PROGRAMME EDUCATIONAL OBJECTIVES
PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Telecommunication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAMME OUTCOMES
Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OBJECTIVES (PSOs)**

1. To analyse, design and develop solutions by applying foundational concepts of electronics and communication engineering.
2. To apply design principles and best practices for developing quality products for scientific and business applications.
3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.

**Contribution**

1: Reasonable  
2: Significant  
3: Strong

**MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES**

A broad relation between the programme objective and the outcomes is given in the following table

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MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:
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## PROFESSIONAL ELECTIVES (PE)

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I    SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS        12

UNIT II   GENERAL READING AND FREE WRITING                                      12
Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and/or short questions/open-ended questions) - inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts) - register. Writing - paragraph writing - topic sentence - main ideas - free writing - short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking - sharing information of a personal kind - greeting - taking leave. Language development - prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT                                     12
Reading - short texts and longer passages (close reading) Writing - understanding text structure - use of reference words and discourse markers - coherence - jumbled sentences. Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison - pronouns - direct vs indirect questions. Vocabulary development - single word substitutes - adverbs.

UNIT IV   READING AND LANGUAGE DEVELOPMENT                                      12
Reading - comprehension - reading longer texts - reading different types of texts - magazines. Writing - letter writing, informal or personal letters - e-mails - conventions of personal email. Listening - listening to dialogues or conversations and completing exercises based on them. Speaking - speaking about oneself - speaking about one's friend. Language development - Tenses - simple present - simple past - present continuous and past continuous. Vocabulary development - synonyms - antonyms - phrasal verbs.
UNIT V EXTENDED WRITING

Reading - longer texts - close reading
Writing - brainstorming - writing short essays - developing an outline - identifying main and subordinate ideas - dialogue writing
Listening - listening to talks - conversations
Speaking - participating in conversations - short group conversations
Language development - modal verbs - present/past perfect tense
Vocabulary development - collocations - fixed and semi-fixed expressions.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, learners will be able to:
- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
OBJECTIVES:
The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFERENTIAL CALCULUS 12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.
TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH8151 ENGINEERING PHYSICS

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS

UNIT IV QUANTUM PHYSICS
UNIT V CRYSTAL PHYSICS

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course,
- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
UNIT I  WATER AND ITS TREATMENT

UNIT II  SURFACE CHEMISTRY AND CATALYSIS

UNIT III  ALLOYS AND PHASE RULE

UNIT IV  FUELS AND COMBUSTION

UNIT V  ENERGY SOURCES AND STORAGE DEVICES
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

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

UNIT II DATA, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

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

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehesion; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.
TEXT BOOKS:

REFERENCES:

GE8152 ENGINEERING GRAPHICS

OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6 +12
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to:
- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.
OBJECTIVES

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

OUTCOMES

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL: 60 PERIODS

BS8161  PHYSICS AND CHEMISTRY LABORATORY  (Common to all branches of B.E. / B.Tech Programmes)  L T P C  0 0 4 2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS:  PHYSICS LABORATORY  (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to

- Apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:


HS8251 TECHNICAL ENGLISH

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.
UNIT I  INTRODUCTION TECHNICAL ENGLISH  12
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking – Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-

UNIT II  READING AND STUDY SKILLS  12
Listening- Listening to longer technical talks and completing exercises based on them-
Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs-
Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III  TECHNICAL WRITING AND GRAMMAR  12
Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV  REPORT WRITING  12

UNIT V  GROUP DISCUSSION AND JOB APPLICATIONS  12
Listening- TED/Ink talks; Speaking – participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL :60 PERIODS

OUTCOMES:
At the end of the course learners will be able to:
• Read technical texts and write area- specific texts effortlessly.
• Listen and comprehend lectures and talks in their area of specialisation successfully.
• Speak appropriately and effectively in varied formal and informal contexts.
• Write reports and winning job applications.
TEXT BOOKS:

REFERENCES:
Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

OBJECTIVES:
This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

UNIT II VECTOR CALCULUS 12
Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS 12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{1}{z}, z^2 \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12
UNIT V   LAPLACE TRANSFORMS


TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

REFERENCES :

PH8253 PHYSICS FOR ELECTRONICS ENGINEERING
(Common to BME, ME, CC, ECE, EEE, E&I, ICE) 3 0 0 3

OBJECTIVES:
- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I   ELECTRICAL PROPERTIES OF MATERIALS
UNIT II  SEMICONDUCTOR PHYSICS

UNIT III  MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS

UNIT IV OPTICAL PROPERTIES OF MATERIALS

UNIT V  NANOELECTRONIC DEVICES

OUTCOMES:
At the end of the course, the students will able to
• Gain knowledge on classical and quantum electron theories, and energy band structures,
• Acquire knowledge on basics of semiconductor physics and its applications in various devices,
• Get knowledge on magnetic and dielectric properties of materials,
• Have the necessary understanding on the functioning of optical materials for optoelectronics,
• Understand the basics of quantum structures and their applications in spintronics and carbon electronics..

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
To impart knowledge on
- Operation of Three phase electrical circuits and power measurement
- Working principles of Electrical Machines
- Working principle of Various measuring instruments

UNIT I  AC CIRCUITS AND POWER SYSTEMS  9

UNIT II  TRANSFORMER  9
Introduction - Ideal Transformer – Accounting For Finite Permeability And Core Loss – Circuit Model Of Transformer – Per Unit System – Determination Of Parameters Of Circuit Model Of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

UNIT III  DC MACHINES  9
Introduction – Constructional Features– Motoring and generation principle - Emf And Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

UNIT IV  AC MACHINES  9

UNIT V  MEASUREMENT AND INSTRUMENTATION  9
Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters, Oscilloscopes- Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- Understand the concept of three phase power circuits and measurement.
- Comprehend the concepts in electrical generators, motors and transformers
- Choose appropriate measuring instruments for given application

TEXT BOOKS:
REFERENCES:

EC8251 CIRCUIT ANALYSIS L T P C 4 0 0 4

OBJECTIVES:
- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 12

UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 12
Network theorems - Superposition theorem, Thevenin’s theorem, Norton’s theorem, Reciprocity theorem, Millman’s theorem, and Maximum power transfer theorem ,application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

UNIT III RESONANCE AND COUPLED CIRCUITS 12
Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

UNIT IV TRANSIENT ANALYSIS 12

UNIT V TWO PORT NETWORKS 12
Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

TOTAL : 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits.
TEXT BOOKS:

REFERENCES:

EC8252 ELECTRONIC DEVICES

OBJECTIVES:
- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

UNIT I SEMICONDUCTOR DIODE
PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS

UNIT III FIELD EFFECT TRANSISTORS
JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES
Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V POWER DEVICES AND DISPLAY DEVICES
UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to:
- Explain the V-I characteristic of diode, UJT and SCR
- Describe the equivalence circuits of transistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices
OUTCOMES:
At the end of the course, the student should be able to:
• Analyze the characteristics of basic electronic devices
• Design RL and RC circuits
• Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

REFERENCES:

TEXT BOOKS:

EC8261 CIRCUITS AND DEVICES LABORATORY

OBJECTIVES:
• To learn the characteristics of basic electronic devices such as Diode, BJT, FET, SCR
• To understand the working of RL, RC and RLC circuits
• To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics
5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications Of Thevinin & Norton theorem
9. Verifications Of KVL & KCL
10. Verifications Of Super Position Theorem
11. Verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

LABORATORY REQUIREMENTS
BC 107, BC 148,2N2646,BFW10 - 25 each
1N4007, Zener diodes - 25 each
Resistors, Capacitors, Inductors - sufficient quantities
Bread Boards - 15 Nos.
CRO (30MHz) – 10 Nos.
Function Generators (3MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos.

TOTAL : 60 PERIODS
OBJECTIVES:
To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools  2 Sets.
9. Study-purpose items: centrifugal pump, air-conditioner  One each.

**ELECTRICAL**
1. Assorted electrical components for house wiring  15 Sets.
2. Electrical measuring instruments  10 Sets.
3. Study purpose items: Iron box, fan and regulator, emergency lamp  1 each.
4. Megger (250V/500V)  1 No.
5. Power Tools: (a) Range Finder  2 Nos.
    (b) Digital Live-wire detector  2 Nos.

**ELECTRONICS**
1. Soldering guns  10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs  10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

**MA8352  LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS**  

**OBJECTIVES:**
- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

**UNIT I  VECTOR SPACES**  12
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

**UNIT II  LINEAR TRANSFORMATION AND DIAGONALIZATION**  12
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

**UNIT III  INNER PRODUCT SPACES**  12
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

**UNIT IV  PARTIAL DIFFERENTIAL EQUATIONS**  12
UNIT V  FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS  


TOTAL : 60 PERIODS

OUTCOMES: 
Upon successful completion of the course, students should be able to:
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts. 
- Demonstrate accurate and efficient use of advanced algebraic techniques. 
- Demonstrate their mastery by solving non-trivial problems related to the concepts and by proving simple theorems about the statements proven by the text. 
- Able to solve various types of partial differential equations. 
- Able to solve engineering problems using Fourier series.

