PROGRAMME EDUCATIONAL OBJECTIVES:
PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication 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 analyze, 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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ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
| Sem | Course Name                                      | a | b | c | d | e | f | g | h | i | j | k | l |
|-----|------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
|     | Circuits Design and Simulation Laboratory       | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |
|     | Linear Integrated Circuits Laboratory          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |
| V   | Digital Communication                          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |
|     | Discrete-Time Signal Processing                | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |
|     | Computer Architecture and Organization        | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |
|     | Communication Networks                         | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |
|     | Professional Elective I                        |   |   |   |   |   |   |   |   |   |   |   |   |   |
|     | Open Elective I                                |   |   |   |   |   |   |   |   |   |   |   |   |   |
|     | Digital Signal Processing Laboratory           | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |
|     | Communication Systems Laboratory               | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |
|     | Networks Laboratory                            | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |
| VI  | Microprocessors and Microcontrollers           | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | VLSI Design                                    | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Wireless Communication                          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Principles of Management                       | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Transmission Lines and RF Systems              | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Professional Elective -II                     |   |   |   |   |   |   |   |   |   |   |   |   |   |
|     | Microprocessors and Microcontrollers Laboratory| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | VLSI Design Laboratory                          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Technical Seminar                              | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Professional Communication                     | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| VII | Antennas and Microwave Engineering             | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Optical Communication                          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Embedded and Real Time Systems                 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Ad hoc and Wireless Sensor Networks            | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Professional Elective -III                    |   |   |   |   |   |   |   |   |   |   |   |   |   |
|     | Open Elective - II                             |   |   |   |   |   |   |   |   |   |   |   |   |   |
|     | Embedded Laboratory                            | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Advanced Communication Laboratory              | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| VIII| Professional Elective - IV                    | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Professional Elective - V                     | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
|     | Project Work                                   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
# ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
### B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
#### REGULATIONS – 2017
#### CHOICE BASED CREDIT SYSTEM
#### I - VIII SEMESTERS CURRICULA AND SYLLABIs

## SEMESTER I

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8. Non Credit / Mandatory
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


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   DIFFERENTIAL CALCULUS
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

UNIT III INTEGRAL CALCULUS
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

UNIT V DIFFERENTIAL EQUATIONS

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.

TOTAL : 45 PERIODS

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:
UNIT I WATER AND ITS TREATMENT 9

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

UNIT III ALLOYS AND PHASE RULE 9

UNIT IV FUELS AND COMBUSTION 9

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9
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:

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING

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 comprehension; 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 L T P C
2 0 4 4

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)
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
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects
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 or 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
4. students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day

GE8161  PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY   L T P C 
0 0 4 2

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
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:

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- Vocabulary Development- technical vocabulary
Language Development – subject verb agreement - compound words.

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 cgrats, 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:
1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016

REFERENCES:

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

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**MA8251 ENGINEERING MATHEMATICS – II**

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**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


TOTAL :45 PERIODS

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:

30
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

UNIT II TRANSFORMER
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
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

UNIT V MEASUREMENT AND INSTRUMENTATION
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

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:
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.

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:
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  9
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  9

UNIT III  FIELD EFFECT TRANSISTORS  9
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  9
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  9
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

TEXT BOOKS:

REFERENCES:
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

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

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 13

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
MA8352  LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS  L  T  P  C
4  0  0  4

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  12

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 9

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9

UNIT III LINEAR DATA STRUCTURES 9
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 9
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 9

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:

EC8351 ELECTRONIC CIRCUITS I

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, Cascade 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  9

UNIT V  POWER SUPPLIES AND ELECTRONIC DEVICE TESTING  9

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  L T P C
4 0 0 4

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
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

TOTAL: 60 PERIODS

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

TEXT BOOK:

REFERENCES

EC8392        DIGITAL ELECTRONICS

OBJECTIVES:

• To present the Digital fundamentals, Boolean algebra and its applications in digital systems
• To familiarize with the design of various combinational digital circuits using logic gates
• To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
• To explain the various semiconductor memories and related technology
• To introduce the electronic circuits involved in the making of logic gates
UNIT I  DIGITAL FUNDAMENTALS
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II  COMBINATIONAL CIRCUIT DESIGN

UNIT III  SYNCHRONOUS SEQUENTIAL CIRCUITS

UNIT IV  ASYNCHRONOUS SEQUENTIAL CIRCUITS
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V  MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS
Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course:
- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

TEXT BOOK:

REFERENCES:
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-Cascade lag-lead 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.

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:
**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

**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

**TOTAL: 60 PERIODS**

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**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. Cascade 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 Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software like Spice
9. Analysis of Cascode and Cascade amplifiers using Spice
10. Analysis of Frequency Response of BJT and FET using Spice

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:

S.NO

S.NO

EQUIPMENTS FOR ANALOG LAB

EQUIPMENTS FOR DIGITAL LAB

1. CRO/DSO (30MHz) – 15 Nos.
2. Dual Regulated Power Supplies (0 – 30V) – 15 Nos.
4. Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos
6. SPICE Circuit Simulation Software: (any public domain or commercial software)

1. Dual power supply/ single mode power supply - 15 Nos
2. IC Trainer Kit - 15 Nos
3. Bread Boards - 15 Nos
4. Seven segment display -15 Nos
5. Multimeter - 15 Nos
6. ICs each 50 Nos
   7400/ 7402 / 7404 / 7408 / 7432 / 7483 / 74150 /
   74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 /
   7485 / 7473 / 74138 / 7411 / 7474
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.

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 12
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 12
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 12

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12
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:

EC8452 ELECTRONIC CIRCUITS II L T P C
3 0 0 3

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 turned amplifier.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multi vibrators, power amplifiers and DC convertors.

UNIT I FEEDBACK AMPLIFIERS AND STABILITY 9
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-Class AB-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 concepts of various analog modulations and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To study the limits set by Information Theory

UNIT I AMPLITUDE MODULATION

UNIT II ANGLE MODULATION

UNIT III RANDOM PROCESS

UNIT IV NOISE CHARACTERIZATION
Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de-emphasis for FM.

UNIT V SAMPLING & QUANTIZATION
Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

OUTCOMES:
At the end of the course, the student should be able to:
- Design AM communication systems
- Design Angle modulated communication systems
- Apply the concepts of Random Process to the design of Communication systems
- Analyze the noise performance of AM and FM systems
- Gain knowledge in sampling and quantization

TEXT BOOKS:
REFERENCES:
5. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006

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 12
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 12
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 12
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 12
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 12
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

TOTAL:60 PERIODS
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

OBJECTIVES:
- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

UNIT I   BASICS OF OPERATIONAL AMPLIFIERS   9
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages - and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.

UNIT II   APPLICATIONS OF OPERATIONAL AMPLIFIERS   9
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III   ANALOG MULTIPLIER AND PLL   9
Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.
UNIT IV  ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS  

UNIT V  WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS  
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

OUTCOMES:  
Upon completion of the course, the student should be able to:
- Design linear and non linear applications of OP – AMPS
- Design applications using analog multiplier and PLL
- Design ADC and DAC using OP – AMPS
- Generate waveforms using OP – AMP Circuits
- Analyze special function ICs

TEXT BOOKS:  

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

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. Clipppers 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>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CRO (Min 30MHz)</td>
<td>15 Nos</td>
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<tr>
<td>2</td>
<td>Signal Generator /Function Generators (2 MHz)</td>
<td>15 Nos</td>
</tr>
<tr>
<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
4. Analog multiplier

TOTAL: 60 PERIODS

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:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>EQUIPMENTS</th>
<th>EQUIPMENTS</th>
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</thead>
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<tr>
<td>1</td>
<td>CRO/DSO (Min 30MHz)</td>
<td>-- 15 Nos</td>
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<tr>
<td>2</td>
<td>Signal Generator /Function Generators (2 MHz)</td>
<td>-- 15 Nos</td>
</tr>
<tr>
<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>IC Tester</td>
<td>-- 5 Nos</td>
</tr>
<tr>
<td>6</td>
<td>Standalone desktops PC</td>
<td>-- 15 Nos</td>
</tr>
<tr>
<td>7</td>
<td>Components and Accessories</td>
<td>-- 50 Nos</td>
</tr>
</tbody>
</table>
Components and Accessories:
Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs.


EC8501      DIGITAL COMMUNICATION       L    T    P    C
            3    0    0    3

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     INFORMATION THEORY  9

UNIT II   WAVEFORM CODING & REPRESENTATION  9
Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester

UNIT III  BASEBAND TRANSMISSION & RECEPTION  9
ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

UNIT IV   DIGITAL MODULATION SCHEME  9
Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK.

UNIT V    ERROR CONTROL CODING  9
Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to
- Design PCM systems
- Design and implement base band transmission schemes
- Design and implement band pass signaling schemes
- Analyze the spectral characteristics of band pass signaling schemes and their noise performance
- Design error control coding schemes
TEXT BOOK:

REFERENCES
3. H P Hsu, Schaum Outline Series - “Analog and Digital Communications”, TMH 2006

EC8553 DISCRETE-TIME SIGNAL PROCESSING

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

UNIT II INFINITE IMPULSE RESPONSE FILTERS

UNIT III FINITE IMPULSE RESPONSE FILTERS
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
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

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  9
UNIT IV         MEMORY AND I/O ORGANIZATION 9
Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory.
Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass
storage, Input and Output Devices.

UNIT V          ADVANCED COMPUTER ARCHITECTURE 9
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:
   Integrated approach”, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

REFERENCES
1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organization”, Fifth

EC8551                 COMMUNICATION NETWORKS

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 9
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

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
EC8562 DIGITAL SIGNAL PROCESSING LABORATORY  L  T  P  C
0  0  4  2

OBJECTIVES:
The student should be made:
- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlogram, 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 Butterworth 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

EC8561 COMMUNICATION SYSTEMS LABORATORY  L  T  P  C
0  0  4  2

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

EC8563 COMMUNICATION NETWORKS LABORATORY

OBJECTIVES:
The student should be made to:
- Learn to communicate between two desktop computers
- Learn to implement the different protocols
- Be familiar with IP Configuration
- Be familiar with the various routing algorithms
- Be familiar with simulation tools

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

EC8691 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

OBJECTIVES:
• To understand the Architecture of 8086 microprocessor.
• To learn the design aspects of I/O and Memory Interfacing circuits.
• To interface microprocessors with supporting chips.
• To study the Architecture of 8051 microcontroller.
• To design a microcontroller based system

UNIT I THE 8086 MICROPROCESSOR 9
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE 9

UNIT III I/O INTERFACING 9
UNIT IV  MICROCONTROLLER  
Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V  INTERFACING MICROCONTROLLER  
Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

OUTCOMES:
At the end of the course, the students should be able to:
- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

TEXT BOOKS:

REFERENCES:
1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012

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: ON 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

EC8652  WIRELESS COMMUNICATION  
L T P C  
3 0 0 3

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:
OBJECTIVE:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

UNIT II PLANNING 9

UNIT III ORGANISING 9

UNIT IV DIRECTING 9

UNIT V CONTROLLING 9
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of the course, students will be able to have clear understanding
- Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

REFERENCES:
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.

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:

EC8681 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY L T P C
0 0 4 2

OBJECTIVES:
• To Introduce ALP concepts, features and Coding methods
• Write ALP for arithmetic and logical operations in 8086 and 8051
• Differentiate Serial and Parallel Interface
• Interface different I/Os with Microprocessors
• Be familiar with MASM

LIST OF EXPERIMENTS:
8086 Programs using kits and MASM
1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripherals and Interfacing Experiments
7. Traffic light controller
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM
14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2’s complement of a number
16. Unpacked BCD to ASCII

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Write ALP Programme for fixed and Floating Point and Arithmetic operations
• Interface different I/Os with processor
• Generate waveforms using Microprocessors
• Execute Programs in 8051
• Explain the difference between simulator and Emulator
LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:
8086 development kits - 30 nos
Interfacing Units - Each 10 nos
Microcontroller - 30 nos

SOFTWARE:
Intel Desktop Systems with MASM - 30 nos
8086 Assembler
8051 Cross Assembler

EC8661 VLSI DESIGN LABORATORY

OBJECTIVES:
The student should be made:
- To learn Hardware Descriptive Language (Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

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

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.
   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>
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<tr>
<th>S.NO</th>
<th>EQUIPMENT</th>
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<td>1</td>
<td>Xilinx ISE/Altera Quartus/ equivalent EDA Tools</td>
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<tr>
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<td>Xilinx/Altera/equivalent FPGA Boards</td>
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<tr>
<td>3</td>
<td>Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools</td>
<td>10 User License</td>
</tr>
<tr>
<td>4</td>
<td>Personal Computer</td>
<td>30 no</td>
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</tbody>
</table>
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.

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 enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

UNIT I  INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS  9
Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

UNIT II  RADIATION MECHANISMS AND DESIGN ASPECTS  9
Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

UNIT III  ANTENNA ARRAYS AND APPLICATIONS  9
Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV  PASSIVE AND ACTIVE MICROWAVE DEVICES  9

UNIT V  MICROWAVE DESIGN PRINCIPLES  9

TOTAL: 45 PERIODS

OUTCOMES:
The student should be able to:

- Apply the basic principles and evaluate antenna parameters and link power budgets
- Design and assess the performance of various antennas
- Design a microwave system given the application specifications

TEXTBOOKS:


REFERENCES:

OBJECTIVES:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various ideas about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

UNIT I  INTRODUCTION TO OPTICAL FIBERS

Introduction-general optical fiber communication system - basic optical laws and definitions-optical modes and configurations -mode analysis for optical propagation through fibers-modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables-classification of optical fiber-single mode fiber-graded index fiber.

UNIT II  TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER


UNIT III  OPTICAL SOURCES AND DETECTORS

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surface emitting LED-Edge emitting LED photometry LED efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.


UNIT IV  OPTICAL RECEIVER, MEASUREMENTS AND COUPLING


UNIT V  OPTICAL COMMUNICATION SYSTEMS AND NETWORKS


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

- Realize basic elements in optical fibers, different modes and configurations.
- Analyze the transmission characteristics associated with dispersion and polarization techniques.
- Design optical sources and detectors with their use in optical communication system.
- Construct fiber optic receiver systems, measurements and coupling techniques.
- Design optical communication systems and its networks.

TEXT BOOKS:

REFERENCES:

EC8791        EMBEDDED AND REAL TIME SYSTEMS        L    T    P    C
3           0           0           3

OBJECTIVES:
The student should be made to:

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the real time operating systems

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN 9

UNIT II ARM PROCESSOR AND PERIPHERALS 9

UNIT III EMBEDDED PROGRAMMING 9
Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.
UNIT IV  REAL TIME SYSTEMS

UNIT V  PROCESSES AND OPERATING SYSTEMS
Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Describe the architecture and programming of ARM processor
- Outline the concepts of embedded systems
- Explain the basic concepts of real time operating system design
- Model real-time applications using embedded-system concepts

TEXT BOOKS:

REFERENCES:
EC8702 AD HOC AND WIRELESS SENSOR NETWORKS

OBJECTIVES:
The student should be made to:
- Learn Ad hoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks
- Have an exposure to mote programming platforms and tools

UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS

UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES

UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS

UNIT IV SENSOR NETWORK SECURITY

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student would be able to:
- Know the basics of Ad hoc networks and Wireless Sensor Networks
- Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
- Apply the knowledge to identify appropriate physical and MAC layer protocols
- Understand the transport layer and security issues possible in Ad hoc and sensor networks.
- Be familiar with the OS used in Wireless Sensor Networks and build basic modules
TEXT BOOKS:

REFERENCES:

EC8711 EMBEDDED LABORATORY  L  T  P  C
0  0  4  2

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
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

LIST OF EXPERIMENTS:
1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDs.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

OUTCOMES:
At the end of the course, the student should be able to:
- Write programs in ARM for a specific Application
- Interface memory, A/D and D/A convertors with ARM system
- Analyze the performance of interrupt
- Write program for interfacing keyboard, display, motor and sensor.
- Formulate a mini project using embedded system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS (3 students per batch)
Embedded trainer kits with ARM board 10 Nos
Embedded trainer kits suitable for wireless communication 10 Nos
Adequate quantities of Hardware, software and consumables
OBJECTIVES:

The student should be made to:

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- Understand the measurement of BER, Pulse broadening
- Understand and capture an experimental approach to digital wireless communication
- Understand actual communication waveforms that will be sent and received across wireless channel

LIST OF OPTICAL EXPERIMENTS

1. Measurement of connector, bending and fiber attenuation losses.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

LIST OF WIRELESS COMMUNICATION EXPERIMENTS

1. Wireless Channel Simulation including fading and Doppler effects
2. Simulation of Channel Estimation, Synchronisation & Equalization techniques
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
4. OFDM Signal Transmission and Reception using Software Defined Radios

LIST OF MICROWAVE EXPERIMENTS

1. VSWR and Impedance Measurement and Impedance Matching
2. Characterization of Directional Couplers, Isolators, Circulators
3. Gunn Diode Characteristics
4. Microwave IC – Filter Characteristics

TOTAL: 60 PERIODS

OUTCOMES:

On completion of this lab course, the student would be able to:

- Analyze the performance of simple optical link by measurement of losses and Analyzing the mode characteristics of fiber
- Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER
- Estimate the Wireless Channel Characteristics and Analyze the performance of Wireless Communication System
- Understand the intricacies in Microwave System design
## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS 3 STUDENTS PER EXPERIMENT:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>NAME OF THE EQUIPMENT</th>
<th>REQUIRED</th>
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<tbody>
<tr>
<td>1</td>
<td>Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter</td>
<td>2 Nos</td>
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<tr>
<td>2</td>
<td>Trainer kit for determining the mode characteristics, losses in optical fiber</td>
<td>2 Nos</td>
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<tr>
<td>3</td>
<td>Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope</td>
<td>2 Nos</td>
</tr>
<tr>
<td>4</td>
<td>Kit for measuring Numerical aperture and Attenuation of fiber</td>
<td>2 Nos</td>
</tr>
<tr>
<td>5</td>
<td>Advanced Optical fiber trainer kit for PC to PC communication, BER Measurement, Pulse broadening.</td>
<td>2 Nos</td>
</tr>
<tr>
<td>5</td>
<td>MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors</td>
<td>2 sets</td>
</tr>
<tr>
<td>6</td>
<td>LEDs with ST / SC / E2000 receptacles – 650 / 850 nm</td>
<td>2 sets</td>
</tr>
<tr>
<td>7</td>
<td>PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm</td>
<td>2 sets</td>
</tr>
<tr>
<td>8</td>
<td>Digital Communications Teaching Bundle (LabVIEW/MATLAB/Equivalent software tools)</td>
<td>10 Users</td>
</tr>
<tr>
<td>9</td>
<td>Transmit/receive pair of NI USRP-2920 transceivers (50 MHz to 2.2 GHz)</td>
<td>2 Nos</td>
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## CS8392 OBJECT ORIENTED PROGRAMMING

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### 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
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, Array Lists - Strings

UNIT III EXCEPTION HANDLING AND I/O
Exceptions - exception hierarchy - throwing and catching exceptions - built in exceptions, creating own exception, 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.

UNIT V EVENT DRIVEN PROGRAMMING

TOTAL: 45 PERIODS

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:
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  9
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  9
pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III  ASSIST DEVICES  9
Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV  PHYSICAL MEDICINE AND BIOTELEMETRY  9
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V  RECENT TRENDS IN MEDICAL INSTRUMENTATION  9
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 biotelemetry principles and methods
- Know about recent trends in medical instrumentation

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads.
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT I OPERATING SYSTEM OVERVIEW

UNIT II PROCESS MANAGEMENT
Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III STORAGE MANAGEMENT
Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV FILE SYSTEMS AND I/O SYSTEMS

UNIT V CASE STUDY

OUTCOMES:
At the end of the course, the students should be able to:
- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers and compare iOS and Android Operating Systems.
TEXT BOOK:

REFERENCES:

EC8074 ROBOTICS AND AUTOMATION

OBJECTIVES:
The student should be made:
• To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
• To study about the electrical drive systems and sensors used in robotics for various applications
• To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
• To learn about various motion planning techniques and the associated control architecture
• To understand the implications of AI and other trending concepts of robotics

UNIT I FOUNDATION FOR BEGINNERS
Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

UNIT II BUILDING BLOCKS OF A ROBOT
Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars
UNIT III  KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS  
Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

UNIT IV  NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE  
Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

UNIT V  AI AND OTHER RESEARCH TRENDS IN ROBOTICS  
Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL:45 PERIODS

OUTCOMES:
The student should be able to:
- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
- Examine different sensors and actuators for applications like maze solving and self driving cars.
- Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
- Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
- Describe the impact and progress in AI and other research trends in the field of robotics

TEXT BOOKS:

REFERENCES:
5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000
7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005
OBJECTIVES:

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology

UNIT I  INTRODUCTION TO NANOTECHNOLOGY  9
Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bio nano-particles.

UNIT II  FABRICATION AND CHARACTERIZATION OF NANOMATERIALS  9
Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.

UNIT III  PROPERTIES AND MEASUREMENT OF NANOMATERIALS  9
Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV  NANO STRUCTURES  9
Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

UNIT V  APPLICATIONS OF NANOTECHNOLOGY  9
Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

OUTCOMES:

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

- Describe the basic science behind the properties of materials.
- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Comprehend the exciting applications of nanotechnology at the leading edge of scientific research
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.

TEXT BOOKS:

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.(Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCES:

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

TOTAL : 45 PERIODS

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

REFERENCES:

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

UNIT I
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

CS8792 CRYPTOGRAPHY AND NETWORK SECURITY L T P C

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 9

UNIT II  SYMMETRIC CRYPTOGRAPHY 9

UNIT III  PUBLIC KEY CRYPTOGRAPHY 9

UNIT IV  MESSAGE AUTHENTICATION AND INTEGRITY 9

UNIT V  SECURITY PRACTICE AND SYSTEM SECURITY 9

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
OBJECTIVES:
- To learn and understand the concepts of stationary and non-stationary random signals and analysis & characterization of discrete-time random processes
- To enunciate the significance of estimation of power spectral density of random processes
- To introduce the principles of optimum filters such as Wiener and Kalman filters
- To introduce the principles of adaptive filters and their applications to communication engineering
- To introduce the concepts of multi-resolution analysis

UNIT I  DISCRETE-TIME RANDOM PROCESSES  
Random variables - ensemble averages a review, random processes - ensemble averages, autocorrelation and autocovariance matrices, ergodic random process, white noise, filtering random processes, spectral factorization, special types of random processes - AR, MA, ARMA

UNIT II  SPECTRUM ESTIMATION  

UNIT III  OPTIMUM FILTERS  

UNIT IV  ADAPTIVE FILTERS  

UNIT V  MULTIRESOLUTION ANALYSIS  

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Articulate and apply the concepts of special random processes in practical applications
- Choose appropriate spectrum estimation techniques for a given random process
- Apply optimum filters appropriately for a given communication application
- Apply appropriate adaptive algorithm for processing non-stationary signals
- Apply and analyse wavelet transforms for signal and image processing based applications
TEXT BOOKS
2. P. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993 (UNIT V)

REFERENCES:

EC8001 MEMS AND NEMS

OBJECTIVES:
- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems

UNIT I
INTRODUCTION TO MEMS AND NEMS
Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II
MEMS FABRICATION TECHNOLOGIES
Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III
MICRO SENSORS
MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

UNIT IV
MICRO ACTUATORS

UNIT V
NANO DEVICES
Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of this course, the student should be able to:
- Interpret the basics of micro/nano electromechanical systems including their applications and advantages
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical transducers including sensors and actuators
- Comprehend the theoretical foundations of quantum mechanics and Nano systems
REFERENCES:
4. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006,

OBJECTIVES:
The student should be made:
- To understand the compression schemes for text, voice, image and video
- To understand the QoS issues in multimedia network
- To know the communication protocols for multimedia networking

UNIT I AUDIO COMPRESSION
Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization - Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

UNIT II IMAGE AND VIDEO COMPRESSION
Graphics Interchange format - Tagged image file format - Digitized documents - Digitized pictures - JPEG - Video Encoding - Motion estimation - Overview of H.263 and MPEG-2

UNIT III TEXT COMPRESSION
Static and Dynamic Huffman coding – Arithmetic coding – Lempel-Ziv coding – LZW coding

UNIT IV GUARANTEED SERVICE MODEL

UNIT V MULTIMEDIA COMMUNICATION

OUTCOMES:
At the end of the course, the student should be able to:
- Design audio compression techniques
- Configure Text, image and video compression techniques
- Select suitable service model for specific application
- Configure multimedia communication network

TOTAL: 45 PERIODS
TEXT BOOK:

REFERENCES

EC8003        CMOS ANALOG IC DESIGN        L   T   P   C
3   0   0   3

OBJECTIVES:
- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs

UNIT I            INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS   9

UNIT II           AMPLIFIERS AND FEEDBACK    9

UNIT III          FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE   9
UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION

General Considerations - One and Two Stage Op Amps - Gain Boosting - Comparison - Common mode feedback - Input range limitations - Slew rate - Power Supply Rejection - Noise in Op Amps - General consideration of stability and frequency compensation - Multipole system - Phase margin - Frequency compensation - Compensation of two stage op Amps - Other compensation techniques.

UNIT V SWITCHED CAPACITOR CIRCUITS AND PLLS

General Considerations - Sampling switches - Switched Capacitor Amplifiers - Switched Capacitor Integrator - Switched Capacitor Common mode feedback - Phase Locked Loops - Simple PLL - Charge pump PLLs - Non ideal Effects in PLLs - Delay locked loops - its Applications.

OUTCOMES:
Upon completion of the course, student should be able to:
- Realize the concepts of Analog MOS devices and current mirror circuits.
- Design different configuration of Amplifiers and feedback circuits.
- Analyze the characteristics of frequency response of the amplifier and its noise.
- Analyze the performance of the stability and frequency compensation techniques of Op-Amp Circuits.
- Construct switched capacitor circuits and PLLs

TEXT BOOK:

REFERENCES:

UNIT I WIRELESS LAN
UNIT II  MOBILE NETWORK LAYER

UNIT III  3G OVERVIEW

UNIT IV  INTERNETWORKING BETWEEN WLANS AND WWANS
Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT V  4G & Beyond

TOTAL:45 PERIODS

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

- Conversant with the latest 3G/4G networks and its architecture
- Design and implement wireless network environment for any application using latest wireless protocols and standards
- Ability to select the suitable network depending on the availability and requirement
- Implement different type of applications for smart phones and mobile devices with latest network strategies

TEXT BOOKS:

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

UNIT I INTRODUCTION 9
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 10
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 10

UNIT IV DIGITAL PRODUCTS AND LAW 9

UNIT V ENFORCEMENT OF IPRs 7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
EC8092 ADVANCED WIRELESS COMMUNICATION

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:

TOTAL : 45 PERIODS
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
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
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

UNIT IV       MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO
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
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:

GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

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 into 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:

CS8082  MACHINE LEARNING TECHNIQUES

OBJECTIVES:
- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn the new approaches in machine learning
- To design appropriate machine learning algorithms for problem solving

UNIT I  INTRODUCTION
UNIT II  NEURAL NETWORKS AND GENETIC ALGORITHMS  9

UNIT III  BAYESIAN AND COMPUTATIONAL LEARNING  9

UNIT IV  INSTANT BASED LEARNING  9
K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

UNIT V  ADVANCED LEARNING  9

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the students will be able to
• Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
• Apply specific supervised or unsupervised machine learning algorithm for a particular problem
• Analyse and suggest the appropriate machine learning approach for the various types of problem
• Design and make modifications to existing machine learning algorithms to suit an individual application
• Provide useful case studies on the advanced machine learning algorithms

TEXT BOOK:

REFERENCES:

103
UNIT II  ELECTRICAL ISSUES IN PACKAGING  9
Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic
Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design
Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals;
Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics

UNIT III  CHIP PACKAGES  9
IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding,
Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging:
functions, types, materials processes, properties, characteristics, trends. Multi chip packaging:
types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated,
and embedded

UNIT IV  PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS  9
Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards.
Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and
Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and
resistance, Conduction, convection and radiation – Cooling requirements

UNIT V  TESTING  9
Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures –
thermo mechanically induced –electrically induced – chemically induced. Electrical Testing:
System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Give a comprehensive introduction to the various packaging types used along with the
  associated thermal, speed, signal and integrity power issues
• Enable design of packages which can withstand higher temperature, vibrations and shock
• Design of PCBs which minimize the EMI and operate at higher frequency
• Analyze the concepts of Testing and testing methods

TEXT BOOK:

REFERENCES:
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
6. Recent literature in Electronic Packaging
   Design”, Computer Science Press,1990
OBJECTIVES:
The student should be made to:
- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio
- Study the integrated circuit of oscillators and PLLs

UNIT I  SUBMICRON CMOS CIRCUIT DESIGN

UNIT II  INTEGRATOR BASED CMOS FILTERS
Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, $g_m$-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

UNIT III  DATA CONVERTER ARCHITECTURES
DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC’s, Successive Approximation ADC.

UNIT IV  DATA CONVERTER MODELING AND SNR
Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

UNIT V  OSCILLATORS AND PLL
LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, student should be able to
- Apply the concepts for mixed signal MOS circuit.
- Analyze the characteristics of IC based CMOS filters.
- Design of various data converter architecture circuits.
- Analyze the signal to noise ratio and modeling of mixed signals.
- Design of oscillators and phase lock loop circuit.

REFERENCES:
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 9
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) 9
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 stakeholders- Institutional Processes 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.

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.

TOTAL: 45 PERIODS
TEXTBOOKS:

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

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 PCBs
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:

REFERENCES:

EC8007                  LOW POWER SoC DESIGN

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OBJECTIVES:
The student should be made to:
- Identify sources of power in an IC.
- Understand basic principle of System on Chip design
- Learn optimization of power in combinational and sequential logic machines for SoC Design
- Identify suitable techniques to reduce the power dissipation and design circuits with low power dissipation.

UNIT I                  POWER CONSUMPTION IN CMOS
Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization – Circuit level low power design.

UNIT II                 SYSTEM-ON-CHIP DESIGN
System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performance algorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC

UNIT III                POWER OPTIMIZATION OF COMBINATIONAL AND SEQUENTIAL LOGIC MACHINES FOR SOC

UNIT IV                 DESIGN OF LOW POWER CIRCUITS FOR SUB SYSTEM ON A SOC
Subsystem Design Principles - Combinational Shifters – Adders – ALUs – Multipliers – High Density Memory – Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetic techniques for low power system – low voltage low power static Random access and dynamic Random access memories, low power clock, Inter connect and layout design
UNIT V  FLOOR PLANNING


TOTAL: 45 PERIODS

OUTCOME:
At the end of the course, the student should be able to:
• Analyze and design low-power VLSI circuits using different circuit technologies for system on chip design

TEXT BOOKS:

REFERENCES:
6. Recent literature in Low Power VLSI Circuits.
7. Recent literature in Design of ASICs

EC8008  PHOTONIC NETWORKS  L  T  P  C
3  0  0  3

OBJECTIVES:
• To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use
• To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue
• To expose the student to the advances in networking and switching domains and the future trends

UNIT I  OPTICAL SYSTEM COMPONENTS

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT II  OPTICAL NETWORK ARCHITECTURES

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.
UNIT III  WAVELENGTH ROUTING NETWORKS  9
The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS  9

UNIT V  NETWORK DESIGN AND MANAGEMENT  9

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student would be able to:
• Use the backbone infrastructure for our present and future communication needs
• Analyze the architectures and the protocol stack
• Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, network management and protection methods in vogue

REFERENCES:

EC8009  COMPRESSIVE SENSING  L  T  P  C
3  0  0  3

OBJECTIVES:
• To present the basic theory and ideas showing when it is possible to reconstruct sparse or nearly sparse signals from undersampled data
• To expose students to recent ideas in modern convex optimization allowing rapid signal recovery
• To give students a sense of real time applications that might benefit from compressive sensing ideas

UNIT I  INTRODUCTION TO COMPRESSED SENSING  9
Introduction; Motivation; Mathematical Background; Traditional Sampling; Traditional Compression; Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

UNIT II  SPARSITY AND SIGNAL RECOVERY  9
Signal Representation; Basis vectors; Sensing matrices; Restricted Isometric Property; Coherence; Stable recovery; Number of measurements.
UNIT III RECOVERY ALGORITHMS 9
Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit (OMP), Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); Iterative Thresholding algorithm: Hard thresholding, Soft thresholding; Model based: Model based CoSaMP, Model based HIT.

UNIT IV COMpressive SENSING FOR WSN 9
Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with Compressive Sensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

UNIT V APPLICATIONS OF COMpressive SENSING 9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Appreciate the motivation and the necessity for compressed sensing technology.
- Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.

TEXT BOOKS:

REFERENCES:
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.

TOTAL : 45 PERIODS

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

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
OUTCOMES:
- 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

EC8010 VIDEO ANALYTICS

OBJECTIVES:
The student should be made:
- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

UNIT I VIDEO ANALYTIC COMPONENTS
Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction-classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

UNIT II FOREGROUND EXTRACTION
Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment

UNIT III CLASSIFIERS
Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier
UNIT IV  VIDEO ANALYTICS FOR SECURITY  9
Abandoned object detection - human behavioral analysis - human action recognition - perimeter security - crowd analysis and prediction of crowd congestion

UNIT V  VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITORING AND ASSISTANCE  9
Customer behavior analysis - people counting - Traffic rule violation detection - traffic congestion identification for route planning - driver assistance - lane change warning

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design video analytic algorithms for security applications
- Design video analytic algorithms for business intelligence
- Design custom made video analytics system for the given target application

REFERENCES:
1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing, Kluwer academic publisher, 2001
2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016
3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012

EC8011 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING L T P C 3 0 0 3

OBJECTIVES:
The objective of this course is to provide knowledge on:
- Basics on Digital Signal Processors
- Programmable DSP’s Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors

UNIT I  FUNDAMENTALS OF PROGRAMMABLE DSPs
Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture - Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.

UNIT II  TMS320C5X PROCESSOR
Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.
UNIT III       TMS320C6X PROCESSOR

UNIT IV       ADSP PROCESSORS
Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V       ADVANCED PROCESSORS
Study of TI’s advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP’s Blackfin and SigmaDSP Processors, NXP’s DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze the concepts of Digital Signal Processors
- Demonstrate their ability to program the DSP processor for signal processing applications
- Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications

REFERENCES:
4. User guides Texas Instruments, Analog Devices and NXP.

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
Kepler’s Laws, Newton’s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –
eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II  SPACE SEGMENT  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, I onospheric 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:
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:

IT8006 PRINCIPLES OF SPEECH PROCESSING  L  T  P  C
3 0 0 3

OBJECTIVES:
The student should be made:
- To understand the speech production mechanism and the various speech analysis techniques and speech models
- To understand the speech compression techniques
- To understand the speech recognition techniques
- To know the speaker recognition and text to speech synthesis techniques

UNIT I SPEECH SIGNAL CHARACTERISTICS & ANALYSIS

UNIT II SPEECH COMPRESSION
Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

UNIT III SPEECH RECOGNITION
LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM- subword unit model based on HMM- language models for large vocabulary speech recognition - Overall recognition system based on subword units - Context dependent subword units- Semantic post processor for speech recognition

UNIT IV SPEAKER RECOGNITION
Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures- Text dependent speaker verification-Text independent speaker verification techniques

UNIT V SPEAKER RECOGNITION AND TEXT TO SPEECH SYNTHESIS
Text to speech synthesis(TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design speech compression techniques
- Configure speech recognition techniques
- Design speaker recognition systems
- Design text to speech synthesis systems
TEXT BOOKS:
1. L. R. Rabiner and R. W. Schafer, Introduction to Digital Signal Processing, Foundations and
2. Ben Gold and Nelson Morgan “Speech and Audio signal processing- processing and
   perception of speech and music", John Wiley and sons 2006

REFERENCES
1. Lawrence Rabiner, Biling and– Hwang Juang and B.Yegnanarayana “Fundamentals of Speech
   Recognition”, Pearson Education, 2009

GE8073                  FUNDAMENTALS OF NANOSCIENCE                          L T P C
3 0 0 3

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

UNIT I   INTRODUCTION                                           8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and
Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-
ultra-thin films-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                                                 9
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, MOMBE.

UNIT III NANOMATERIALS                                                    12
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon
Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-
growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-
Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, Nano alumina, CaO, AgTiO2, Ferrites, Nano
clays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and
applications.

UNIT IV         CHARACTERIZATION TECHNIQUES                                                  9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques,
Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-
AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V         APPLICATIONS                                                     7
Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nanocrystal,
Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines,
Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro
Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition,
Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

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: