- examine power amplifiers concepts in RF microelectronics.
- evaluate the concepts and types of PLL in microelectronics.

TEXT BOOKS

1. B.Razavi - "RF Microelectronics" - Prentice Hall PTR - 1998.
2. Behzad Razavi - "Design of Analog CMOS Integrated Circuits" - McGraw Hill - Second Edition - 2008

REFERENCES

1. R. Jacob Baker - H.W.Li and D.E. Boyce - "CMOS Circuit Design - Layout and Simulation" - Prentice - Hall of India -1998.
2. Y.P.Tsividis - "Mixed Analog and Digital VLSI Devices and Technology" - McGraw Hill - 1996.
3. Robert E Colin - "Foundations for Microwave Engineering" - John Wiley & Sons Inc - 2005

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15751 **OPTOELECTRONIC DEVICES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basics of solid state physics
- acquire the knowledge of display devices.
- learn the concepts of optical detection devices.
- gain knowledge about optoelectronic integrated circuits.
- know the design of optoelectronic integrated circuits.

UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

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

UNIT II DISPLAY DEVICES AND LASERS 9

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

UNIT III DETECTION DEVICES 9

Photo detection Principle - Photoconductors - Noise in photoconductors -Photodiodes - PIN Photodiode - APD Detector performance parameters - Detectors for long wavelength operation - wavelength - selective detection - Charge Coupled Device.

UNIT IV OPTOELECTRONIC MODULATOR 9

Introduction - Analog and Digital Modulation - Electro -optic modulators - Magneto -optic Devices - Acousto -optic devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the basics of solid state physics.
- analyze the design of optoelectronic detection devices and modulators. .
- evaluate the concepts of optical detection devices.
- synthesize the design of optoelectronic integrated circuits.

- apply the concepts of Opto electronic and integrated circuits

TEXT BOOKS

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices” - Prentice Hall of India Pvt. - Ltd. - NewDelhi
2. .Jasprit Singh - “Opto Electronics – As Introduction to Materials and Devices” - McGraw -Hill International Edition - 1998

REFERENCES

1. . S.O.Kasap - “Opto Electronics and Photonics – Principles and Practices” - Pearson - Second Edition
2. S C Gupta - Opto Electronic Devices and Systems - Prentice Hal of India - 2005.
3. J. Wilson and J.Haukes - “Opto Electronics – An Introduction” - Prentice Hall - 1995

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15752 MICROELECTROMECHANICAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn MEMS and its fabrication methods
- understand the principle of mechanical sensing.
- study the micro opto - electro principles.
- acquire the principle of magnetic sensing.
- gain knowledge about the significance of radio frequency MEMS and its applications.

UNIT I MEMS AND ITS FABRICATION METHODS 9

Definition of MEMS - MEMS history and development - micro machining - lithography principles and methods - structural and sacrificial materials - thin film deposition - impurity doping - etching - surface micro machining - wafer bonding.

UNIT II MECHANICAL SENSORS AND ACTUATORS 9

Principles of sensing and actuation: beam and cantilever - capacitive - piezo electric - strain - pressure - flow pressure measurement by micro phone - MEMS gyroscopes - shear mode piezo actuator - gripping piezo actuator - Inchworm technology.

UNIT III MICRO - OPTO - ELECTRO MECHANICAL SYSTEMS 9

Principle of MEMS technology - properties of light - light modulators - beam splitter - micro lens - micro mirrors - digital micro mirror device - light detectors - grating light valve - optical switch - wave guide and tuning - shear stress measurement

UNIT IV MAGNETIC SENSORS AND ACTUATORS 9

Magnetic materials for MEMS and properties - magnetic sensing and detection - magneto resistive sensor - more on hall effect - magneto diodes - magneto transistor - MEMS magnetic sensor - MEMS actuators by directional micro actuator - feedback circuit integrated magnetic actuator - magnetic probe based storage device.

UNIT V RADIO FREQUENCY MEMS 9

RF based communication systems - RF MEMS - MEMS inductors - varactors - tuner/filter - resonator - clarification of tuner - filter - resonator - MEMS switches - phase shifter.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the basics of MEMS.
- analyze the principle of mechanical sensing.
- apply the micro -opto -electro principles.
- synthesize the principle of magnetic sensing.
- compare the radio frequency MEMS and its applications.

TEXT BOOKS

1. Nitaigour Premchand Mahalik - "MEMS" - TMH Publishing co.
2. Tai -Ran Hsu - "MEMS and Micro Systems: Design and Manufacture" - TMH Publishers.

REFERENCES

1. Chang Liu - "Foundation of MEMS" - Prentice Hall Ltd.
2. Sergey Edwrd Lyshevski - "MEMS and NEMS" - CRC Press - Indian Edition.
3. Mohamed Gad -el -Hak - "MEMS – Introduction and fundamentals" - Taylor and Francis - Second Edition - 2013

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 6**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15753 **OPTICAL NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire basic concepts in optical system components.
- know the concepts in optical network architectures.
- learn about wavelength routing networks.
- gain knowledge on the concepts of packet switching and access networks.
- study the network design and management.

UNIT I OPTICAL SYSTEM COMPONENTS **9**

Light propagation in optical fibers - Loss and bandwidth - System limitations - Non -linear effects; Optical network components - Couplers - Isolators and Circulators - Multiplexers and Filters - Optical Amplifiers - Switches - Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES **9**

Introduction to Optical Networks; SONET / SDH - Metropolitan -Area Networks - Layered Architecture Broadcast and Select networks -Topologies for broadcast networks - Media -Access Control Protocols - Test beds for Broadcast and Select WDM; Wavelength Routing Architecture.

UNIT III WAVELENGTH ROUTING NETWORKS **9**

The optical layer - Node Designs - Optical layer cost tradeoff - Routing and wavelength assignment - Virtual topology design - Wavelength Routing Test beds - Architectural variations.

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

Photonic Packet Switching - OTDM - Multiplexing and Demultiplexing - Synchronization - Broadcast OTDM networks - Switch -based networks; Access networks - Network architecture overview - Future Access Networks - Optical Access Network Architectures; OTDM networks.

UNIT V NETWORK DESIGN AND MANAGEMENT **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the basic concepts in optical system components.
- examine the concepts in optical network architectures

- elucidate about wavelength routing networks.
- evaluate the concepts of packet switching and access networks
- apply about network design and management

TEXT BOOKS

1. Rajiv Ramaswami and Kumar N. Sivarajan - “Optical Networks: A Practical Perspective” - Harcourt Asia Pte Ltd. - Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy - “WDM Optical Networks: Concept - Design and Algorithms” - Prentice Hall of India - Ist Edition - 2002.

REFERENCES

1. P.E. Green - Jr. - “Fiber Optic Networks” - Prentice Hall - NJ - 1993
2. John M.Senior - "Optical Fiber Communication” - Second Edition - Pearson Education - 2007.
3. Gerd Keiser - "Optical Fiber Communication" McGraw -Hill International - 4th Edition - 2010.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
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CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15754 **VIRTUAL INSTRUMENTATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about virtual versus traditional instruments and programming techniques
- learn about A/D and D/A converter and data acquisition.
- study PC buses - Instrumentation buses and network protocols
- design using VI software
- understand PC operating system and instrumentation

UNIT I VIRTUAL INSTRUMENTATION **9**

Virtual Instrumentation - Definition and Flexibility - Block diagram and Architecture for Virtual Instruments versus Traditional Instruments - Review of software in Virtual Instrumentation - VI Programming techniques - VI - sub VI - Loop and Charts - Arrays - Clusters and Graphs - Case and Sequence Structures - Formula nodes - String and File Input / Output.

UNIT II DATA ACQUISITION IN VIRTUAL INSTRUMENTATION **9**

A/D and D/A converters - Plug -in Analog Input / Output cards – Digital Input and Output Cards - Organization of the DAQ VI system – Opto isolation – Performing analog input and analog output – Scanning multiple analog channels – Issues involved in selection of Data acquisition cards – Data acquisition modules with serial communication – Design of digital voltmeter with transducer input – Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES **9**

Introduction to PC Buses – Local busses: - ISA - PCI - RS232 - RS422 and RS485 – Interface Buses: USB - PCMCIA - VXI - SCXI and PXI – Instrumentation Buses : Modbus and GPIB – Networked busses – ISO/OSI Reference model - Ethernet and TCP/ IP Protocols

UNIT IV REAL TIME CONTROL IN VIRTUAL INSTRUMENTATION **9**

Designs using VI Software - ON/OFF controller – Proportional controller – Modeling and basic control of level and reactor processes – Case studies on development of HMI - SCADA in VI

UNIT V OPERATING SYSTEM AND HARDWARE OVERVIEW **9**

PC architecture - current trends - operating system requirements - PC based instrumentation - analog and digital interfaces - PXI and SCXI main frame - modular instruments – Transducers – power - speed and timing considerations.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- examine virtual instrumentation concepts.
- analyze the various acquisition methodologies.
- evaluate traditional and virtual instrumentation.
- discuss operating systems required for virtual instrumentation.
- synthesize the implementation methods for instrumentation.

TEXT BOOKS

1. .Barry Paton - "Sensor - transducers and LabVIEW" - Prentice Hall of India 2000.
2. Sanjay Gupta and Joseph John - " Virtual Instrumentation using LabVIEW" Second Edition

REFERENCES

1. Lisa K Wells and Jeffery Travis "LabVIEW for Everyone" - Prentice Hall of India.1996.
2. Buchanan - W. "Computer buses" - CRC Press 209
3. .Jeffery Travis "Internet applications in LabVIEW" - Prentice Hall of India.1996

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15802 **PROJECT WORK PHASE II** **0 0 12 6**

COURSE OBJECTIVES

To enable the students to

- learn to work as a member of a project team.
- understand project management tasks.
- simulate software solution for a real-time, industry relevant problem
- develop a hardware for a real-time, industry relevant problem

Every student will be required to undertake a suitable project work in the Department during VIII semester, in consultation with the Head of the Department and the guide. Every student will have to submit their project report at the end of the Semester within the stipulated time as announced by the Institute/Department.

COURSE OUTCOMES

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

- apply knowledge of basic science and engineering to Electronics and Communication Engineering problems
- recognize the real world applications and to solve with core engineering knowledge.
- analyze and work on multidisciplinary tasks
- choose latest tools, software and equipment to solve real world problems identify, formulate, and model engineering equipment

TOTAL PERIODS 180

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO2	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO3	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO4	3	2	3	2	3	2	1	1	2	2	3	1	3	2

EC16951 EMBEDDED PROGRAMMING USING ARDUINO BOARD 0 0 2 1

AIM

This course will familiarize the student with the basic principles and techniques of embedded programming using ARDUINO microcontroller boards and integrating them with sensor and actuator circuits.

COURSE OBJECTIVES

To enable the students

- understand basics of ARDUINO controller.
- know about various blocks of ARDUINO and its programming.
- understand interfacing with I/O devices.

PREREQUISITES

- Basics of Electronics Circuits
- Microprocessor & Microcontroller
- C Programming.

TEACHING STRATEGIES

- Simulation and Demonstration
- Power point presentation
- Chalk and talk 6

UNIT I INTRODUCTION TO ARDUINO 10

Microcontroller architecture - Signals -Operation features-Introduction to ARDUINO IDE Introduction to ARDUINO IDE-Introduction to Proteus-Introduction to I/O ports.

UNIT II TIMER AND COUNTER 10

Interrupts-Serial communication -Memory organization - Time/counters- Programming using timers/counters serial Communication Interface.

UNIT III I/O DEVICE 6

Analog to Digital I/O -Interfacing simple sensors - Key board interfacing - 7segment Display -LCD interfacing - stepper Motor interfacing _DC motor interfacing.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course- the students will be able to:

- Utilize ARDUINO development kits effectively for embedded system design.
- Gain experience with real time embedded system projects and working in a small team- cooperating on various aspects of software development.
- Understand development of embedded system applications.

EC16952 PC HARDWARE ASSEMBLING AND TROUBLESHOOTING 0 0 2 1

AIM

This course imparts practical knowledge and provides hands-on experience in the area of how to assemble computers- and how to troubleshoot hardware and software issues.

COURSE OBJECTIVES

To enable the students to

- understand basics of PC and its hardware concepts.
- know about various networking of PCs.
- gain knowledge about existing operating systems.
- learn about synchronization of peripherals.
- get training in PC assembly and trouble shooting.

PREREQUISITES

Basic knowledge of computer peripherals.

TEACHING STRATEGIES

- Group activities
- Power point presentations and Video Presentations
- Practical demonstrations

UNIT I PC HARDWARE 6

BIOS settings-Motherboard Components- RAM- Expansion Cards- Storage Devices- The CPU- Interfaces- Computer Power- Custom Computer Components- Display Devices- Connector Types- Computer Peripherals

UNIT II NETWORKING 6

Network Connectors- Network Cabling- TCP/IP- Common Network Ports- Wireless Networking Standards- Installing a Wireless Router- Internet Connection Types- Network Types- Common Network Devices- Networking Tools

UNIT III OPERATING SYSTEMS 6

Characteristic impedance of symmetrical networks - Filter fundamentals- Design of filters: Constant K -LPF- HPF and BPF Filter design- m-derived filters - Composite filters- Fundamentals of Attenuators and Equalizers.

UNIT IV LAPTOPS- PRINTERS AND MOBILE DEVICES 6

Laptop - Hardware- Displays; Printers-Installing and maintenance; Mobile devices-Mobile Operating Systems - Network Connectivity -Securing Mobile Devices-Mobile Device Synchronization

UNIT V ASSEMBLING AND TROUBLESHOOTING 6

Hardware assembling- Common Hardware Problems- Troubleshooting techniques of Devices- Hard Drive- Networks- Operating System- Laptops and Troubleshooting Printers.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- explain- install- and navigate an operating system .
- upgrade components based on customer needs and perform preventive measures and trouble shooting.
- assess customer needs- analyse possible configurations .
- provide solutions or recommendations for hardware- operating systems- networking and security.
- elucidate various assembling and Troubling shooting problems.

EC16953 **CISCO CERTIFIED NETWORK ASSOCIATE (CCNA)** **0 0 2 1**

AIM

To impart knowledge about detailed knowledge of Computer Networks, various protocols used in Communication, Managing and configuring Cisco Switches and Routers and various WAN technologies.

COURSE OBJECTIVES

To enable the students to

- understand functional modules of Networks
- know about Network challenges
- learn about the implementation targets

TEACHING STRATEGIES

- Power point presentation
- Chalk and talk

UNIT I **INTRODUCTION TO NETWORKS** **10**

Introduction to Local Area Networks (LANs) - The OSI Model - Basics of LAN Media

UNIT II **ROUTING AND SWITCHING ESSENTIALS** **10**

Structured Cabling - Routing and IP Addressing - TCP/IP - LAN Technologies

UNIT III **SCALING NETWORKS AND CONNECTING NETWORKS** **10**

Network architecture - Basic Network Design and Documentation - Typical implementations - Performance analysis - Commercially available platforms.

TOTAL PERIODS **30**

COURSE OUTCOMES

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

- elucidate the functional modules of networks
- ellaborate the network challenges
- describe the implementation targets

EC16954 BASIC ELECTRONIC CIRCUIT DESIGN USING MULTISIM 0 0 2 1

AIM

To impart basic knowledge of circuit design using MultiSim and SPICE

COURSE OBJECTIVES

To enable the students to

- understand basics of simulation with Multisim.
- know about circuit designing using Multisim.
- learn about SPICE modeling.

PREREQUISITES

- Experience with Microsoft Windows
- Basic knowledge of Electronics theory

TEACHING STRATEGIES

- The teaching methodologies include lectures- presentations- circuit design- Simulation and mini-projects

UNIT I BASICS CIRCUIT SIMULATION TECHNIQUES IN MULTISIM 10

Multisim Environment: Design Process - Setting environment preferences - The Multisim GUI - Schematic capture of circuits: Placing components - Wiring components -simulation and result display in Multisim.

UNIT II ELECTRONIC CIRCUIT DESIGN USING MULTISIM 10

Device modeling: Design of Bridge rectifier- Half-Wave rectifier- clippers and clampers using diode- voltage regulator- AC voltage measurement- DC transfer curve analysis.

UNIT III CIRCUIT MODELLING USING SPICE 10

Spice Simulation overview -Design Environment- SPICE based simulator analysis - Real time applications.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- use Multisim to capture circuit schematics
- use interactive simulation to check circuit design
- perform circuit analysis using SPICE

EC16955 **MATLAB PROGRAMMING** **0 0 2 1**

AIM

The course will impart knowledge on performing various image processing tasks using the Image Processing Toolbox and implementing various analog and digital modulation schemes using the Communication System Toolbox.

COURSE OBJECTIVES

To enable the students to

- understand basics of Image processing.
- know about various modulation schemes.
- learn about Graphical User Interface

PREREQUISITES

- Familiarity with using Windows applications
- Fundamentals of MATLAB

TEACHING STRATEGIES

- Power point presentations
- Demonstrations
- Programming practices

UNIT I IMAGE PROCESSING **10**

Introduction to Image Processing Toolbox- Image Import and Export- Image Types in the Toolbox - Converting Between Image Types- Process Multi-Frame Image Arrays- Reading Image Data- Writing Image Data to Files- Displaying and Exploring Images- Geometric Transformations.

UNIT II COMMUNICATION SYSTEM **10**

Introduction to Communication System Toolbox- Analog modulation - Amplitude and frequency modulation- Digital modulation - Amplitude- phase and frequency modulation- AM and FM using Simulink.

UNIT III GUI **10**

Creating a GUI - GUI for performing simple operations on an image - GUI for amplitude and frequency modulation.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- Work comfortably with various image processing tasks
- Implement various analog and digital modulation schemes
- Create simple GUIs

EC16956 **SOFTWARE DEFINED RADIO** **0 0 2 1**

AIM

To make the students to get knowledge of fundamental and state-of-the-art concepts in software defined radio.

COURSE OBJECTIVES

To enable the students to

- understand functional modules of SDR
- know about SDR challenges
- learn about the implementation targets

TEACHING STRATEGIES

- Power point presentation
- Chalk and talk

UNIT I FUNCTIONAL MODULES OF SDR **10**

Introduction to Software Defined Radio- Radio technology evolution - Basics of Radio section - Digital Signal Processing and Digital Communication functional modules.

UNIT II SDR CHALLENGES **10**

Physical Layer functions- Digital generation of signals -Application of signal processing- ADC/DAC choices and issues - RF system functional blocks and implementation issues.

UNIT III IMPLEMENTATION TARGETS **10**

SDR architecture - Implementation Targets- GPP/FPGA/SoC/ASIC - Typical implementations - Performance analysis - Commercially available platforms.

TOTAL PERIODS **30**

COURSE OUTCOMES

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

- elucidate the functional modules of SDR
- ellaborate the Software defined radio challenges
- describe the implementation targets

EC16957 **INDUSTRIAL ELECTRICAL SYSTEMS** **0 0 2 1**

AIM

To bring the awareness in the students regarding latest trends in electrical industry in the field of switchgears and protection and provide them with hands-on experience

COURSE OBJECTIVES

To enable the students to

- understand basics of electrical systems.
- know about various switch gears.
- learn about electrical protection systems

PREREQUISITES

- Knowledge of basic concepts of electrical engineering
- Fundamentals of electrical components

TEACHING STRATEGIES

- Power point presentations
- Demonstrations
- Hands on practices

UNIT I SWITCH GEARS **20**

Importance and Selection of LV switchgear - Electrical safety, various LV switchgear their importance, operation, selections, applications, features, maintenance; Workshop session, Hands on practice, Demonstration.

UNIT II ELECTRICAL PROTECTION SYSTEMS **10**

Electrical Protection Systems - Concepts of electrical protection system, Overview of Advance Electrical Protection System, various components of protection systems, Feeder Protection Relays, Motor Protection Relays, Workshop session, Hands on practice, Demonstration on above relays

TOTAL PERIODS 30

COURSE OUTCOMES

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

- acquire good knowledge and overview of latest switchgears products
- gain knowledge on the protective systems which is prevalent in the modern industry.

EC16958 OPEN SOURCE PROGRAMMING USING LINUX 0 0 2 1

AIM

To give introduction about basic file system and process commands in Linux operating systems.

COURSE OBJECTIVES

To enable the students to

- understand Linux commands and directories
- know about different processes in Linux
- learn about Shell programming

TEACHING STRATEGIES

- Power point presentation
- Chalk and talk

UNIT I LINUX COMMANDS FOR FILES AND DIRECTORIES 10

Linux introduction and file system – Basic features, advantages, installing requirement, basic architecture of UNIX/Linux system, Kernel, Shell. Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces, Essential linux commands.

UNIT II PROCESSES IN LINUX 10

Processes in linux –process fundamentals, connecting processes with pipes, Redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes, batch commands, Printing commands, file related commands.

UNIT III SHELL PROGRAMMING 10

Shell programming: Shell programming basic, various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, shell variables, shell keywords, creating simple shell programs.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- install Linux OS by partitioning the hard disk
- manage files through file operation commands
- control process through shell programming.

EC16959 **PCB DESIGN USING CADENCE EDA TOOL** **0 0 2 1**

AIM

To impart basic knowledge and provide hands- on experience in PCB layout and design.

COURSE OBJECTIVES

To enable the students to

- understand basics of ORCAD CAPTURE CIS.
- know about analog and digital circuit design
- learn about PCB Layout design

PREREQUISITES

- Electron Devices and Circuits.
- Circuit Theory.

TEACHING STRATEGIES

- Lectures
- Group works, presentations
- Practical

UNIT I CIRCUIT CREATION USING ORCAD CAPTURE CIS 10

Introduction to PCB Design Flow-Tool bar – Customization – Library creation – Library customization – Editing part reference and value- Property editor- Wire and Net properties – Net alias, Editing parts , Creating parts, power symbol, part creation.

UNIT II ANALOG and DIGITAL CIRCUIT DESIGN 10

Design of simple AC and DC Circuits using Cadence Allegro Design Entry CIS -Placing parts, editing parts, and wiring the circuit-Setting up the analysis-Bias point-DC Sweep-AC Sweep/Noise-Time Domain (Transient). Creation of simple Digital Circuits-Bus Creation.

UNIT III PCB LAYOUT DESIGN 7 **10**

Footprint creation-Pad Design-PCB Symbol Creation-Net list-Placement-Routing- File Generation

COURSE OUTCOMES

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

- do schematic drawing and circuit simulation
- analyse different circuits through PCB layouts

EC16960 **DIGITAL SYSTEM DESIGN USING VHDL** **0 0 2 1**

AIM

To introduce the challenges, methodologies, techniques, and issues for designing digital systems using reprogrammable FPGA devices.

COURSE OBJECTIVES

To enable the students to

- understand basics of VHDL circuits
- know about test bench development
- learn about PCB Layout design

PREREQUISITES

- Digital Electronics.
- C - Programming

TEACHING STRATEGIES

- Power point presentations
- Hands on training

UNIT I DIGITAL SYSTEM DESIGN **10**

Digital system design concepts, Combinational and sequential logic design: principles and practices, Sequential and combinational VHDL design, Synchronous and asynchronous design.

UNIT II TESTBENCH DEVELOPMENT **10**

Writing Test Bench , Test bench development, FPGA Architecture , FPGA Implementation , timing analysis, power analysis.

UNIT III APPLICATIONS OF FPGA **10**

CAD design software, Applications of FPGA in practical digital system development.

COURSE OUTCOMES

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

- utilize the syntax and behavior of the VHDL language
- use modern development tools to design complex digital circuits
- simulate and make a synthesis of extensive designs in so called "Field Programmable Gate Array"

EC16961 **INDUSTRIAL AUTOMATION** **0 0 2 1**

AIM

- To impart knowledge in automation technologies used in Process Industries, Automotive Industries, Home, Factory, Agriculture etc.

COURSE OBJECTIVES

To enable the students to

- understand the basics of hydraulics
- know about basics of pneumatic, electro pneumatics and its circuits
- learn about different types of automation

PREREQUISITES

- Basic knowledge in Analog/Digital circuits and electrical drives
- Principles and operations of sensors and transducers
- knowledge in microprocessor - based systems

TEACHING STRATEGIES

- Power point presentations
- Practices on different Sensors

UNIT I HYDRAULICS **10**

Basics of Hydraulics - Components of hydraulics - Types of valves - DCVs - operations - hydraulic Circuits - Electro hydraulics - Solenoids - Relays - Electrical logic circuits - Applications of electro hydraulics - Practices on electro hydraulic circuits.

UNIT II PNEUMATICS **10**

Basics of Pneumatics - Components of Pneumatics - Types of valves - DCVs - operations - Pneumatic circuits - Electro pneumatics - Electrical Logic circuit – Relay ladder logic - Applications of electro pneumatics - Practices on electro pneumatic circuits. Types of Proximity sensors - construction - principle of operation - Applications proximity sensors

UNIT III MECHATRONICS **10**

Introduction to Mechatronics system – overview of Automation System – Types of Automation – role of sensors in automation system – Electrical drives – interfacing of PLC – Case study of modular Mechatronics System– Demonstration - Troubleshooting

COURSE OUTCOMES

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

- analyze the electro hydraulics and its circuits
- develop different applications using electro pneumatics and its circuits
- develop an automation system with suitable sensors

EC16962 INDUSTRIAL ELECTRONIC PRODUCT DESIGN 0 0 2 1

AIM

- This course is intended to prepare students to design products based on industrial product design principles, guidelines and skills.

COURSE OBJECTIVES

To enable the students to

- understand the basics of industrial design
- know about comprehensive process of design, engineering and producing products and systems.
- learn about ergonomics and aesthetics in electronic product design

PREREQUISITES

- Basic knowledge in Analog/Digital circuits
- Knowledge in Electronic products

TEACHING STRATEGIES

- Power point presentations

UNIT I INTRODUCTION TO INDUSTRIAL DESIGN 10

Role of Industrial design in the domain of industry , product innovation, designer's philosophy and role in product design. Product development tools and methods.

UNIT II PRODUCT PLANNING 10

Defining the task , scheduling , estimation of labor cost, amount of documentation; Layout design, structure design, standard, non-standard structures, Industrials standards.

UNIT III ERGONOMICS AND AESTHETICS IN ELECTRONIC PRODUCT DESIGN 10

Overview of Electronic Product Design, Top-Down and Bottom-Up Approach, Power Supply Design - example, Ergonomic - Aesthetics.

COURSE OUTCOMES

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

- design electronic products using user centered design process
- apply product development process for realization of the product.
- apply different approaches in electronic product design