TEXTBOOKS: 

REFERENCES :

EC8393  FUNDAMENTALS OF DATA STRUCTURES IN C  L T P C 
3 0 0 3

OBJECTIVES: 
- To learn the features of C 
- To learn the linear and non-linear data structures 
- To explore the applications of linear and non-linear data structures 
- To learn to represent data using graph data structure 
- To learn the basic sorting and searching algorithms 

UNIT I  C PROGRAMMING BASICS 
UNIT II  FUNCTIONS, POINTERS, STRUCTURES AND UNIONS  

UNIT III  LINEAR DATA STRUCTURES  
Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT IV  NON-LINEAR DATA STRUCTURES  
Trees – Binary Trees – Binary tree representation and traversals – Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

UNIT V  SEARCHING AND SORTING ALGORITHMS  

TOTAL: 45 PERIODS

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

- Implement linear and non-linear data structure operations using C
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem
- Modify or suggest new data structure for an application
- Appropriately choose the sorting algorithm for an application

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To understand the methods of biasing transistors
- To design and analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze the regulated DC power supplies.
- To troubleshoot and fault analysis of power supplies.

UNIT I  BIASING OF DISCRETE BJT, JFET AND MOSFET


UNIT II  BJT AMPLIFIERS

Small Signal Hybrid π equivalent circuit of BJT – Early effect - Analysis of CE, CC and CB amplifiers using Hybrid π equivalent circuits - AC Load Line Analysis- Darlington Amplifier - Bootstrap technique - Cascade, Cascode configurations - Differential amplifier, Basic BJT differential pair – Small signal analysis and CMRR.

UNIT III  SINGLE STAGE FET, MOSFET AMPLIFIERS

Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers using Hybrid π equivalent circuits - Basic FET differential pair- BiCMOS circuits.

UNIT IV  FREQUENCY RESPONSE OF AMPLIFIERS


UNIT V  POWER SUPPLIES AND ELECTRONIC DEVICE TESTING


TOTAL: 45 PERIODS

OUTCOMES:

After studying this course, the student should be able to:

- Acquire knowledge of
  ▪ Working principles, characteristics and applications of BJT and FET
  ▪ Frequency response characteristics of BJT and FET amplifiers
- Analyze the performance of small signal BJT and FET amplifiers - single stage and multi stage amplifiers
- Apply the knowledge gained in the design of Electronic circuits

TEXT BOOKS:

REFERENCES


EC8352 SIGNALS AND SYSTEMS

OBJECTIVES:
- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 12
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 12
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 12
Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12

OUTCOMES:
At the end of the course, the student should be able to:
- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains

TOTAL: 60 PERIODS
TEXT BOOK:

REFERENCES

CS8351 DIGITAL PRINCIPLES AND SYSTEM DESIGN

OBJECTIVES:
- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES
12

UNIT II COMBINATIONAL LOGIC
12

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC
12

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC
12

UNIT V MEMORY AND PROGRAMMABLE LOGIC
12

TOTAL: 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits
TEXT BOOK:

REFERENCES:
1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010

EC8391 CONTROL SYSTEMS ENGINEERING  L  T  P  C
3  0  0  3

OBJECTIVES:
- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION  9
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS  9
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS  9
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS  9

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS  9
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL:45 PERIODS
OUTCOMES:
Upon completion of the course, the student should be able to:
- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

TEXT BOOK:

REFERENCES:

EC8381 FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY

OBJECTIVES:
- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

LIST OF EXERCISES
1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

TOTAL:60 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Write basic and advanced programs in C
- Implement functions and recursive functions in C
- Implement data structures using C
- Choose appropriate sorting algorithm for an application and implement it in a modularized way
OBJECTIVES:
The student should be made to:

- Study the Frequency response of CE, CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristics of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits
- Design and implement the Combinational and sequential logic circuits

LIST OF ANALOG EXPERIMENTS:

1. Design of Regulated Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement
5. Cascode and Cascade amplifiers
6. Determination of bandwidth of single stage and multistage amplifiers
7. Analysis of BJT with Fixed bias and Voltage divider bias using P-Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using PSpice
9. Analysis of Cascode and Cascade amplifiers using PSpice
10. Analysis of Frequency Response of BJT and FET using PSpice

LIST OF DIGITAL EXPERIMENTS

1. Design and implementation of code converters using logic gates (i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
6. Design and implementation of 3-bit synchronous up/down counter

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this laboratory course, the student should be able to:

- Design and Test rectifiers, filters and regulated power supplies.
- Design and Test BJT/JFET amplifiers.
- Differentiate cascode and cascade amplifiers.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Measure CMRR in differential amplifier
- Simulate and analyze amplifier circuits using PSpice.
- Design and Test the digital logic circuits.
LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>EQUIPMENTS FOR ANALOG LAB</th>
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<tbody>
<tr>
<td>1</td>
<td>CRO/DSO (30MHz) – 15 Nos.</td>
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<tr>
<td>2</td>
<td>Signal Generator /Function Generators (3 MHz) – 15 Nos</td>
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<tr>
<td>3</td>
<td>Dual Regulated Power Supplies (0 – 30V) – 15 Nos.</td>
</tr>
<tr>
<td>4</td>
<td>Standalone desktop PCs with SPICE software – 15 Nos.</td>
</tr>
<tr>
<td>5</td>
<td>Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos</td>
</tr>
<tr>
<td>6</td>
<td>Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.</td>
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<tr>
<td>7</td>
<td>SPICE Circuit Simulation Software: (any public domain or commercial software)</td>
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<tr>
<th>S.NO</th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>Dual power supply/ single mode power supply - 15 Nos</td>
</tr>
<tr>
<td>2</td>
<td>IC Trainer Kit - 15 Nos</td>
</tr>
<tr>
<td>3</td>
<td>Bread Boards - 15 Nos</td>
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<tr>
<td>4</td>
<td>Seven segment display -15 Nos</td>
</tr>
<tr>
<td>5</td>
<td>Multimeter - 15 Nos</td>
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<tr>
<td>6</td>
<td>ICs each 50 Nos</td>
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|  | 7400/ 7402 / 7404 / 7406 / 7408 / 7432 / 7483 / 74150 / 74151 / 7445 / 7485 / 7473 / 74138 / 7411 / 7474 |

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<thead>
<tr>
<th>HS8381</th>
<th>INTERPERSONAL SKILLS/LISTENING&amp; SPEAKING</th>
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OBJECTIVES:
The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

45
UNIT III
Lexical chunking for accuracy and fluency - factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

REFERENCES

MA8451 PROBABILITY AND RANDOM PROCESSES

OBJECTIVES:
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.
UNIT I PROBABILITY AND RANDOM VARIABLES

Probability – Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES


UNIT IV CORRELATION AND SPECTRAL DENSITIES


UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS:


REFERENCES:

OBJECTIVES:
- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To study about feedback amplifiers and oscillators principles
- To design oscillators.
- To study about tuned amplifier.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multivibrators, power amplifiers and DC convertors.

UNIT I FEEDBACK AMPLIFIERS AND STABILITY

UNIT II OSCILLATORS
Barkhausen criterion for oscillation – phase shift, Wien bridge - Hartley & Colpitt’s oscillators – Clapp oscillator-Ring oscillators and crystal oscillators – oscillator amplitude stabilization.

UNIT III TUNED AMPLIFIERS

UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS

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

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Analyze different types of amplifier, oscillator and multivibrator circuits
- Design BJT amplifier and oscillator circuits
- Analyze transistorized amplifier and oscillator circuits
- Design and analyze feedback amplifiers
- Design LC and RC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, power amplifier and DC convertors.

TEXT BOOKS:
REFERENCES:

OBJECTIVES:
- To introduce the fundamentals of various analog modulations
- To know the generation and detection of AM and FM waves
- To know the AM and FM transmitter and Receiver
- To know the effect of noise on communication systems

UNIT I AMPLITUDE MODULATION
Need for modulation, Definition, Time domain and frequency domain description of AM waves, single tone modulation, power relations in AM waves, Generation of AM waves, Detection of AM Waves, power relations in DSB/SC AM waves, Generation of DSBSC Waves, Coherent detection of DSB-SC Modulated waves, Generation of SSB Modulated waves, Demodulation of SSB Waves, Vestigial side band modulation, Comparison of AM Techniques.

UNIT II ANGLE MODULATION

UNIT III AM AND FM TRANSMITTERS
Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter.

UNIT IV AM AND FM RECEIVERS
Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency conversion and tracking, Intermediate frequency, AGC, FM Receivers, Comparison with AM Receiver, Amplitude limiting.

UNIT V NOISE CHARACTERIZATION

OUTCOMES:
At the end of the course, the students would
- Design AM communication systems.
- Design Angle modulated communication systems.
- Ability to understand and analyze the AM and FM receivers.
- Examine the noise performance of AM and FM systems.

TOTAL:45PERIODS
TEXT BOOK:

REFERENCES:

EC8451 ELECTROMAGNETIC FIELDS L T P C
4 0 0 4

OBJECTIVES:
- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

UNIT I INTRODUCTION
Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

UNIT II ELECTROSTATICS
Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

UNIT III MAGNETOSTATICS
Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS
Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields
UNIT V  PLANE ELECTROMAGNETIC WAVES

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.

OUTCOMES:
By the end of this course, the student should be able to:

- Display an understanding of fundamental electromagnetic laws and concepts
- Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning
- Explain electromagnetic wave propagation in lossy and in lossless media
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws.

TEXT BOOKS:

REFERENCES:

TL8402  LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS  L T P C

OBJECTIVES:
- To study the IC fabrication procedure
- To study characteristics; realize circuits; design for signal analysis using Op-amps
- To study the applications of Op-amp
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs

UNIT I  CHARACTERISTICS OF OPAMP

UNIT II  APPLICATIONS OF OPAMP
UNIT III  ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS


UNIT IV  APPLICATIONS OF ANALOG ICS - TIMER AND PLL


UNIT V  APPLICATIONS OF ANALOG ICS - VOLTAGE REGULATOR AND FUNCTION GENERATOR


OUTCOMES:
By the end of this course, the student would be able to:

- Design linear and non-linear applications of op-amps.
- Design the applications using Timer and PLL.
- Design the applications using Voltage regulator and Function generator ICs

TEXT BOOKS:
1. David A.Bell, ‘Op-amp & Linear ICs’, Oxford, 2013.(For Units 1,2 & 3 )

REFERENCES
OBJECTIVES:
- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.
UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:


REFERENCES:


EC8461 CIRCUITS DESIGN AND SIMULATION LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To gain hands on experience in designing electronic circuits
- To learn simulation software used in circuit design
- To learn the fundamental principles of amplifier circuits
- To differentiate feedback amplifiers and oscillators.
- To differentiate the operation of various multivibrators
DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS

1. Series and Shunt feedback amplifiers - Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers

SIMULATION USING SPICE (Using Transistor):
1. Tuned Collector Oscillator
2. Twin-T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this laboratory course, the student should be able to:
- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
- Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators using SPICE Tool.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>EQUIPMENTS</th>
<th>- 15 Nos</th>
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<td>1</td>
<td>CRO (Min 30MHz)</td>
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<td>3</td>
<td>Dual Regulated Power Supplies (0 – 30V)</td>
<td>- 15 Nos</td>
</tr>
<tr>
<td>4</td>
<td>Digital Multimeter</td>
<td>- 15 Nos</td>
</tr>
<tr>
<td>5</td>
<td>Digital LCR Meter</td>
<td>- 2 Nos</td>
</tr>
<tr>
<td>6</td>
<td>Standalone desktops PC</td>
<td>- 15 Nos</td>
</tr>
<tr>
<td>7</td>
<td>Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)</td>
<td>- 50 Nos</td>
</tr>
</tbody>
</table>

Components and Accessories:
Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers. SPICE Circuit Simulation Software: (any public domain or commercial software)
OBJECTIVES:

- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators using Op-amp
8. Astable and Monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
11. DC power supply using LM317 and LM723.
12. Study of SMPS

SIMULATION USING SPICE :

1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/ D converter ( Flash Type)
4. Analog multiplier

TOTAL:60PERIODS

OUTCOMES:
On completion of this laboratory course, the student should be able to:

- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design DC power supply using ICs.
- Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

EQUIPMENTS:

1. CRO/DSO (Min 30MHz) -- 15 Nos
2. Signal Generator /Function Generators (2 MHz) – 15 Nos
3. Dual Regulated Power Supplies (0 – 30V) -- 15 Nos
4. Digital Multimeter -- 15 Nos
5. IC Tester -- 5 Nos
6. Standalone desktops PC -- 15 Nos
7. Components and Accessories -- 50 Nos
Components and Accessories:
Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs.


TL8501 DIGITAL COMMUNICATION TECHNIQUES

OBJECTIVES:
- To know the principles of sampling & quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various Band pass signaling schemes
- To know the fundamentals of channel coding

UNIT I SAMPLING AND PULSE MODULATION
Introduction to Digital Communication Systems, Sampling process, Aliasing, Sampling theorem for band limited signals, pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse position modulation (PPM), pulse code modulation (PCM), Bandwidth, Noise trade off, Quantization -Uniform & non-uniform quantization, Noise considerations in PCM Systems, Logarithmic Comanding of speech signal, TDM.

UNIT II WAVEFORM CODING

UNIT III BASEBAND TRANSMISSION & RECEPTION TECHNIQUES
Inter symbol Interference, Nyquist’s criterion for Distortionless Base band Binary Transmission, Receiving Filter – Correlator type, Matched Filter type; Equalising Filter, Maximum Likelihood Detector, Error Probability, Figure-of-Merit for Digital Detection, Adaptive Equalization, Eye patterns.

UNIT IV BANDPASS SIGNAL TRANSMISSION AND RECEPTION
Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BASK, BFSK, QPSK, QAM, MSK schemes - Carrier Synchronization - structure of Non-coherent Receivers - Principle of DPSK. Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.

UNIT V ERROR CONTROL CODING
Discrete Memoryless channels - Shannon- Fano coding, Huffman Coding -Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

TOTAL:45PERIODS

OUTCOMES:
At the end of the course, the student will be able to
- Design PCM systems
- Design and implement base band transmission and reception schemes
- Design and implement band pass signaling schemes
- Design error control coding schemes
TEXT BOOKS:

REFERENCES

EC8553 DISCRETE-TIME SIGNAL PROCESSING L T P C
4 0 0 4

OBJECTIVES:
- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

UNIT I DISCRETE FOURIER TRANSFORM 12

UNIT II INFINITE IMPULSE RESPONSE FILTERS 12

UNIT III FINITE IMPULSE RESPONSE FILTERS 12
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations
UNIT IV  
**FINITE WORD LENGTH EFFECTS**  
12  
Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V  
**INTRODUCTION TO DIGITAL SIGNAL PROCESSORS**  
12  
DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

OUTCOMES:  
At the end of the course, the student should be able to  
- Apply DFT for the analysis of digital signals and systems  
- Design IIR and FIR filters  
- Characterize the effects of finite precision representation on digital filters  
- Design multirate filters  
- Apply adaptive filters appropriately in communication systems

TEXT BOOK:  

REFERENCES  

EC8552  
**COMPUTER ARCHITECTURE AND ORGANIZATION**  
L T P C  
3 0 0 3

OBJECTIVES:  
- To make students understand the basic structure and operation of digital computer  
- To familiarize with implementation of fixed point and floating-point arithmetic operations  
- To study the design of data path unit and control unit for processor  
- To understand the concept of various memories and interfacing  
- To introduce the parallel processing technique

UNIT I  
**COMPUTER ORGANIZATION & INSTRUCTIONS**  
9  

UNIT II  
**ARITHMETIC**  
9  
Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism
UNIT III THE PROCESSOR

UNIT IV MEMORY AND I/O ORGANIZATION

UNIT V ADVANCED COMPUTER ARCHITECTURE
Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to
• Describe data representation, instruction formats and the operation of a digital computer
• Illustrate the fixed point and floating-point arithmetic for ALU operation
• Discuss about implementation schemes of control unit and pipeline performance
• Explain the concept of various memories, interfacing and organization of multiple processors
• Discuss parallel processing technique and unconventional architectures

TEXT BOOKS:

REFERENCES

EC8551 COMMUNICATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Understand the division of network functionalities into layers.
• Be familiar with the components required to build different types of networks
• Be exposed to the required functionality at each layer
• Learn the flow control and congestion control algorithms
UNIT I FUNDAMENTALS & LINK LAYER
Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction

UNIT II MEDIA ACCESS & INTERNETWORKING
Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols ( IP, ICMP, Mobile IP)

UNIT III ROUTING

UNIT IV TRANSPORT LAYER

UNIT V APPLICATION LAYER

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

TEXT BOOK:

REFERENCES:
OBJECTIVES:
The student should be made:
- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts

LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems
- Analyze the architecture of a DSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- Design a DSP system for various applications of DSP
OBJECTIVES:
The student should be made:
- To visualize the effects of sampling and TDM
- To implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

LIST OF EXPERIMENTS:
1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. Simulation of ASK, FSK, and BPSK generation schemes
9. Simulation of DPSK, QPSK and QAM generation schemes
10. Simulation of signal constellations of BPSK, QPSK and QAM
11. Simulation of ASK, FSK and BPSK detection schemes
12. Simulation of Linear Block and Cyclic error control coding schemes
13. Simulation of Convolutional coding scheme
14. Communication link simulation

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Simulate & validate the various functional modules of a communication system
- Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
- Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
- Simulate end-to-end communication Link

LAB Requirements for a Batch of 30 students (3 students per experiment):

i) Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes
ii) CROs/DSOs – 15 Nos, Function Generators – 15 Nos.
iii) MATLAB or equivalent software package for simulation experiments
iv) PCs - 15 Nos
LIST OF EXPERIMENTS:
1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Implementation of IP Commands such as ping, Traceroute, nslookup.
6. Implementation of IP address configuration.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Implementation of Encryption and Decryption Algorithms using any programming language

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Communicate between two desktop computers
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use the simulation tool.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
SOFTWARE
- C / Python / Java / Equivalent Compiler
- MATLAB SOFTWARE (Few experiments can be practiced with MATLAB)
- Standard LAN Trainer Kits 4 Nos
- Network simulator like NS2/ NS3 / Glomosim/OPNET/ 30 Equivalent

HARDWARE
Standalone Desktops 30 Nos

TL8601
MOBILE ADHOC NETWORKS 3 0 0 3

OBJECTIVES:
- To introduce the characteristic features of adhoc wireless networks and their applications to the students.
- To enable the student to understand the functioning of different access and routing protocols that can be used for adhoc networks.
- To enable the student to understand the need for security and the challenges and also the role of crosslayer design in enhancing the network performance

UNIT I INTRODUCTION
Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.
UNIT II MEDIUM ACCESS PROTOCOLS
MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS

UNIT IV END-TO-END DELIVERY AND SECURITY

UNIT V CROSS LAYER DESIGN AND INTEGRATION
Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

OUTCOMES:
Upon completion of the course, students will be able to:
- The student would be able to demonstrate an understanding of the trade-offs involved in the design of adhoc networks
- The student would be able to design and implement protocols suitable to adhoc communication scenario using design tools and characterize them.
- The student is exposed to the advances in adhoc network design concepts

TEXT BOOKS:
1. C.Siva Ram Murthy and B.S.Manoj, —Ad hoc Wireless Networks Architectures and protocols‖, 2nd edition, Pearson Education. 2007 (For units1,2 & 3)
2. Charles E. Perkins, —Ad hoc Networking‖, Addison – Wesley, 2000 (For units 4 & 5)

REFERENCES:

EC8095 VLSI DESIGN L T P C
3 0 0 3

OBJECTIVES:
- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.
**UNIT I  INTRODUCTION TO MOS TRANSISTOR**
MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

**UNIT II  COMBINATIONAL MOS LOGIC CIRCUITS**

**UNIT III  SEQUENTIAL CIRCUIT DESIGN**
Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

**UNIT IV  DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM**
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

**UNIT V  IMPLEMENTATION STRATEGIES AND TESTING**

**TOTAL : 45 PERIODS**

**OUTCOMES:**
Upon completion of the course, students should be able to
- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

**TEXT BOOKS:**

**REFERENCES**
OBJECTIVES:
- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

UNIT I  WIRELESS CHANNELS  9

UNIT II  CELLULAR ARCHITECTURE  9
Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.

UNIT III  DIGITAL SIGNALING FOR FADING CHANNELS  9
Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV  MULTIPATH MITIGATION TECHNIQUES  9
Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT V  MULTIPLE ANTENNA TECHNIQUES  9
MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL: 45 PERIODS

OUTCOMES:
The student should be able to:
- Characterize a wireless channel and evolve the system design specifications
- Design a cellular system based on resource availability and traffic demands
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To acquaint the students with the architecture, theory and operation of telecommunication systems
- To discuss various issues related to telecommunication systems and the services rendered by the system to the end users.

UNIT I BASICS OF TELECOMMUNICATION
End users, nodes and connectivities, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simple, Half duplex and full duplex, One-way and two-way circuits, Network topologies, variations in traffic flow, quality of service, Standardization in telecommunication.

UNIT II SIGNALLING IN TELECOMMUNICATION
Introduction, purpose of signaling. Defining the functional areas-supervisory signaling, address signaling and Call Progress-audio and visual. Signaling techniques - conveying signaling information, evolution of signaling subscriber call progress tones and push button codes, compelled signaling, concepts of Link-by-link and end-to-end signaling, effects of numbering on signaling, associated and disassociated channel signaling, signaling in the subscriber loop-background and purpose, metallic trunk signaling - basic loop signaling, reverse-battery signaling, stimulus signaling, functional signaling, Object-oriented signaling.

UNIT III TELECOMMUNICATION TRAFFIC

UNIT IV TELECOMMUNICATION SERVICES ENGINEERING
Introduction, definition for service and service engineering. Telecommunication services engineering- Telecommunication services on broad band networks - basics of ATM, connection oriented and connectionless services.

UNIT V QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS

OUTCOMES:
Upon completion of the course, students will be able to:
- Understand the basics of telecommunication signaling
- Analyze the traffic in telecommunication systems
- Acquire knowledge about QoS and various impairments

TEXT BOOKS:
1. Roger L. Freeman, “Fundamentals of Telecommunications”, John Wiley & Sons, 1999. (For Units 1,2,3 & 4)
EC8651 TRANSMISSION LINES AND RF SYSTEMS   L  T  P  C
                                      3  0  0  3

OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

UNIT I TRANSMISSION LINE THEORY
General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES
Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES
Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT IV WAVEGUIDES
General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

UNIT V RF SYSTEM DESIGN CONCEPTS
Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

TOTAL:45 PERIODS

REFERENCE:
OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the characteristics of transmission lines and its losses
- Write about the standing wave ratio and input impedance in high frequency transmission lines
- Analyze impedance matching by stubs using smith charts
- Analyze the characteristics of TE and TM waves
- Design a RF transceiver system for wireless communication

TEXT BOOKS:

REFERENCES:

TL8611 NETWORK SECURITY LABORATORY

OBJECTIVES:
- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce the concept of waveguides
- To get acquaintance with cavity resonator

LIST OF EXPERIMENTS
1. Implement the following substitution & transposition techniques concepts
   a. Caesar cipher
   b. Play fair cipher
   c. Hill cipher
   d. Vigenere cipher
   e. Rail fence – row & column transformation
2. Implement the following algorithms
   a. DES
   b. RSA Algorithm
   c. Diffiee- Hellman
   d. MD5
   e. SHA-1
3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA
   (Net Stumbler)
8. Demonstrate intrusion detection system (ids) using any tool (snort s/w)

TOTAL : 60 PERIODS

LIST OF HARDWARE REQUIREMENTS & SOFTWARE REQUIREMENTS

SOFTWARE REQUIREMENTS

- C
- C++
- Java or equivalent compiler GnuPG
- KF sensor or equivalent
- Snort
- Net stumbler or equivalent

HARDWARE REQUIREMENTS

- Standalone desktops (or) Server supporting 30 terminals or more

LIST OF EXPERIMENTS:

**Part I: Digital System Design using HDL & FPGA (24 Periods)**

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6.

Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards
Part-II Digital Circuit Design (24 Periods)
7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops
   Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9
   Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

Part-III Analog Circuit Design (12 Periods)
10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
   Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.
12. Design and simulate simple 5 transistor differential amplifier. Analyze Gain,
   Bandwidth and CMRR by performing Schematic Simulations.

Requirements: Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

TOTAL :60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Write HDL code for basic as well as advanced digital integrated circuit
- Import the logic modules into FPGA Boards
- Synthesize Place and Route the digital IPs
- Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.NO</th>
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<td>1</td>
<td>Xilinx ISE/Altera Quartus/ equivalent</td>
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HS8581 PROFESSIONAL COMMUNICATION

OBJECTIVES:
The course aims to:
- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

72
UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews— telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL : 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:
OBJECTIVES:
- To deal with the microwave generation and microwave measurement techniques
- To deal with the issues in the design of microwave amplifier
- To install knowledge on the properties of various microwave components.
- To Facilitate the knowledge about optical fiber sources and transmission techniques

UNIT I PASSIVE AND ACTIVE MICROWAVE DEVICES 9
Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottkey diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode.

UNIT II MICROWAVE GENERATION 9
Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III INTRODUCTION TO OPTICAL FIBERS 9

UNIT IV OPTICAL SOURCES AND DETECTORS 9
OPTICAL SOURCES: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD.

OPTICAL DETECTORS: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise -Noise sources ,Signal to Noise ratio , Detector response time.

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- Examine the digital transmission and its associated parameters on system performance.
- Know the various optical fiber modes, configurations
- Generate Microwave signals and design microwave amplifiers.
- Measure and analyze Microwave signal and parameters

TEXT BOOKS:
REFERENCES:
1. David M. Pozar, “Microwave Engineering”, Wiley India (P) Ltd, New Delhi, 2008..

TL8702 RISC PROCESSORS AND EMBEDDED SYSTEM L T P C 3 0 0 3
OBJECTIVES:
The student should be made to:
• To teach the embedded system architecture, 8051 and ARM Microcontrollers
• To teach the Device Drivers and Interrupts Service Mechanism
• To teach Real Time Operating Systems and Programming
• To teach the application development with embedded ARM processor

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS AND MICROCONTROLLERS 9
Introduction to Embedded Systems - 8051 and ARM Microcontrollers, Real-World Interfacing, and the Inputs and Outputs Using Buses.

UNIT II EMBEDDED SYSTEM ARCHITECTURES 9
ARM Architectures and Processor-Memory Organisations - I/O Devices, Communication Buses and Distributed Networked Embedded Architectures.

UNIT III DEVICE DRIVERS AND INTERRUPTS SERVICE MECHANISM 9

UNIT IV REAL TIME OPERATING SYSTEMS AND PROGRAMMING 9
REAL TIME OPERATING SYSTEMS: Processes, Tasks and Threads and their Synchronization Using Inter-process Communication, Basic Functions of OS and RTOS.


UNIT V DESIGN EXAMPLES AND CASE STUDIES 9

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student would be able to:
• Understand embedded system architecture, 8051 and ARM Microcontrollers
• To device drivers programming and interrupts service mechanism
• To realtime programming for embedded real-time applications
TEXT BOOKS:

REFERENCES:

EC8094 SATELLITE COMMUNICATION L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

UNIT I SATELLITE ORBITS 9

UNIT II SPACE SEGMENT 9
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN 9
Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING METHODS 9

UNIT V SATELLITE APPLICATIONS 9

TOTAL:45 PERIODS
OUTCOMES:
At the end of the course, the student would be able to:
- Analyze the satellite orbits
- Analyze the earth segment and space segment
- Analyze the satellite Link design
- Design various satellite applications

TEXT BOOKS:

REFERENCES

TL8703 ANTENNAS AND RADIO WAVE PROPAGATION

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

UNIT I FUNDAMENTALS OF ANTENNA AND RADIATION
Introduction, Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Related Problems. Antenna characteristics: Radiation pattern, Beam solid angle, Directivity, Gain, Input impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture, Vector effective length, Antenna temperature.

UNIT II WIRE ANTENNAS AND ANTENNA ARRAYS
UNIT III APERTURE AND SLOT ANTENNAS

UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS

UNIT V RADIO WAVE PROPAGATION

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- Know basic terminology and concepts of Antennas.
- Aware of parameter considerations viz. antenna efficiency, beam efficiency, radiation resistance etc. in the design of an antenna.
- Examine the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
- To have knowledge on antenna operation and types as well as their usage in real time field.
- Knowledge about the means of propagation of Electromagnetic wave i.e. free space propagation and also about frequency dependent layer selection, its respective issues for an effective transmission of information in the form of EM wave to a remote location and related issues.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To gain insight of fiber optic components
- To gain knowledge about various microwave components with regard to communication.

LIST OF EXPERIMENTS:

1. Reflex Klystron – Mode characteristics
2. Gunn Diode – Characteristics
3. VSWR, Frequency and Wave Length Measurement
4. Directional Coupler – Directivity and Coupling Coefficient – S – parameter measurement
5. Isolator and Circulator – S - parameter measurement
6. Isolator and Circulator – S - parameter measurement
7. S - matrix Characterization of E-Plane T, H-Plane T and Magic T.
8. Radiation Pattern of Antennas.
9. Antenna Gain Measurement

OPTICAL EXPERIMENT

1. DC characteristics of LED and PIN Photo Diode.
2. Mode Characteristics of Fibers
4. Fiber Optic Analog and Digital Link
5. Numerical Aperture Determination for Fibers
6. Attenuation Measurement in Fibers

OUTCOMES:

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

- To inculcate an ability to analyze Electronics and Communications Engineering problems by applying the knowledge of mathematics and core engineering subjects
- To design Electronics & Communication systems with specifications based on societal and environmental considerations
- To teach the use of modern engineering tools, techniques, equipments, software and programming language skills necessary for designing and testing Electronics and Communication Engineering systems
- To make the students understand the impact of the engineering solutions in a global, economic, environmental and societal context

OBJECTIVES:

The student should be made to:

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

1. LED Interfacing using ARM processor
2. LCD Interfacing using ARM processor
3. Keyboard Interfacing using ARM processor
4. Temperature sensor Interfacing using ARM processor
5. Stepper Motor Interfacing using ARM processor
6. Flashing of LEDs using ARM processor
7. ADC Interfacing using ARM processor
8. DAC Interfacing using ARM processor
9. Interrupt pooling using ARM processor
10. EPROM Interfacing using ARM processor.
11. Real Time Clock Interfacing using ARM processor.
12. Implementing zigbee protocol with ARM.
13. Study of one type of Real Time Operating Systems (RTOS) with ARM Processor
14. Study of basic image processing algorithm using Single board computers such as Raspberry Pi, BeagleBone block etc

OUTCOMES:
Upon completion of the course, the student would be able to:
- Understand ARM processor and Building Blocks of Embedded Systems
- Understanding peripheral interface with ARM Processor
- Acquire Knowledge on Real Time Operating Systems using ARM
- Understanding the realization of image processing algorithm using single board computers

PREFERABLE DEVELOPMENT KIT:
1. STM32 MCU Discovery Kits
2. TI Launch Pad development kits
3. Single board computers (Raspberry Pi, Beaglebone Block, etc)
4. Required interface boards

CS8392 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:
- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10
UNIT II INHERITANCE AND INTERFACES
Inheritance – Super classes – sub classes – Protected members – constructors in sub classes – the Object class – abstract classes and methods – final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning - inner classes, ArrayLists - Strings

UNIT III EXCEPTION HANDLING AND I/O
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING
Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING

OUTCOMES:
Upon completion of the course, students will be able to:
- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To know the basic circuit design using FINFET
- To describe the concepts of SRAM, NRAM, MRAM.
- To understand the interconnection is done using the nano wire and nano scale
- To know the usage of CNT in VLSI.
- To provide an overview of Graphene transistor and quantum cellular

UNIT I FINFET CIRCUIT DESIGN

UNIT II SRAM DESIGN AND HYBRID NANO CMOS SYSTEM

UNIT III NANO WIRE ARRAYS AND NANOSCALE ASIC

UNIT IV CARBON NANOTUBE VLSI CIRCUITS AND FPCNA

UNIT V GRAPHENE TRANSISTOR AND QUANTUM CELLULAR AUTOMATE

OUTCOMES:
Upon completion of the course, students will be able to:
- Design using FINFET
- Understand the interconnection using nano wire and nano scale.
- Knowledge on the usage of CNT in VLSI
- Gain the concept of Graphene transistor and quantum cellular

TEXT BOOKS:
1. Deming Chen and Niraj K. Jha ,"Nanoelectronic Circuit Design" ,Springer, (2011).(For units 1,2,3)
2. Vladimir V. Mitin, Viatcheslav A. Kochelap& Michael A. Stroscio,"Introduction to Nanoelectronics (For units 4,5)
REFERENCES

TL8002 TELECOMMUNICATION SYSTEM MODELING AND SIMULATION

OBJECTIVES:
The student should be made to:
- To gain knowledge in modeling of different communication systems.
- To know the techniques involved in performance estimation of telecommunication systems.
- To learn the use of random process concepts in telecommunication system simulation.
- To study the modeling methodologies of a telecommunication system.
- To study about the QAM digital radio link environment

UNIT I SIMULATION OF RANDOM VARIABLES RANDOM PROCESS
Generation of random numbers and sequence – Gaussian and uniform random numbers

UNIT II MODELING OF COMMUNICATION SYSTEMS
Radio frequency and optical sources – Analog and Digital signals – Communication channel and model – Free space channels – Multipath channel and discrete channel noise and interference.

UNIT III ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION
Quality of estimator – Estimation of SNR – Probability density function and bit error rate – Monte Carlo method – Importance sampling method – Extreme value theory.

UNIT IV SIMULATION AND MODELING METHODOLOGY
Simulation environment – Modeling considerations – Performance evaluation techniques – Error source simulation – Validation.

UNIT V CASE STUDIES
Simulations of QAM digital radio link environment – Light wave communication link – Satellite system.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply the constituents of a telecommunication systems.
- Analyze various modeling methodologies and simulation techniques.
- Estimate the performance measures of telecommunication systems.
- Apply system modeling in telecommunication.
- Demonstrate light wave communication and satellite communication systems.
TEXT BOOKS:
2. Jerry banks John S, Carson Discrete Event System Simulation Prentice Hall of India 1996. (For units-3,4&5)

REFERENCES:

TL8003 INFORMATION THEORY AND CODING

OBJECTIVES:
The student should be made to:
- Study the basic concepts information theory
- Understand the concept of error control coding: block code, convolution codes.
- Learn various Image and Video Formats

UNIT I INFORMATION THEORY

UNIT II ERROR CONTROL CODING: BLOCK CODES
Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

UNIT III ERROR CONTROL CODING: BCH Codes
Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non-binary BCH codes: q-ary Linear Block Codes, Primitive BCH codes over GF (q), Reed–Solomon Codes, Decoding of Non-binary BCH and RS codes: The Berlekamp – Massey Algorithm.

UNIT IV ERROR CONTROL CODING: CONVOLUTIONAL CODES
Encoding of Convolutional codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding.

UNIT V ERROR CONTROL CODING: Concatenated Codes & Turbo Codes
Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Understand the concepts of information theory.
- Identify the errors using error control coding: block code, convolution codes..
- Knowledge on various Image and Video Formats

TEXT BOOKS:
2. R Bose, “Information Theory, Coding and Cryptography”, TMH 2007. (For units-3,4&5)

REFERENCES

EC 8073 MEDICAL ELECTRONICS

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

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING
Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT
pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

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

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

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

TOTAL: 45 PERIODS
OUTCOMES:
On successful completion of this course, the student should be able to:

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

TEXT BOOK:

REFERENCES:

GE8074 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVE:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.
UNIT V


OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

GE8077 TOTAL QUALITY MANAGEMENT

OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, 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
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
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS
OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO9001-2015 standards

EC8093 DIGITAL IMAGE PROCESSING

OBJECTIVES:
- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS

UNIT II IMAGE ENHANCEMENT

UNIT III IMAGE RESTORATION

UNIT IV IMAGE SEGMENTATION
UNIT V IMAGE COMPRESSION AND RECOGNITION
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

OUTCOMES:
At the end of the course, the students should be able to:
- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

REFERENCES:

TL8004 SPREAD SPECTRUM COMMUNICATION
OBJECTIVES:
- To understand the basics of spread spectrum communication systems.
- To understand the way in which spread spectrum is applied to CDMA.
- To understand the performance of spread spectrum techniques.

UNIT I PERFORMANCE CHARACTERIZATION OF DIGITAL DATA TRANSMISSION
Detection of binary signals in AWGN - Quadrature multiplexed signalling schemes - Signalling through band limited channels - Equalization of digital data transmission system - Realization imperfections - Degradations in performance. Communication in the presence of pulse noise jamming - Low probability detection scheme - Direct Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and examples of Spread Spectrum Systems.

UNIT II SPREAD SPECTRUM SYSTEMS
Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum - Complex envelope representation of spread spectrum systems.
UNIT III  BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS
Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

UNIT IV  SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS
Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

UNIT V  PERFORMANCE OF SPREAD SPECTRUM SYSTEM
Systems communications models - Performance without coding under AWGN and different jamming environments - Spread spectrum systems performances with forward error correction - Block coding - Convolutional coding and specific error correcting codes - Inter leaving - Random coding bounds.

TOTAL : 45 PERIODS

OUTCOMES:
• To be able to arrive at detailed specifications of the spread spectrum systems.
• To design the spread spectrum based systems for CDMA.
• To be able to evaluate the performance of spread spectrum based systems

TEXT BOOKS:

REFERENCE:

TL8005  MICRO ELECTRO MECHANICAL SYSTEMS  L  T  P  C
3  0  0  3

OBJECTIVES:
• To educate on the rudiments of micro fabrication techniques.
• To introduce various sensors and actuators.
• To introduce different materials used for MEMS.
• To educate on the application of MEMS to disciplines beyond Electrical and Mechanical engineering.
• To understand about the concept of MEMS switching capacitor

UNIT I  INTRODUCTION
Historical perspective – Silicon microelectronics – MEMS –sensors and actuators– Introduction to micro sensors– Microfabrication– MEMS examples – Application of MEMS.

UNIT II  MEMS MATERIALS

UNIT III  MICROELECTRONIC TECHNOLOGY FOR MEMS - I
UNIT IV MICROELECTRONIC TECHNOLOGY FOR MEMS – II

9
Lithography: Photo-resist – Pattern transfer – Etching – Wet ,dry – doping Semiconductors- metallization - bonding and packaging – Bulk Micromachining for silicon based MEMS.

UNIT V MEMS SWITCH DESIGN

9

TOTAL: 45 PERIODS

OUTCOMES:
After studying this course, the student would be able to:

• Analyze the operation of micro devices, micro systems and their applications.
• Design the micro devices, micro system using the MEMS fabrication process.
• Understand the necessity of MEMS in thrust areas like sensors and actuators.
• Understand the principles of energy transduction, sensing and actuation on a microscopic scale.
• Design the principles of micro fabrication to the development of micro mechanical devices.

TEXT BOOKS:

REFERENCES:
1. Fukuda T Menz W Micro Mechanical Systems Principles and Technology Elsevier 2002
3. Gabriel M RebeizRF MEMS theory,Design and Technology John wiley and sons 2003
4. Vijay vardin K Vinoy K J Jose KARF MEMS and their Applications John wiley and sons 2003

CS8792 CRYPTOGRAPHY AND NETWORK SECURITY 3 0 0 3

OBJECTIVES:
• To understand Cryptography Theories, Algorithms and Systems.
• To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

UNIT I INTRODUCTION


UNIT II SYMMETRIC CRYPTOGRAPHY

UNIT III PUBLIC KEY CRYPTOGRAPHY

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY

TOTAL 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
• Apply the different cryptographic operations of symmetric cryptographic algorithms
• Apply the different cryptographic operations of public key cryptography
• Apply the various Authentication schemes to simulate different applications.
• Understand various Security practices and System security standards

TEXT BOOK:

REFERENCES
1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd YEAR

TL8006 BLUETOOTH TECHNOLOGY

OBJECTIVES:
• To understand the bluetooth networks, architecture and various telephone networks standards.
• To understand the bluetooth standards and various bluetooth channels.
• To understand how bluetooth devices operate in the frequency band.
• To understand the concept of zigbee networks.
• To understand about the concept of Hold mode and Sniff mode
UNIT I  THE BLUETOOTH MODULE  

UNIT II  THE LINK CONTROLLER  
The link controller – Link control protocol – Link controller operation – Pico net, scatter net operation – Master/Slave role switching – Base band/Link controller architectural overview – Link manager – The host controller interface

UNIT III  THE BLUETOOTH HOST  
The bluetooth host – Logical link control and adaptation protocol – RFCOMM – The service discovery protocol – The wireless access protocol – OBEX and IrDA telephony control protocol

UNIT IV  CROSS LAYER FUNCTIONS  
Cross layer functions – Encryption and security – Low power operations – Controlling low power modes – Hold mode – Sniff mode – Park mode – Quality of service – Managing bluetooth devices

UNIT V  ZIGBEE NETWORKS  

TOTAL:45PERIODS

OUTCOMES:
- Explain the process of linkage between the bluetooth devices.
- Identify the protocols which have been used to transfer the data from bluetooth host.
- Explain the encryption process used in Bluetooth data transfer.
- Analyze the concept of zigbee protocols

TEXT BOOK:

REFERENCE:

GE8075  INTELLECTUAL PROPERTY RIGHTS  
L T P C  3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION  
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.
UNIT II REGISTRATION OF IPRs
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS

UNIT IV DIGITAL PRODUCTS AND LAW

UNIT V ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

REFERENCES

TL8007 TELECOMMUNICATION NETWORK MANAGEMENT

OBJECTIVES:
- To understand the concept of network management standards.
- To design the common management information service element model.
- To understand the various concept of information modelling.
- To analyze the concept of SNMPv1 and SNMPv2 protocol.
- To analyze the concept of examples of network management

UNIT I FOUNDATIONS
UNIT II COMMON MANAGEMENT INFORMATION SERVICE ELEMENT

UNIT III INFORMATION MODELING FOR TMN
Rationale for information modeling–management information model–object oriented modeling paradigm– structure of management information–managed object class definition–management information base.

UNIT IV SIMPLE NETWORK MANAGEMENT PROTOCOL

UNIT V NETWORK MANAGEMENT EXAMPLES

TOTAL: 45 PERIODS

OUTCOMES:
After studying this course, the student would be able to:
- Design and analyze of fault management.
- Analyze the common management information protocol specifications.
- Design and analyze of management information model.
- Design the simple network management protocol.
- Design the various types of network management tools

TEXT BOOKS:

REFERENCES:
2. Salah Aidarous Thomas Plevyak Telecommunication Network Management: Technologies and Implementations Wiley 1997
OBJECTIVES:

- To learn design of RF amplifiers using transistors.
- To learn modern Power Supplies using SCR and SMPS technology
- To learn about signal shielding & grounding techniques and study of A/D and D/A Converters.
- To learn knowledge about fabrication of PCBs using CAD

UNIT I INTRODUCTION TO RF DESIGN

UNIT II RF TRANSISTOR AMPLIFIER DESIGN
Impedance matching using discrete components. Microstrip line matching networks. Amplifier classes of operation and biasing networks – Amplifier power gain, Unilateral design (S_{12} = 0) – Simple input and output matching networks – Bilateral design - Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors. Broadband amplifiers, High power amplifiers and multistage amplifiers.

UNIT III DESIGN OF POWER SUPPLIES
DC power supply design using transistors and SCRs, Design of crowbar and foldback protection circuits, Switched mode power supplies, Forward, flyback, buck and boost converters, Design of transformers and control circuits for SMPS.

UNIT IV DESIGN OF DATA ACQUISITION SYSTEMS
Amplification of Low level signals, Grounding, Shielding and Guarding techniques, Dual slope, quad slope and high speed A/D converters, Microprocessors Compatible A/D converters, Multiplying A/D converters and Logarithmic A/D converters, Sample and Hold, Design of two and four wire transmitters.

UNIT V DESIGN OF PRINTED CIRCUIT BOARDS
Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To design RF system
- To design modern power supplies
- To design data acquisition system
TEXT BOOKS:

REFERENCES:

EC8071 COGNITIVE RADIO L T P C 3 0 0 3

OBJECTIVES:
The student should be made:
- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitive radio

UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9
Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT II COGNITIVE RADIO ARCHITECTURE 9
Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9

UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9
MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9
Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Gain knowledge on the design principles on software defined radio and cognitive radio
- Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
- Build experiments and projects with real time wireless applications
- Apply the knowledge of advanced features of cognitive radio for real world applications

TEXT BOOKS:

REFERENCES:

TL8009 MULTIMEDIA COMPRESSION TECHNIQUES

OBJECTIVES:
To provide in-depth knowledge about
- Data Compression
- Text Compression and Audio Compression
- Image and Video Compression

UNIT I INTRODUCTION
Special features of Multimedia—Graphics and Image Data Representations-Fundamental Concepts in Video and Digital Audio—Storage requirements for multimedia applications - Need for Compression-Taxonomy of compression techniques—Overview of source coding, source models, scalar and vector quantization theory—Evaluation techniques—Error analysis and Methodologies

UNIT II TEXT COMPRESSION

UNIT III AUDIO COMPRESSION

UNIT IV IMAGE COMPRESSION
UNIT V  VIDEO COMPRESSION


TOTAL: 45 PERIODS

OUTCOMES:
After studying this course, Students will be able to
- Explain Scalar quantization theory and Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques

TEXT BOOKS:

REFERENCES

TL8071 RADAR AND NAVIGATIONAL AIDS

OBJECTIVES:
- To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation

UNIT I  INTRODUCTION TO RADAR EQUATION

UNIT II  MTI AND PULSE DOPPLER RADAR
UNIT III  DETECTION OF SIGNALS IN NOISE  9

Radar Transmitters and Receivers - Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.- The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV  RADIO DIRECTION AND RANGES  9


UNIT V  SATELLITE NAVIGATION SYSTEM  9

TOTAL: 45 PERIODS

OUTCOMES:
After studying this course, Students will be able to
- Explain principles of navigation, in addition to approach and landing aids as related to navigation
- Derive and discuss the Range equation and the nature of detection.
- Describe about the navigation systems using the satellite.

TEXT BOOKS:

REFERENCES
OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT


UNIT II  REQUIREMENTS AND SYSTEM DESIGN


UNIT III  DESIGN AND TESTING


UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

GE8071 DISASTER MANAGEMENT

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.
UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT  9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as
 dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and
 Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology
 and local resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA  9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation,
 Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and
 Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes
 and legislation – Role of GIS and Information Technology Components in Preparedness, Risk
 Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD
WORKS  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and
 Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge
 Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man
 Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and
 field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Differentiate the types of disasters, causes and their impact on environment and society
• Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster
 damage assessment and management.

TEXTBOOKS:
 13: 978-9380386423 (For unit-1,2)
3. Gupta Anil K, Sreeja S. Nair.  Environmental Knowledge for Disaster Risk Management, NIDM,
  New Delhi, 2011 (For unit-4)
  New Delhi, 2010.(For unit-5)

REFERENCES
1.  Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

TL8010  BROADBAND COMMUNICATIONS  L  T  P  C
        3  0  0  3

OBJECTIVES:
The student should be made :
• Discuss and analyze the latest technologies in broadband communications including
  wireless components
• Analyze different techniques and technologies required for the development of broadband
  communications
• Discuss the recent development of fiber-optic communication and next generation
  Internet protocols in current and emerging broadband communications
UNIT I \hspace{1cm} INTRODUCTION AND OVERVIEW  \hspace{1cm} 9

UNIT II \hspace{1cm} B-ISDN SERVICES AND PROTOCOL  \hspace{1cm} 9
B-ISDN protocols - User plane, management plane, control plane, signaling plane, Other aspects of B-ISDN: Broadcast service aspects, Network aspects and user network interface aspects, SONET- An overview.

UNIT III \hspace{1cm} TQM TOOLS AND TECHNIQUES I  \hspace{1cm} 9
Overview, Virtual channels, Virtual paths, VP & VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols. ATM switching building blocks, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.

UNIT IV \hspace{1cm} TQM TOOLS AND TECHNIQUES II  \hspace{1cm} 9
Broad band Access network: Design-Requirements, and topology, Backbone network: design-requirement and topologies.

UNIT V \hspace{1cm} QUALITY SYSTEMS  \hspace{1cm} 9
Introduction to Broadband Wireless, Evolution of Broadband Wireless; Fixed & Mobile Broadband Wireless; WiMAX and Other Broadband Wireless Technologies: overview.

TOTAL: 45 PERIODS

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

- Gain complete knowledge about Basics of ISDN and B-ISDN
- The knowledge about the concept of ATM Switching and transmission.
- The concept SONET and its operations.
- The Design of broadband networks.
- Knowledge on broadband technologies

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made:
- To generate and test the properties of random variables and random processes
- To understand Channel, filter and noise models of Communication systems
- To analyze a receiver based on estimation of various parameters like SNR, BER etc.,
- To Analyze cellular radio system as case studies through simulation.

UNIT I INTRODUCTION TO SIMULATION
Concept of Simulation and Modeling, Roles of Simulation, Types of Simulation Limits of Simulation, Mapping a problem into a simulation Model, real time Simulation, Efficient Simulation Techniques.

UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS
Generation of random numbers and sequence, Gaussian and uniform random numbers Correlated random sequences, Testing of random numbers generators Random process models- Markov and ARMA Sequences.

UNIT III MODELING OF COMMUNICATION SYSTEMS
Modeling of Individual Communication block - Channel Model - Filter Model - Noise and Fading Model - Receiver Model.

UNIT IV ESTIMATION OF PERFORMANCE MEASURE

UNIT V SIMULATION OF CELLULAR RADIO SYSTEM
System level Description Modeling a Cellular Communication System - Simulation Methodology - Processing the Simulation Results.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Provide a comprehensive coverage on Simulation Concept, Random numbers and random variables generation, modeling of channel, noise, fading and receiver and performance evaluation in terms of probability of error and bit error rate

TEXT BOOK:

REFERENCES:
ON-CHIP COMMUNICATION ARCHITECTURES

OBJECTIVES:
- To understand the basic concepts of bus-based communication architectures and standards
- Provide an understanding of the concepts and building blocks of System-on-Chip (SoC) design
- To understand the concepts and building blocks of Network-on-Chip (NoC) design
- Provide an understanding of emerging on-chip interconnect technologies

UNIT I BASIC CONCEPTS OF BUS-BASED COMMUNICATION ARCHITECTURES
Terminology, Characteristics of Bus-Based Communication Architectures, Data Transfer Modes, Bus Topology Types, Physical Implementation Of Bus Wires, Types of On-Chip Communication Architectures.

UNIT II ON-CHIP COMMUNICATION ARCHITECTURE STANDARDS

UNIT III SYSTEM ON CHIP
System design methodologies: System on Board (SoB) – System on Chip (SoC) - Generic SoC Architecture Components: Generic SoC Block Diagram - Subsystems of an SoC - Platform-Based SoC Design: Concept of the Platform, Types of Platforms: Processor-Centric Platform, Application-Specific Platform ,Fully Programmable Platform, Communication-Centric Platform.

UNIT IV NETWORKS-ON-CHIP

UNIT V EMERGING ON-CHIP INTERCONNECT TECHNOLOGIES
Optical Interconnects (OIs) -Use of OIs for On-Chip Communication - RF/Wireless Interconnects - Use of RF/Wireless Interconnects for On-Chip Communication – Carbon Nanotube (CNT) Interconnects - Circuit Parameters for Isolated Single-Walled Carbon Nanotubes (SWCNTS) - Circuit Parameters for a Bundle of SWCNTs - Comparison between Copper and SWCNT-Bundles - Using CNTs for On-Chip Communication.

OUTCOMES:
Upon completion of the course, the student would be able to:
- Know the various bus-based communication architectures and standards
- Know the concepts and building blocks of System-on-Chip (SoC) and Network on Chip (NoC)
- Know the emerging on-chip interconnect technologies

TEXT BOOKS:
REFERENCES


OBJECTIVES:

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

UNIT I INTRODUCTION TO SOFT COMPUTING

UNIT II ARTIFICIAL NEURAL NETWORKS
Back propagation Neural Networks - Kohonen Neural Network - Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network - Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks - Support Vector Machines - Spike Neuron Models.

UNIT III FUZZY SYSTEMS

UNIT IV GENETIC ALGORITHMS

UNIT V HYBRID SYSTEMS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students should be able to

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.
TEXT BOOKS:

REFERENCES:

TL8013 3G AND 4G WIRELESS MOBILE COMMUNICATIONS L T P C 3 0 0 3

OBJECTIVES:
- To understand the concepts of CDMA and OFDM
- Provide an understanding of the concepts MIMO and UWB
- To understand the concepts 3G and 4G Wireless Standards
- Provide an understanding of Mobility Management in wireless mobile communications

UNIT I CDMA and OFDM 9

UNIT II MIMO 9
Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing - BLAST, MIMO Diversity - Alamouti, OSTBC, MRT, MIMO – OFDM.

UNIT III UWB (Ultra wide Band) 9
UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit - Error Rate Performance of UWB.

UNIT IV 3G and 4G Wireless Standards 9
Architectural Review of UMTS and GSM, From UMTS to LTE, From LTE to LTE-Advanced, GSM, GPRS, WCDMA, WiMAX.

UNIT V Mobility Management 9
Transitions Between Mobility Management States - Cell Reselection in RRC_IDLE - Measurements in RRC_CONNECTED - Handover in RRC_CONNECTED.

TOTAL:45PERIODS
OUTCOMES:
Upon completion of the course, the student would be able to:

- Know the concepts of CDMA and OFDM
- Know the concepts the concepts MIMO and UWB
- Acquire knowledge on 3G and 4G Wireless Standards
- Know about the Mobility Management in wireless mobile communications

TEXT BOOKS:
1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications" - Cambridge University Press.2005 (For unit -1)
2. Ezio Biglieri, Robert Calderbank, Anthony Constantinides, "MIMO Wireless Communications" – - Cambridge University Press .2010 (For unit -2)

REFERENCES

EC8072 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

OBJECTIVES:

- To introduce the basic concepts of Electromagnetic Interference
- To teach the importance of Electromagnetic Compatible designs
- To explain the existing standards for Electromagnetic Compatibility

UNIT I EMI/EMC CONCEPTS
EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility; Case Histories; Radiation Hazards to humans.

UNIT II EMI COUPLING PRINCIPLES
Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cable coupling; Power mains and Power supply coupling; Transient EMI, ESD.

UNIT III EMI CONTROL
Shielding; EMI Filters; Grounding; Bonding; Isolation transformer; Transient suppressors; EMI Suppression Cables.

UNIT IV EMC DESIGN FOR CIRCUITS AND PCBBS
Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and cross talk control; Component selection and mounting; PCB trace impedance; Routing; Power distribution decoupling; Zoning; Grounding; VIAs; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:

- Identify the various types and mechanisms of Electromagnetic Interference
- Propose a suitable EMI mitigation technique
- Describe the various EMC Standards and methods to measure them

TEXT BOOKS:
2. C.R.Paul,”Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992. (For Unit- IV)

REFERENCES:

GE8076 PROFESSIONAL ETHICS IN ENGINEERING LT P C
3 0 0 3

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

UNIT I HUMAN VALUES 10

UNIT II ENGINEERING ETHICS 9

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

UNIT V GLOBAL ISSUES 8

TOTAL: 45 PERIODS
OUTCOME:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

EC8092 ADVANCED WIRELESS COMMUNICATION L T P C 3 0 0 3

OBJECTIVES:
- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

UNIT I CAPACITY OF WIRELESS CHANNELS
The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II RADIO WAVE PROPAGATION
Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.
UNIT III SPACE TIME BLOCK CODES
Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

UNIT IV SPACE TIME TRELLIS CODES
Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V LAYERED SPACE TIME CODES
LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

OUTCOMES:
The student should be able to:
- Comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply the knowledge about the importance of MIMO in today's communication
- Appreciate the various methods for improving the data rate of wireless communication system

REFERENCES:

OBJECTIVES:
- To learn different Components of Remote Sensing.
- To learn modern optical and microwave remote sensing
- To learn knowledge about Filtering AND Application of Remote Sensing

UNIT I REMOTE SENSING
UNIT II  EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS  9

UNIT III  OPTICAL AND MICROWAVE REMOTE SENSING  9

UNIT IV  MISCELLANEOUS TOPICS  9

UNIT V  DESIGN OF PRINTED CIRCUIT BOARDS  9

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- To design remote sensing system
- To design printed circuit boards

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the basics of solid state physics
- To understand the basics of display devices
- To understand the optical detection devices
- To understand the design of optoelectronics integrated circuits.

UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

UNIT II DISPLAY DEVICES AND LASERS 9

UNIT III OPTICAL DETECTION DEVICES 9
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR 9

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: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- To design display devices
- To design optoelectronics detection devices and modulators.
- To design optoelectronic integrated circuits

TEXT BOOKS:
1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006. (For unit-1&2)

REFERENCES
1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India,2005
OBJECTIVES:
The student should be made to:
- Use hypothesis testing and Bayesian approaches to formulate and solve problems for signal detection from noisy signals.
- Learn different methods for Channel estimation
- Derive and apply various methods for parameter estimation and signal smoothing

UNIT I HYPOTHESIS TESTING 9
Bayes Risk, Minimum Bayes Risk detector, Minimax and Neyman-Pearson testing, Receiver operating characteristics, Composite hypothesis testing, Generalized likelihood ratio tests.

UNIT II SIGNAL DETECTION APPLICATIONS 9

UNIT III RANDOM PARAMETER ESTIMATION 9
Bayesian formulation, Minimum mean squared error and MAP estimation, Linear MMSE estimation, Orthogonality principle, Applications to channel estimation problems.

UNIT IV MINIMUM VARIANCE UNBIASED ESTIMATION 9

UNIT V NON-RANDOM PARAMETER ESTIMATION 9
Least squares estimation, Best linear unbiased estimation, Geometric interpretations, Maximum likelihood Estimation, Efficiency and consistency of estimators and asymptotic properties.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- Solve signal detection problem using hypothesis testing and Bayesian approaches
- Acquire knowledge about basic Estimation Methods
- Gain ability to apply various estimation methods to real application problems

TEXT BOOK:
1. H. L. Van Trees, "Detection, Estimation, and Modulation Theory, Part I," John Wiley, 1968(For Unit 1,2,3,4 & 5)

REFERENCES
OBJECTIVES:
The student should be made to:
- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.

UNIT I  INTRODUCTION  

UNIT II  MAC PROTOCOLS FOR ADHOC WIRELESS NETWORKS  

UNIT III  ROUTING PROTOCOLS AND TRANSPORT LAYER IN ADHOC WIRELESS NETWORKS  
Issues in designing a routing and Transport Layer protocol for Ad hoc networks-proactive routing, reactive routing (on-demand), hybrid routing-Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT IV  WIRELESS SENSOR NETWORKS(WSNS) AND MAC PROTOCOLS  
Single node architecture: hardware and software components of a sensor node -WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC-IEEE 802.15.4.

UNIT V  WSN ROUTING, LOCALIZATION & QOS  

TOTAL:45 PERIODS

OUTCOME:
At the end of the course, the student should be able to:
- Design and implement wireless networks environment for any application using latest protocols and standard.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMB.

UNIT III NANOMATERIALS

UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

REFERENCES: