VISION

To be recognized as a benchmark and trend setter in Electronics and Communication Engineering domain keeping in phase with rapidly changing technologies through effective partnership with reputed academic institutions, research organizations, industries and community.

MISSION

- Create highly motivated, technologically competent human resource by imparting high quality technical education through flexible student centric updated curricula suited to students with diverse backgrounds.
- Adopt best teaching and learning practices and establish state-of-the-art facilities to provide quality academic ambience for innovativeness, research and developmental activities.
- Enhance collaborative activities with academic institutions and industries for evolving indigenous technological solutions to meet societal needs and nurture leadership and entrepreneurship qualities with ethical means.
- Facilitate adequate exposure to the students, faculty and staff through training in the state-of-the art technologies, efficient administration, global outreach and benchmarking against referential institutions.
The Programme defines Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes as follows:

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1 The graduated Students will demonstrate sufficient theoretical, analytical and initiative skills in Basic Sciences and Engineering necessary, to assimilate, analyze, synthesize and innovative solutions to meet societal needs.

PEO2 The graduated students will have inculcated a thirst for lifelong learning and sustained research interest.

PEO3 The graduated students will practice values and exhibit leadership qualities and team spirit to promote entrepreneurship and indigenization.

After the course duration of four years, B.E. graduates of Electronics and Communication Engineering will exhibit the following outcomes:

2. PROGRAMME OUTCOMES (POs):

PO1: Ability to apply technical knowledge in mathematics, Science and Engineering leading to the realization and evaluation of complex systems, through research problems in the context of evolving societal needs.

PO2: Imaginative critical thinking with an ability to think critically, analyze and solve engineering problems.

PO3: Ability to design a system, component, or process to meet desired needs within realistic constraints.

PO4: Ability to gather user needs and requirements, design, develop, integrate, and test complex systems by employing systems engineering thinking and processes, within required operational and acquisition system environments.

PO5: Personal and intellectual autonomy to independently and with an openness to reflect upon and use modern engineering tools necessary to engineering practices.

PO6: Educational practices necessary to understand the impact of engineering solutions in a global, economical, environmental and societal context.

PO7: An active and committed global citizen with an awareness of contemporary issues and their impact on economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PO8: An understanding of professional, ethical, legal issues and responsibilities.

PO9: A creative, enterprising team player and engaged participative leader able to effect change.

PO10: A confident, resilient and adaptable individual with good communication skills.

PO11: Exercise their responsibilities in the management of cost-effective systems product development by leading and participating in interdisciplinary teams.

PO12: Active exploration of new ideas through lifelong learning.
3. **PROGRAMME SPECIFIC OUTCOMES (PSOs):**

After the completion of B.E. Electronics and Communication Engineering programme, the student will process the follow program Specific Outcomes:

PSO1  The curriculum of ECE includes mathematics and Engineering topics necessary to analyse and design complex Electronic Systems containing Hardware and Software components.

PSO2  The curriculum of ECE includes mathematics and Engineering topics necessary to analyse and design complex Communication Systems containing Hardware and Software components.

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

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<tr>
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A broad relation between the programme educational objective and the Programme outcomes is given in the following table.
### MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table.

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ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTER CURRICULA AND SYLLABI
(Applicable to Students admitted from the Academic Year 2020-2021 onwards)

## SEMESTER I

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**EEC COURSES**

**AUDIT COURSES (AC)**

Registration for any of these courses is optional to students

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34. **EC5025** Introduction to Web Technology  
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35. **EC5079** Soft Computing and Applications  
   **PE** 3 0 0 3 3
36. **EC5026** Parallel and Distributed Processing  
   **PE** 3 0 0 3 3
37. **GE5073** Foundation Skills In Integrated Product Development  
   **PE** 3 0 0 3 3
38. **EC5027** Artificial Intelligence and Machine Learning  
   **PE** 3 0 0 3 3

### SUMMARY

#### B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

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OBJECTIVES:
The first semester English course entitled ‘Technical English’ aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I  INTRODUCING ONESELF
Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – Speaking: Introducing oneself – introducing friend/ family - Reading: Descriptive passages (from newspapers / magazines)- Writing: Writing a paragraph (native place, school life) - Grammar: Simple present, present continuous – Vocabulary Development: One word substitution

UNIT II  DIALOGUE WRITING
Listening: Listening to conversations (asking for and giving directions) – Speaking: making conversation using (asking for directions, making an enquiry), Role plays-dialogues- Reading: Reading a print interview and answering comprehension questions- Writing: Writing a checklist, Dialogue writing - Grammar: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions) - Vocabulary Development: Stress shift, lexical items related to the theme of the given unit.

UNIT III  FORMAL LETTER WRITING
Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-Speaking: Giving short talks on a given topic- Reading: Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- Writing: Writing formal letters/ emails (Complaint letters) - Grammar: Future Tense forms of verbs, subject and verb agreement - Vocabulary Development: Collocations – Fixed expressions

UNIT IV  WRITING COMPLAINT LETTERS

UNIT V  WRITING DEFINITIONS AND PRODUCT DESCRIPTION
Listening: Listening to a product description (labeling and gap filling) exercises- Speaking: Describing a product and comparing and contrasting it with other products- Reading: Reading graphical material for comparison (advertisements)- Writing: Writing Definitions (short and long) – compare and contrast paragraphs- Grammar: Adjectives – Degrees of comparison - compound nouns- Vocabulary Development: Use of discourse markers – suffixes (adjectival endings).
COURSE OUTCOMES:
At the end of the course the students will have gained,
CO1: Exposure to basic aspects of technical English.
CO2: The confidence to communicate effectively in various academic situations.
CO3: Learnt the use of basic features of Technical English.

TEXTBOOK:

ASSESSMENT PATTERN
- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158 ENGINEERING MATHEMATICS – I L T P C
(Common to all branches of B.E / B.Tech. Programmes in I Semester)

OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES
12

UNIT II DIFFERENTIAL CALCULUS
12

UNIT III FUNCTIONS OF SEVERAL VARIABLES
12
UNIT IV 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 V MULTIPLE INTEGRALS
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area
enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and
triple integrals.

TOTAL :60 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1: Use the matrix algebra methods for solving practical problems.
CO2: Apply differential calculus tools in solving various application problems.
CO3: Use differential calculus ideas on several variable functions.
CO4: Apply different methods of integration in solving practical problems.
CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To make the students understand the importance of mechanics.
- To equip the students with knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics, and lasers.
- To enable students to understand the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I  MECHANICS  9

UNIT II  ELECTROMAGNETIC WAVES  9
Gauss’s law – Faraday’s law - Ampere’s law - The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III  OSCILLATIONS, OPTICS AND LASERS  9

UNIT IV  BASIC QUANTUM MECHANICS  9
Photons and light waves - Electrons and matter waves - The Schrödinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS  9
The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1: Understand the importance of mechanics.
CO2: Express the knowledge of electromagnetic waves.
CO3: Know the basics of oscillations, optics, and lasers.
CO4: Understand the importance of quantum physics.
CO5: Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

[Signature]
Director
Centre for Academic Courses
Anna University, Chennai-600 025
TEXT BOOKS:

REFERENCES:

CY5151 ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES) L T P C
3 0 0 3

OBJECTIVES:
- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY

UNIT II NANO CHEMISTRY

UNIT III PHOTO CHEMISTRY AND SPECTROSCOPY
UNIT IV  ENERGY CONVERSIONS AND STORAGE

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H₂-O₂ and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V  WATER TECHNOLOGY


TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
CO2: To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3: To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
CO4: To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
CO5: To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

REFERENCE BOOKS:

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING  L T P C
3 0 0 3

OBJECTIVES:
- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
To use Python data structures - lists, tuples, dictionaries.
To do input/output with files in Python.

UNIT I  INTRODUCTION TO COMPUTING AND PROBLEM SOLVING  9

SUGGESTED ACTIVITIES:
- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II  CONDITIONALS AND FUNCTIONS  9

SUGGESTED ACTIVITIES:
- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III  SIMPLE DATA STRUCTURES IN PYTHON  10

SUGGESTED ACTIVITIES:
- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
Billing Scheme during shopping.

- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV  STRINGS, DICTIONARIES, MODULES  10


SUGGESTED ACTIVITIES:

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student’s choice) and importing into the application.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.

UNIT V  FILE HANDLING AND EXCEPTION HANDLING  7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

SUGGESTED ACTIVITIES:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

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BS5161 BASIC SCIENCES LABORATORY L T P C 0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVES:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle  
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids

Attested

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Centre for Academic Courses
Anna University, Chennai-600 025
11. Post office box - Determination of Band gap of a semiconductor.
13. Photoelectric effect
14. Michelson Interferometer.
16. Melde’s string experiment

TOTAL: 30 PERIODS

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

CO1: To determine various moduli of elasticity and also various thermal and optical properties of materials.

CO2: To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:
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 lodometry.
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-Phenantheroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
CO3: To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.

CO4: To determine the amount of metal ions through volumetric and spectroscopic techniques

CO5: To determine the molecular weight of polymers by viscometric method.

CO6: To quantitatively analyse the impurities in solution by electroanalytical techniques

CO7: To design and analyse the kinetics of reactions and corrosion of metals
TEXTBOOKS:
1. Laboratory Manual- Department of Chemistry, CEGC, Anna University, 2014.

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

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MA5252  ENGINEERING MATHEMATICS – II  L  T  P  C
(Common to all branches of B.E. / B.Tech. Programmes in II  Semester)

3  1  0  4

OBJECTIVES:
- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  VECTOR CALCULUS

UNIT II  ANALYTIC FUNCTION
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation $w = c + z, \ a z, \ 1/z, \ z^2$.

UNIT III  COMPLEX INTEGRATION

UNIT IV  DIFFERENTIAL EQUATIONS
Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT V  LAPLACE TRANSFORMS

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
CO1: Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.

CO2: Construct analytic functions and use their conformal mapping property in application problems.

CO3: Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
CO4: Apply various methods of solving differential equation which arise in many application problems.
CO5: Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

REFERENCES:

EE5201 BASICS OF ELECTRICAL AND MEASUREMENTS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic concepts of electric circuits.
- To understand the operation of AC and DC machines.
- To understand the operation and applications of special electrical components
- To understand the working principle of electrical and mechanical measurements.

UNIT I ELECTRIC CIRCUITS

UNIT II ELECTRICAL MACHINES

UNIT III SPECIAL ELECTRICAL COMPONENTS
Synchronous machine – Brushless DC Motor - Stepper motor – Switched reluctance motor, Electromechanical Relays.

UNIT IV ELECTRICAL MEASUREMENTS
UNIT V  MECHANICAL MEASUREMENTS

Classification of transducers, strain, RTD, thermocouples, Piezo-electric transducer, LVDT, Turbine and electromagnetic flow meters, level transducers ultrasonic and fiber optic transducers, type of sensors, elastic sensors, viscosity, moisture and pH sensors, Digital transducers, vibrating wire instruments like load cells, stress meter, etc.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: Upon Completion of this subject, the students will gain knowledge on different types of electrical circuits, electrical machines and basics of measurements and instrumentation.

TEXT BOOKS:


REFERENCES:


GE5152  ENGINEERING MECHANICS

OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
- Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
- Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
- Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
- Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I  STATICS OF PARTICLES (9+3)

UNIT II  EQUILIBRIUM OF RIGID BODIES  (9+3)

UNIT III DISTRIBUTED FORCES  (9+3)
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus - Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration.
Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION  (9+3)

UNIT V DYNAMICS OF PARTICLES  (9+3)

TOTAL (L: 45 + T: 15): 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
CO2: Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
CO3: Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
CO4: Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
CO5: Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

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EC5251 CIRCUIT THEORY  L T P C  3 1 0 4

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

UNIT I DC CIRCUIT ANALYSIS 9+3
Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff’s Current Law, Kirchoff’s voltage law, The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNIT II NETWORK THEOREM AND DUALITY 9+3

UNIT III SINUSOIDAL STEADY STATE ANALYSIS 9+3
UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS


UNIT V COUPLED CIRCUITS AND TOPOLOGY

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

TOTAL : 60 PERIODS

COURSE OUTCOMES

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<td>Ability to apply the basic laws for DC and AC circuits Analysis</td>
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<td>Ability to apply Network Theorems in DC and AC circuits</td>
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<td>Ability to analyze AC circuits for phase relationship and power calculation</td>
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<td>Ability to design and analyze first and second order AC circuits</td>
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<td>Ability to analyze inductively coupled circuits</td>
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CO-PO Articulation Matrix

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PH5202 SEMICONDUCTOR PHYSICS AND DEVICES

OBJECTIVES:
- To make the students understand the concepts of electronic states and band structure formation.
- To equip the students with knowledge of carrier concentration and doping in semiconductors.
- To introduce the basics of electrical transport of charge carriers.
- To enable the students to understand the importance of optical properties of materials.
- To elucidate the physics of semiconductor devices and quantum structures.

UNIT I ELECTRONIC STATES

UNIT II CARRIERS AND DOPING

UNIT III ELECTRICAL TRANSPORT

UNIT IV OPTICAL TRANSPORT

UNIT V DEVICES

TOTAL: 45 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Blooms Level</th>
<th>COURSE OUTCOMES</th>
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<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>Ability to recall the basics of electronic states and understand the energy band structure formation</td>
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<tr>
<td>CO2</td>
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<td>Ability to understand the importance of carrier concentration and doping in semiconductors</td>
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<tr>
<td>CO</td>
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<td>Ability to demonstrate the Physics of transport &amp; charge carriers</td>
</tr>
<tr>
<td>CO</td>
<td>2</td>
<td>Ability to understand the importance of optical properties of materials</td>
</tr>
<tr>
<td>CO</td>
<td>3</td>
<td>Ability to apply the physics of derives and importance of quantum structures</td>
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**TEXT BOOKS:**

**REFERENCES:**

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**Attested**

**Director**
Centre for Academic Courses
Anna University, Chennai-600 025
OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I  CIVIL ENGINEERING PRACTICES  15

PLUMBING WORK:
   a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
   b) Preparing plumbing line sketches.
   c) Laying pipe connection to the suction side of a pump
   d) Laying pipe connection to the delivery side of a pump.
   e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
   a) Sawing,
   b) Planning and
   c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
   a) Studying joints in door panels and wooden furniture
   b) Studying common industrial trusses using models.

PART II  ELECTRICAL ENGINEERING PRACTICES  15

WIRING WORK:
   a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
   b) Wiring Stair case light.
   c) Wiring tube – light.
   d) Preparing wiring diagrams for a given situation.

Wiring Study:
   a) Studying an Iron-Box wiring.
   b) Studying a Fan Regulator wiring.
   c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)
PART III  MECHANICAL ENGINEERING PRACTICES

WELDING WORK:
   a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
   b) Practicing gas welding.

BASIC MACHINING WORK:
   a) (simple)Turning.
   b) (simple)Drilling.
   c) (simple)Tapping.

ASSEMBLY WORK:
   a) Assembling a centrifugal pump.
   b) Assembling a household mixer.
   c) Assembling an air conditioner.

SHEET METAL WORK:
   a) Making of a square tray

FOUNDRY WORK:
   a) Demonstrating basic foundry operations.

PART IV  ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:
   a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
   a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
   a) Studying a FM radio.
   b) Studying an electronic telephone.

TOTAL (P: 60) = 60 PERIODS

COURSE OUTCOMES:

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

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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OBJECTIVES /OUTCOMES
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

TOTAL: 60 PERIODS

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

COURSE OUTCOMES:

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<th>CO No.</th>
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<td>Ability to apply the circuit laws and theorems</td>
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<td>Ability to construct the electrical /electronic</td>
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<td>Ability to Measure and record</td>
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<td>Ability to validate the Measured parameters with design</td>
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<td>Ability to interpret the observations</td>
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CO-PO Articulation Matrix

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OBJECTIVES:
The basic concepts and tools of the subject covered are:
- Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces;
- Linear maps between vector spaces, their matrix representations, null-space and Range spaces, the Rank-Nullity Theorem;
- Inner product spaces: Cauchy-Schwarz inequality, orthonormal bases, the Gramm-Schmidt procedure, orthogonal complement of a subspace, orthogonal projection;
- Eigenvalues and eigenvectors, diagonalizability of a real symmetric matrix, canonical forms;
- Mathematical foundations of numerical techniques for solving linear systems, eigenvalue problems and generalized inverses.

UNIT I VECTOR SPACES
Vector spaces – Subspaces – Linear combinations - Linear Span – Linear dependence - Linear independence – Bases and Dimensions

UNIT II LINEAR TRANSFORMATIONS

UNIT III INNER PRODUCT SPACES
Inner Products and norms - Inner Product Spaces - Orthogonal vectors – Gram Schmidt orthogonalization process – Orthogonal complement – Least square Approximations

UNIT IV NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS

UNIT V NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1: The students can able to solve system of linear equations, to use matrix operations and vector spaces using algebraic methods.
CO2: Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
CO3: Apply numerical methods to obtain approximate solutions to mathematical problems.
CO4: Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
CO5: Analyze and evaluate the accuracy of common numerical methods.
TEXT BOOKS:

REFERENCES:

EC5301 ELECTRONIC CIRCUITS – I  L  T  P  C 
3 1 0 4

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To learn about biasing of BJT and MOSFET circuits.
- To design amplifiers.
- To study the effect of source and load.
- To design amplifiers with active loads.
- To study high frequency response of amplifiers.

UNIT I BIASING OF DISCRETE BJT AND MOSFET  9+3
DC Load line, operating point, Various biasing methods for BJT-Design-Stability-Bias compensation, Thermal stability, DC bias analysis of MOSFET circuits.

UNIT II BJT AMPLIFIERS  9+3

UNIT III MOSFET AMPLIFIERS  9+3
Small signal Analysis of amplifiers, Common source amplifier, Voltage swing limitations, Small signal analysis of Source follower and Common Gate amplifiers, Cascode amplifiers, Differential amplifiers, BiMOSCascode amplifier.

UNIT IV FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS  9+3
Low frequency analysis, Miller effect, High frequency analysis of CE, MOSFET CS amplifier and single stage amplifiers, Short circuit current gain, cut off frequency – \( f_\alpha \), \( f_\beta \), Unity Gain Bandwidth

UNIT V  
IC MOSFET AMPLIFIERS  
9+3  
IC biasing Current steering circuits for IC amplifiers- current mirrors, - current sources- PMOS and NMOS current sources, Cascode current source, Widlar current source. Amplifier with resistive load, active load - Depletion load, current source load, Differential amplifiers with active load

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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<th>CO No.</th>
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<td>Choose appropriate biasing circuits for BJT and MOSFET discrete amplifiers</td>
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<td>Design and Analysis BJT amplifier</td>
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<td>Analyze the modeling of MOSFET amplifiers, the effect of source and load of MOSFET circuits</td>
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<td>CO4</td>
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<td>Analyze the high frequency response of BJT</td>
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<tr>
<td>CO5</td>
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<td>Design biasing circuits and amplifiers with active loads meant for IC's</td>
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</tbody>
</table>

TEXT BOOKS:

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

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

UNIT II  STATIC ELECTRIC FIELD
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.

UNIT III  STATIC MAGNETIC FIELD
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 torque.

UNIT IV  TIME VARYING FIELDS AND MAXWELL EQUATIONS

UNIT V  PLANE EM WAVES IN ISOTROPIC MEDIA
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: 45 PERIODS

COURSE OUTCOMES:

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<td>CO1</td>
<td>3</td>
<td>Ability to apply the mathematical concepts to EM laws and theorem</td>
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<tr>
<td>CO2</td>
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<td>Ability to apply electromagnetic laws to static fields</td>
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<td>CO3</td>
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<td>Ability to apply Maxwell’s equation for static and magnetic fields</td>
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<tr>
<td>CO4</td>
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<td>Ability to apply EM laws for electromagnetic fields</td>
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<tr>
<td>CO5</td>
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<td>Ability to apply EM laws for the propagation of plane waves through different medium</td>
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TEXT BOOKS:

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EC5303 DIGITAL SYSTEM DESIGN

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce Boolean algebra and its applications in digital systems
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits
- To introduce the electronic circuits involved in the making of logic gates
- To introduce semiconductor memories and related technology

UNIT I BASIC CONCEPTS AND COMBINATIONAL CIRCUITS
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods.
UNIT II  MSI CIRCUITS  9
Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry lookahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit

UNIT III  SYNCRONOUS SEQUENTIAL CIRCUITS  9
Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock

UNIT IV  ASYNCHRONOUS SEQUENTIAL CIRCUITS  9
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  LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES  9
Logic families- TTL, MOS, CMOS, BiCMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, ROM, PLA and PAL

TOTAL: 45 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Blooms Level</th>
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<tr>
<td>CO1 3</td>
<td>Ability to apply Boolean algebra and simplification procedure to digital logic</td>
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<tr>
<td>CO2 3</td>
<td>Ability to design combinational digital circuits using logic gates</td>
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<tr>
<td>CO3 3</td>
<td>Ability to analyze and design synchronous sequential circuits</td>
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<tr>
<td>CO4 3</td>
<td>Ability to analyze and design synchronous sequential circuits</td>
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<tr>
<td>CO5 2</td>
<td>Ability to understand the working of logic gate electronic circuits and memory device</td>
<td></td>
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</table>

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce visualization and mathematical representation of continuous-time and discrete-time signals
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous-time signals
- To teach the applications of Z- and Fourier transforms in the analysis of discrete – time signals

UNIT I 
CLASSIFICATION OF SIGNALS AND SYSTEMS 6+6
Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals – periodic and aperiodic signals, random signals, Energy & Power signals - CT systems and DT systems, Classification of systems.

UNIT II 
ANALYSIS OF CONTINUOUS TIME SIGNALS 6+6
Fourier series analysis- Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms in Signal Analysis.

UNIT III 
LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS 6+6
Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis.

UNIT IV 
ANALYSIS OF DISCRETE TIME SIGNALS 6+6
Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal DTFT and properties, Z-transform & properties.

UNIT V 
LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS 6+6
Difference Equations-Block diagram representation-Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive & Non-Recursive systems.

TOTAL: 30L + 30T: 60 PERIODS
COURSE OUTCOMES:

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<th>CO No.</th>
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<td>Ability to clarify signals and systems based on various characteristics and decomposition for easier analysis</td>
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<td>Ability to determine and analyze frequency components of signals and frequency response of the systems</td>
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<tr>
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<td>Ability to determine and analyze the capability and stability LTI systems for their impulse response</td>
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<td>Ability to convert the CT signals into DT signals and analyze, the effect of sampling and frequency content of DT signals</td>
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<tr>
<td>CO5</td>
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<td>Ability to analyze LTI systems and realize with various structures</td>
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TEXT BOOKS:

REFERENCES:

CO-PO Articulation Matrix

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</table>

CO-PO Articulation Matrix
OBJECTIVES:
- To learn hardware implementation and testing of analog and digital circuits
- To design amplifier circuits to meet desired specifications
- To understand the functionality of combinational and sequential circuits
- To simulate basic combinational and sequential circuits using Hardware Description Language HDL

1. Implementation of Boolean expression using universal gates, BCD adder and 2-bit Magnitude comparator
2. Implementation of Boolean expression using MUX and truth table verification of RS, JK, T, and D Flip Flops
3. BCD counter and counters with seven segment display
4. Data transfer using shift registers
5. Realization of Digital circuits using HDL – Combinational circuits
6. Realization of Digital circuits using HDL – Sequential circuits
7. Frequency Response of CE, CB amplifiers and its Spice simulation
8. Design of CC Amplifier for a specific output impedance and its Spice Simulation
9. Spice simulation of CS, CG, and CD configuration of MOSFET amplifiers with various active load configurations.
10. Design of Differential Amplifiers and its CMRR measurement
   a. Frequency response of cascode amplifier
   b. Frequency response of cascade amplifier

TOTAL: 60 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
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<tbody>
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<td>Ability to design and verify amplifiers and buffers for a given problem definition</td>
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<tr>
<td>CO2</td>
<td>3</td>
<td>Ability to design and verify differential amplifiers for a given problem definition</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to design and simulate MOSFET amplifiers for a given problem definition</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>Ability to realize combinational and sequential circuits as per the given problem definition</td>
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<tr>
<td>CO5</td>
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<td>Ability to realize digital circuits using HDL</td>
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</table>

CO-PO Articulation Matrix

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OBJECTIVES:

- To train the students in performing various tests on electrical machines.
- To impart knowledge on basics of Instrumentation

LIST OF EXPERIMENTS

1. Load test on separately excited DC shunt generator
2. Load test on DC shunt motor
3. Load test on Single phase Transformer
4. Load test on three phase Induction motor
5. Regulation of three Phase Alternator
6. Bridge Networks – AC and DC Bridges
7. Instrumentation Amplifier
8. Time constant of RC circuit
9. Characteristics of LVDT
10. Characteristics of RTD
11. Characteristics of Thermistor
12. Dynamics of pressure transducer

TOTAL: 60 PERIODS

COURSE OUTCOMES

CO1: To be able to perform speed characteristic of different electrical machines
CO2: Become familiar with the fundamentals of Electrical and Mechanical Measurements.

EC5401 TRANSMISSION LINES AND WAVEGUIDES

OBJECTIVES:

- To introduce the various types of transmission lines and to discuss the losses associated.
- To provide thorough understanding about impedance transformation and matching.
- To give insight about the usage of smith chart in problem solving.
- To impart knowledge on filter theories and waveguide theories.
- To analyze and minimize cross talk in unbounded conductive media.

UNIT I TRANSMISSION LINE FUNDAMENTALS

- 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 Zo - Input and transfer impedance - reflection factor, reflection loss, insertion loss, S-parameters and its properties.

UNIT II LINE AT RADIO FREQUENCY AND IMPEDANCE MATCHING


UNIT III NETWORK COMPONENTS

UNIT IV WAVEGUIDES AND RESONATORS

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic (TEM) waves, Transverse Magnetic (TM) waves, Transverse Electric (TE) waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel’s differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular cavity Resonators.

UNIT V PLANAR TRANSMISSION LINES AND COUPLING

Introduction to strip line – Slot line – Coplanar waveguide - Transmission line reflections – Lattice diagram – Time domain reflectometry – Coupled wave equation – Coupled line analysis – Modal Analysis – Crosstalk Minimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<th>CO No.</th>
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<td>Ability to apply Transmission Line concepts and obtain general solution</td>
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<td>Ability to analyze the impedance concepts</td>
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<td>Ability to apply filter basics and design element filters</td>
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<td>CO4</td>
<td>4</td>
<td>Ability to analyze the behavior of guiding structures</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>Ability to apply reflection and coupling concepts to coplanar</td>
</tr>
</tbody>
</table>

TEXT BOOKS:
1. John D Ryder, "Networks lines and fields", Prentice Hall of India, 2005

REFERENCES:

CO-PO Articulation Matrix

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</table>
OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the concepts of various modulations and their spectral analysis
- To introduce random processes and their characteristics
- To understand noise impact on modulations
- To introduce some of the essential baseband signal processing techniques

UNIT I AMPLITUDE MODULATION

UNIT II ANGLE MODULATION

UNIT III RANDOM PROCESS

UNIT IV NOISE PERFORMANCE

UNIT V BASEBAND TECHNIQUES
Sampling - Quantization – Uniform and non-uniform quantization – Quantization noise – Companding laws of speech signals – PCM, DPCM, ADPCM, DM, ADM, and Subband Coding. Multiplexing– TDM (E and T lines), FDM

COURSE OUTCOMES:

<table>
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<td>Ability to apply transforms for signal modulation techniques</td>
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<td>Ability to develop the architecture of communication system for analog modulation techniques</td>
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<td>Ability to explore the role of random process in communication system</td>
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<td>Ability to analyze the noise performance of analog communication receiver</td>
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<td>CO5</td>
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<td>Learn the speech coding techniques and communication system</td>
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TEXT BOOKS:
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EC5403 ELECTRONIC CIRCUITS – II

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study about feedback amplifiers and oscillator principles
- To design Op Amps
- To design oscillators
- To study about tuned amplifiers
- To know the principles of DC-DC convertors

UNIT I FEEDBACK AMPLIFIERS AND STABILITY 6+6

UNIT II OPERATIONAL AMPLIFIER 6+6

UNIT III OSCILLATORS 6+6
Barkhausen criteria for oscillator – Analysis of RC oscillators – Phase shift and Wein bridge oscillators – LC oscillators – Colpitts, Hartley, Clapp, and Ring Oscillators.
UNIT IV TUNED AMPLIFIERS 6+6

UNIT V POWER AMPLIFIERS AND DC CONVERTERS 6+6
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: 30L + 30T: 60 PERIODS

COURSE OUTCOMES:

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<td>3</td>
<td>Ability to design feedback amplifiers and analyze stabilization techniques</td>
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<td>Ability to design Op-amps</td>
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<td>Ability to analyze RC and LC oscillators</td>
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<tr>
<td>CO4</td>
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<td>Ability to analyze tuned amplifiers and its stability conditions</td>
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<tr>
<td>CO5</td>
<td>3</td>
<td>Ability to analyze power amplifiers and DC-DC Converters</td>
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TEXT BOOKS:

REFERENCES

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EC5404 DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:
• To introduce discrete fourier transform and its applications
• To teach the design of infinite and finite impulse response filters for filtering undesired signals
• To introduce signal processing concepts in systems having more than one sampling frequency
UNIT I  DISCRETE FOURIER TRANSFORM  

UNIT II  DESIGN OF INFINITE IMPULSE RESPONSE FILTERS  
Analog filters – Butterworth filters, Chebyshev Type I filters (upto 3rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method- Realization structures for IIR filters – direct, cascade, parallel forms.

UNIT III  DESIGN OF FINITE IMPULSE RESPONSE FILTERS  
Design of linear phase FIR filters windowing and Frequency sampling methods - Realization structures for FIR filters – Transversal and Linear phase structures- Comparison of FIR & IIR.

UNIT IV  FINITE WORDLENGTH EFFECTS  
Representation of numbers-ADC Quantization noise-Coefficient Quantization error-Product Quantization error-truncation & rounding errors -Limit cycle due to product round-off error- Round-off noise power-limit cycle oscillation due to overflow in digital filters- Principle of scaling.

UNIT V  MULTIRATE SIGNAL PROCESSING  
Introduction to Multirate signal processing-Decimation-Interpolation - Polyphase Decomposition of FIR filter-Multistage implementation of sampling rate conversion- Design of narrow band filters - Applications of Multirate signal processing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Blooms Level</th>
<th>COURSE OUTCOMES</th>
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<tr>
<td>CO1</td>
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<td>Ability to apply the concepts of discrete Fourier transform</td>
</tr>
<tr>
<td>CO2</td>
<td>4</td>
<td>Ability to design and analyze IIR filter</td>
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<tr>
<td>CO3</td>
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<td>Ability to design and analyze FIR filter</td>
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<tr>
<td>CO4</td>
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<td>Ability to analyze performance degradation of digital signal processing systems due to finite precision</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>Ability to analyze the architectural details of fixed and floating digital signal processor</td>
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</table>

TEXTBOOKS:

REFERENCES:
EC5405 LINEAR INTEGRATED CIRCUITS

L T P C
0 3 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To study the circuit configuration of linear integrated circuits.
- To introduce practical applications of linear integrated circuits.
- To introduce the concept of analog multiplier and Phase Locked Loop with applications.
- To study the application of ADC and DAC in real time systems.
- To introduce special function ICs and its construction.

UNIT I CIRCUIT CONFIGURATION FOR LINEAR ICS
9
Current sources, Analysis of difference amplifiers with active loads, supply and temperature independent biasing, Band gap references, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate. Interpretation of TL082 datasheet.

UNIT II APPLICATION OF OPERATIONAL AMPLIFIERs
9
Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Noninverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.

UNIT III ANALOG MULTIPLIER AND PLL
9
Analysis of four quadrants and variable Transconductance multipliers, Analog multiplier MPY634 features, Voltage controlled oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS
9
Analogue switches, High speed sample and hold circuit and IC’s, Types of D/A converter, Current driven DAC, Switches for DAC, A/D converter - Flash, Single slope, Dual slope, Successive approximation, Voltage to Time and Voltage to Frequency converters.
UNIT V  SPECIAL FUNCTION ICS

Timers, Voltage regulators - linear and switched mode types, Switched capacitor filter, SMPS, Frequency to Voltage converters, Tuned amplifiers, Power amplifiers and Isolation Amplifiers, Video amplifiers, Sources for Noises, Op Amp noise analysis and Low noise OP-Amps.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<th>CO No.</th>
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<tbody>
<tr>
<td>CO1</td>
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<td>Ability to appreciate the significance and role of this course (or) Op-Amp in the present contemporary world</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>Ability to apply and design linear and Non-Linear analog circuits using Op-Amp</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to analyze and develop Communication systems</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>Ability to differentiate date Converters in real time scenario</td>
</tr>
<tr>
<td>CO5</td>
<td>6</td>
<td>Ability to select and create IC'S and circuits for analog systems</td>
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TEXT BOOK:

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GE5251  ENVIRONMENTAL SCIENCES  L T P C  3 0 0 3

OBJECTIVES:
- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.

To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.

To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
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 – bio geographical 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
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 – soil 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
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 47 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
conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<td>Apply the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.</td>
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<td>Analysing to impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.</td>
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<tr>
<td>CO3</td>
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<td>Ability to understand the global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.</td>
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<td>CO4</td>
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<td>Analyze the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.</td>
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<tr>
<td>CO5</td>
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<td>Ability to inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues</td>
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TEXT BOOKS:

REFERENCES:

CO-PO Articulation Matrix

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**EC5411**  
**DIGITAL SIGNAL PROCESSING LABORATORY**  
**L T P C**  
0 0 4 2

**OBJECTIVES:**
1. To implement generation of sequences  
2. To realize Linear and Circular Convolution  
3. To design and realize FIR and IIR filters  
4. To implement signal processing algorithms using digital signal processor

**DSP Processor Implementation**
1. Study of architecture of Digital Signal Processor  
2. MAC operation using various addressing modes  
3. Implementation of difference equations  
4. Linear Convolution  
5. Circular Convolution  
6. Waveform generation

**MATLAB / Equivalent Software package**
7. Generation of sequences  
8. Linear and Circular Convolutions  
9. DFT  
10. FIR filter design  
11. IIR filter design  
12. Finite wordlength effects  
13. Decimation and Interpolation

**TOTAL: 60 PERIODS**

**LAB REQUIREMENTS:**
TMS 320C5x / TMS 320C6x Kits – 15 Nos.  
MATLAB or Equivalent S/w – 15 User License

**OUTCOMES:**

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<td>Ability to apply and analyze signals and systems concepts and verify using simulation tool</td>
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<td>Ability to design and analyze digital filters and verify using simulation tool</td>
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<td>Ability to apply convolution operations in digital signal processor</td>
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<tr>
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<td>Ability to apply different addressing mode and verify MAC operation using digital signal processor</td>
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<td>Ability to design a system using decimation and interpolation concepts using simulation tool</td>
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**CO-PO Articulation Matrix**

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</table>
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To study circuits using feedback concepts and tuned circuits.
- To learn circuits using OPAMP, PLL and Timer ICs.
- To know the design of power amplifier circuits to meet desired specifications.

1. Design and Analysis of Feedback amplifiers
2. Design and analysis of RC phase shift oscillator
3. Design and analysis of Hartley and Colpitts LC Oscillators
4. Design and analysis of single Tuned amplifier
5. Design and analysis of Wien bridge oscillator using OPAMP
6. Design and analysis of Schmitt trigger using OPAMP
7. Design and analysis of Waveform generators using OPAMP
8. Design and analysis of Active filters using OPAMP
9. Design and analysis of Voltage Controlled Oscillator using PLL IC
10. Design and analysis of Astable and Monostable Multivibrators using Timer IC
11. Spice simulation of differential amplifiers and operational amplifiers

TOTAL: 60 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Blooms Level</th>
<th>COURSE OUTCOMES</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>Ability to design and verify feedback amplifiers and tuned amplifiers for a given problem definition</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>Ability to design and verify RC and LC Oscillators for a given problem definition</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to design and verify Multivibrators using OPAMPS Timers and PLL for a given problem definition</td>
</tr>
<tr>
<td>CO4</td>
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<td>Ability to design and verify filters using OPAMS for the given problem definition</td>
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<tr>
<td>CO5</td>
<td>4</td>
<td>Ability to simulate and analyze various analog circuit building blocks required for realizing a continuous time system</td>
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CO-PO Articulation Matrix

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DIRECTOR

Centre for Academic Courses
Anna University, Chennai-600 025

59
OBJECTIVES:
- To give insight into the radiation phenomena.
- To give a thorough understanding of the radiation characteristics of different types of antennas.
- To create awareness about the different types of propagation of radio waves at different frequencies.

UNIT I  FUNDAMENTALS OF RADIATION
Antenna parameters - Gain, Directivity, Effective aperture, Radiation Resistance, Bandwidth, Beam width, Impedance analysis using S parameters and Impedance matching: BALUNS, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, half wave dipole and folded dipole, yagiUda array, Spiral antenna, log periodic antenna.

UNIT II  ANTENNA ARRAYS
Two element array, N-element linear array, Pattern multiplication, Broadside and end fire array, Array synthesis: Binomial array, Tschebyscheff array, planar array antennas.

UNIT III  APERTURE ANTENNAS
Huygens’ principle, radiation from rectangular aperture, design considerations, Babinet’s principle, Radiation from sectoral and pyramidal horns, design concepts, parabolic reflector antennas and feeding techniques, microstrip patch antenna.

UNIT IV  MODERN ANTENNAS
Phased array antennas, Smart antennas – switched beam and adaptive arrays, UWB antennas, RFID Antennas, Wearable antennas, Reconfigurable antennas, Dielectric resonator antennas, bandwidth enhancement techniques, gain enhancement techniques.

UNIT V  ANTENNA MEASURMENTS & WAVE PROPAGATION

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<tbody>
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<td>3</td>
<td>Ability to apply EM Concepts to determine antenna parameters</td>
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<tr>
<td>CO2</td>
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<td>Ability to design and analyze aperture antennas</td>
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</tbody>
</table>
**TEXT BOOKS:**

**REFERENCES:**

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**EC5502 DIGITAL COMMUNICATION**

**OBJECTIVES:**
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To demonstrate the concept of information and types of channels
- To understand the various source coding theorems and the fundamental limit of transmission over the channel.
- To understand the various baseband and bandpass processing techniques.
- To understand spread spectrum.

**UNIT I BASEBAND TECHNIQUES**

Overall picture and the relevance of digital communication techniques, Pulse Modulation-PAM, PPM and PDM, Line codes – RZ, NRZ, Manchester, Binary N-zero substitution codes- PSDs– ISI – Nyquist Criterion for distortion less transmission – Pulse shaping – Correlative coding- M-ary schemes – Eye pattern
UNIT II  ERROR CONTROL CODING TECHNIQUES  9
Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes – Convolutional
codes – Viterbi decoding

UNIT III  INFORMATION THEORY  9
Measure of information – Entropy – Source coding theorem – Discrete memoryless channels–
lossless, deterministic, noiseless, BEC, BSC – Mutual information – Channel capacity – Shannon-
Hartley law- Transform coding – LPC – Shannon-Fano coding, Huffman Coding, Run length coding,
LZW algorithm

UNIT IV  BANDPASS SIGNALING  9
Introduction to Band Pass Sampling theorem - Comparison of base band and band pass signaling,
Geometric representation of signals – ML detection - Correlator and matched filter detection-
generation and detection of BPSK, BFSK, QPSK- BER and Power spectral Density Comparison-
Structure of non-coherent receivers-generation and detection of BFSK, DPSK, MSK.

UNIT V  SYNCHRONISATION AND SPREAD SPECTRUM TECHNIQUES  9
Importance of Synchronizations – Carrier, frame and symbol/Chip synchronization techniques,
Spread Spectrum - PN Sequences, Direct Sequence and Frequency Hopping Spread Spectrum
Systems, BER Analysis, Processing gain and Jamming Margin, Link Budget

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<th>CO No.</th>
<th>Blooms Level</th>
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<tr>
<td>CO1</td>
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<td>Ability to analyze baseband signaling schemes and their special characteristics</td>
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<tr>
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<td>Ability to apply error control coding schemes and analyze its performance</td>
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<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to encode and decode source symbols and determine the channel capacity</td>
</tr>
<tr>
<td>CO4</td>
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<td>Ability to analyze pass band signaling schemes and its spectral and BER characteristics</td>
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<tr>
<td>CO5</td>
<td>2</td>
<td>Ability to describe the principles of synchronization and spread special techniques</td>
</tr>
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TEXT BOOKS:

REFERENCES:
EC5551 MICROPROCESSORS AND MICROCONTROLLERS  LTPC 3 0 0 3

OBJECTIVES:
- To study the architecture of 8085, 8086, 8051 and ARM.
- To study the addressing modes and instruction set of 8085, 8086, 8051 and ARM.
- To explore the need and use of Peripherals and Interfacing.
- To develop skills to explore system design technique.

UNIT I 8-BIT and 16-BIT MICROPROCESSOR.
8085 Architecture, Instruction set, Addressing modes, Interrupts, Timing diagrams, Memory and I/O interfacing. 8086 Architecture, Instruction set and programming, Minimum and Maximum mode configurations.

UNIT II PERIPHERALS AND INTERFACING
Programmable Peripheral Interface (8255), Keyboard display controller (8279), ADC0808 and DAC0808 Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

UNIT III MICROCONTROLLER
8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, Interrupts and serial communication.

UNIT IV MICROCONTROLLER BASED SYSTEM DESIGN
Interfacing to: matrix display, (16x2) LCD, high power devices, optical motorshaft encoder, Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol.

UNIT V 32-BIT ARM PROCESSOR
RISC Vs CISC Architecture, ARM Processor Architecture, ARM Core data flow model, Barrel Shifter, ARM processor modes and families, pipelining, ARM instruction Set and its Programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

<table>
<thead>
<tr>
<th>CO No.</th>
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<tr>
<td>CO1</td>
<td>3</td>
<td>Ability to analyze and develop the assembly language program for microprocessor 8085 and 8086</td>
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<tr>
<td>CO2</td>
<td>4</td>
<td>Ability to interface peripherals with Microprocessors and Microcontrollers</td>
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<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to analyze and develop the assembly language program for microprocessor 8051</td>
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<tr>
<td>CO4</td>
<td>5</td>
<td>Ability to design and create microcontroller based system</td>
</tr>
</tbody>
</table>
Ability to analyze architecture and develop assembly language program for ARM 32 bit processor

TEXT BOOKS:

REFERENCES:

CO-PO Articulation Matrix

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EC5503 CONTROL SYSTEMS ENGINEERING L T P C 3 0 0 3

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

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION
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
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems
UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation
UNIT IV CONCEPTS OF STABILITY ANALYSIS 9
UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.
TOTAL:45 PERIODS
COURSE OUTCOMES:

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<td>Ability to comprehend the systems components and their representation using various control system</td>
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<td>Ability to compute the steady state response using various time domain parameters for various system</td>
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<td>Ability to analyze the frequency response characteristics for both open loop and closed loop system</td>
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<td>CO4</td>
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<td>Ability to analyze the stability of various system using Routh Hurwitz Root locus techniques</td>
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<td>CO5</td>
<td>5</td>
<td>Ability to illustrate the state space model of various control system</td>
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TEXT BOOK:

REFERENCES:
OBJECTIVES:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

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

COURSE OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling.

CO2: Have same basic knowledge on international aspect of management.

CO3: Ability to understand management concept of organizing.

CO4: Ability to understand management concept of directing.

CO5: Ability to understand management concept of controlling.

TEXT BOOKS:

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EC5561 MICROPROCESSOR AND MICROCONTROLLER INTERFACING

LABORATORY

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study introduce the programming language of 8085, 8086 and 805.
- To develop skill in program writing for microprocessors and controllers.
- To introduce microprocessor and microcontroller based system design.
- To impart knowledge on embedded S/W development.

Experiments:
Assembly Language Programming of 8085 and 8086.
1. Programs for 8 / 16 bit Arithmetic, Sorting, Searching and String operations,
2. Programs for Digital clock, Interfacing ADC and DAC
3. Interfacing and programming 8279, 8259, and 8253.
4. Serial Communication between two microprocessors kits using 8251.
5. Interfacing Stepper Motor, Speed control of DC Motor
6. Parallel communication between two microprocessors kits using Mode 1 and Mode 2 of 8255.
7. Macro assembler Programming for 8086.

8051 based experiments using assembly language and C programming:
8. Programming using Arithmetic, Logical and Bit Manipulation instructions of the 8051 microcontroller.
10. Interfacing – DAC and ADC and 8051 based temperature measurement
11. Interfacing – LED and LCD
12. Interfacing – Stepper motor and traffic light control system
13. Communication between 8051 Microcontroller kit and PC.
14. Programming ARM processor using Embedded C.

TOTAL: 60 PERIODS
COURSE OUTCOMES:

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<td>Ability to develop assembly Language program for 8085 and 8086 Microprocessors</td>
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<td>Ability to develop assembly Language program for 8051 Microcontroller</td>
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<td>Ability to interface peripherals, sensors and actuators in embedded systems</td>
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<td>Ability to analyze and develop the assembly Language program for ARM processor</td>
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<tr>
<td>CO5</td>
<td>6</td>
<td>Ability to design develop and trouble shoot Microcontroller based systems</td>
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CO-PO Articulation Matrix

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EC5511 ANALOG AND DIGITAL COMMUNICATION LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues
- It is intended to demonstrate the architecture of analog and digital communication link components to the students
- Students must understand the role of each module present in the communication links
- They have to study by evaluating the comparing the performance of each techniques used in various modules.

Simulation using MATLAB/SIMULINK/ SDR equivalent
1. AM / FM Modulator and Demodulator
2. Time Division Multiplexing
3. Signal Sampling and reconstruction
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes
7. FSK, PSK and DPSK schemes (Simulation)
8. Error control coding schemes (Simulation)
9. Symbol Timing Synchronization
10. Spread spectrum communication (Simulation)
11. Communication link simulation

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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<tbody>
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<td>Ability to apply &amp; analyze Analog &amp; Pulse modulation schemes</td>
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EC5651 DIGITAL VLSI L T P C 3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn the fundamentals of VLSI design
- To understand the IC Manufacturing Process
- To familiarize with VLSI combinational logic circuits design
- To familiarize with VLSI sequential logic circuits design
- To learn the various arithmetic circuits and testing methodologies
- To familiarize with the different FPGA architectures

UNIT I MOS TRANSISTOR PRINCIPLES
MOS Technology and VLSI, Pass transistors, NMOS, CMOS Fabrication process and Electrical properties of CMOS circuits and Device modelling. Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Stick diagram, Layout diagrams, Elmore’s constant, Logical Effort. Case study: Study of technology development in MOS.

UNIT II COMBINATIONAL LOGIC CIRCUITS
Static CMOS logic Design, Design techniques to improve the speed, power dissipation of CMOS logic, low power circuit techniques, Ratioed logic. Pass transistor Logic, Transmission CPL, DCVSL, Dynamic CMOS logic, Domino logic, Dual Rail logic, NP CMOS logic and NORA logic

UNIT III SEQUENTIAL LOGIC CIRCUITS
Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Memory Architectures, and Memory control circuits.

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS & TESTING
Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Need for testing- Manufacturing test principles- Design for testability. Case study: Analysis of area, power and delay for 16 bit adder and 8 bit multiplier.
UNIT V  IMPLEMENTATION STRATEGIES

Full Custom and Semicustom Design, Standard Cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures. Demo: Complete ASIC flow using Backend tool and fabrication flow Overall case study: Development of IC in commercial aspects (design, testing and fab cost)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<tr>
<th>CO No.</th>
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<td>Ability to analyze MOS devices and inverter</td>
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<td>Ability to design and analyze combinational logic</td>
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<td>Ability to design and analyze Sequential logic</td>
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<td>Ability to design and analyze data path cells</td>
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<tr>
<td>CO5</td>
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<td>Ability to design digital logic using FPGA</td>
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TEXT BOOK:

REFERENCES

EC5601  WIRELESS COMMUNICATION  L T P C

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

UNIT II  CELLULAR ARCHITECTURE
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
Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, QAM Principle, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<td>Ability to characterize the wireless channel &amp; evolve system design specifications</td>
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<tr>
<td>CO2</td>
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<td>Ability to design cellular systems based on resource availability &amp; traffic demands</td>
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<tr>
<td>CO3</td>
<td>3</td>
<td>Ability to design &amp; analyses suitable signaling schemes for fading channels</td>
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<tr>
<td>CO4</td>
<td>4</td>
<td>Ability to evaluate multipath mitigation technique for wireless channel &amp; system under consideration</td>
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<tr>
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<td>Ability to apply &amp; evaluate the multiple antenna concepts for capacity &amp; performance gains</td>
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**EC5602 COMMUNICATION NETWORKS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To introduce the layered communication architectures.
- To understand various physical, data link and routing layer protocols.
- To understand application layer protocols and security issues.
- To understand various digital switching techniques.

**UNIT I NETWORK FUNDAMENTALS AND PHYSICAL LAYER**


**UNIT II DATA LINK LAYER AND NETWORK INTERCONNECTION**

Logical link control Functions: - Framming, Flow control, Error control: CRC, LLC protocols:-HDLC,P to P. Medium access layer: - Random access, Controlled access, Channelization, IEEE standards: - 802.3, 802.4 and 802.5. Internetworking, Interconnection issues, Interconnection devices: - Repeaters, Hubs, Routers/switches and Gateways.

**UNIT III MESSAGE ROUTING TECHNOLOGIES**

Circuit switching, packet switching, message switching. Internet protocols; IPV4, IPV6, ARP, RARP, ICMP, IGMP, VPN. Network Routing Algorithms:- Distance vector routing, OSPF, Dijkstra’s, Bellaman Ford, Congestion control algorithms.

72
UNIT IV  END-END PROTOCOLS AND SECURITY

UNIT V  DIGITAL SWITCHING
Switching functions, Space Division Switch, Time Division Switch, STS switching, TST switching, No 4 ESS Toll switch, digital cross connect systems, Recent advances in Switching Approaches, Introduction to Software Defined Networking.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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<td>Ability to illustrate the performance of data link layer</td>
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<td>Ability to analyze different routing protocols and algorithms</td>
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<td>Ability to discuss transport layer and application layer protocols</td>
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<td>Ability to summarize different types of switching techniques</td>
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EC5611  VLSI LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn the Hardware Description 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 hardware/software based embedded system.

Digital and Analog Experiments

I Digital Experiments - FPGA BASED EXPERIMENTS:

1. Design and simulation of Full adder and full substractor
2. Design and simulation of multiplexer, Decoder and 4 bit comparator
3. Design and simulation of 8 bit adder
4. HDL based design entry and simulation of Ripple counter, synchronous counter and BCD counter
5. Design and simulation of simple state machines
6. 4 bit multiplier design and simulation using HDL
7. Synthesis, P&R and post P&R simulation of the components simulated in (1-6) above. Critical paths and static timing analysis results to be identified. Identify and verify possible conditions under which the blocks will fail to work correctly.
8. Hardware fusing and testing of each of the blocks simulated in (1-6). Use of either chipscope feature (Xilinx) or the signal tap feature (Altera) is a must. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

II Analog / IC Design Experiments
(Based on Cadence/Any other equivalent SPICE Circuit Simulator and FPAA based experiments)

9. Design and simulation of a simple five transistor differential amplifier – Measure gain, ICMR and CMRR
10. Layout generation, parasitic extraction and resimulation of the five transistor differential amplifier
11. Synthesis and standard cell based design of circuits simulated in 9 above. Identification of critical paths, power consumption
12. For experiment 11 above, P & R, Power and clock routing and post P & R simulation
13. Analysis of results of static timing analysis

FPAA Based Experiments:

14. Design, Simulate and implement an inverting gain amplifier, low pass, high pass filters and full wave rectifier. Analyze the frequency response of filters
15. Design and Implement a circuit which introduces noise tone to the audio and then bring the original audio by removing the noise tone

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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<td>CO1</td>
<td>3</td>
<td>Ability to design combinational logic using various logic styles, satisfying different requirements</td>
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<td>Ability to design sequential logic using various logic styles satisfying static &amp; dynamic requirements</td>
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<td>Ability to analyze timing issues of sequential logic and Design Memories</td>
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<td>Ability to design data path elements</td>
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EC5612 WIRELESS COMMUNICATION AND NETWORKING LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To understand various protocols of physical, MAC and routing layers.
- To understand and implement various modulation techniques.
- To understand the security issues in the wireless and network and implement the security algorithms.

1. Characterization of Wireless Channels (Simulation/Experiment)
2. Equalization Techniques for Wireless Channels
3. Simulation / Implementation of Multicarrier Modulation
4. Simulation / Implementation of Space Time Block Codes
5. Performance Studies of Adaptive Modulation and Coding
6. Performance Studies of Random MAC Protocols
7. Performance Studies of LLC Protocols
8. Wireless Routing Protocols
9. IOS development of applications using prototype router boards, switches.
11. Network Security Protocols
12. QoS Analysis on Wireless Networks

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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<td>Ability to characterize the wireless channels &amp; analyze the various modulation techniques</td>
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<td>Ability to analyze the diversity &amp; Equalization techniques in the fording environment</td>
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<td>CO3</td>
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<td>Ability to develop and analyze wireless network securing protocol</td>
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<td>CO4</td>
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<td>Ability to develop and simulate wireless network protocol LLC, MAC &amp; Routing protocols</td>
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<td>CO5</td>
<td>3</td>
<td>Ability to develop &amp; perform the wireless packet &amp; QOS analysis</td>
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OBJECTIVES:
• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• To teach the principle of millimeter waves and millimeter transceivers
• To equip the student with concepts of light propagation through optical fibers and signal distortion
• To introduce the knowledge of optical transmitters and receivers for fiber and free space links

UNIT I  MILLIMETER WAVES  9
Millimeter wave characteristics- Channel performance at 60 GHz – Gigabit wireless communication – Development of millimeter wave standards-coexistence with wireless backhaul – review of modulation for millimeter wave – OOK, PSK, FSK and QAM.

UNIT II  TRANSEIVERS FOR MILLIMETER WAVES  9

UNIT III  OPTICAL FIBERS CHARACTERISTICS  9
Relevance of optical communication in backhaul/backbone networks and interconnects, fiber optics, optical fiber structure and parameters, ray and mode theory of light propagation in optical fibers, Optical signal attenuation- Optical signal distortion – Dispersion - fiber types, Standard Singlemode and multimode Fibers, Principles of fiber nonlinearities.

UNIT IV  OPTICAL TRANSMITTERS AND RECEIVERS  9
Materials for optical sources, light-emitting diodes, semiconductor laser diodes, power-current characteristics, noise, direct and external modulation, Laser sources and transmitters for free space communication – Receivers - Principles of optical detection, spectral responsivity, PIN, APD, preamplifier types, receiver noises.

UNIT V  FREE SPACE OPTICS  9

TOTAL : 45 PERIODS
COURSE OUTCOMES:

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<td>Ability to understand fundamentals &amp; millimeter wave communication</td>
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<td>Ability to design millimeter wave communication systems</td>
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<td>Ability to understand and apply fiber transmission characteristics</td>
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<td>Ability to understand and analyze optical transmitters and receivers</td>
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<tr>
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<td>Ability to understand &amp; apply free space optical systems</td>
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TEXT BOOKS:

REFERENCES:

CO-PO Articulation Matrix

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EC5711 HIGH FREQUENCY COMMUNICATION LABORATORY

OBJECTIVES:
- To enable the student to verify the basic principles and design aspects involved in high frequency bandpass communication system components design and the performance parameters for the components and the overall system.
- To enable the student to gain insight into the practical aspects of radiation phenomena and thoroughly understand the radiation characteristics of different types of antennas. To enable the student to appreciate the practical aspects of bandpass system design.
- Understand the associated link power and risetime budgeting challenges and enable them to design and conduct experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.
2. DC Characteristics of LEDs and PIN Photodiodes – Determination of external power Efficiency and dark current of detector Responsivity
3. P-I of LED Characteristics of Laser Diode Sources – Threshold Current Determination and Study of Temperature Effects
4. Gain Characteristics of APDs – Determination of Threshold Voltage and Average gain estimation
5. Analog Transmission Characteristics of a Fiber Optic Link – Determination of Operating Range of LED and System Bandwidth for Glass and Plastic fiber links and determination of device capacity of photo detection
6. Determination of Capacity of a Digital Fiber Optic Link – Maximum Bit Rate estimation for Glass and Plastic fiber links
7. Spectral Characterisation of Optical Sources – Determination of Peak Emission Wavelength and Spectral Width
8. Study of WDM Link Components – WDM Mux / Demux, Isolator, Circulator, Fiber Bragg Grating, EDFA.
9. Gain and Radiation Pattern Measurement of an Antenna - Horn Antenna, Dipole Antenna, Array Antenna,
10. Log-Periodic Antenna, Loop Antenna
11. Determination of Mode Characteristics of a Reflex Klystron Oscillator
12. VSWR and Impedance Measurement and Impedance Matching
13. Dielectric Constant Measurement
14. Characterisation of Directional Couplers and Multiport junctions
15. Gunn Diode Characteristics
16. Microwave IC – Filter Characteristics

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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<td>Ability to characterize the fiber optic sources and detectors</td>
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<td>Ability to design and analyze transmission of analog and digital signals through fiber optic links</td>
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<td>Ability to analyze the characteristics of different types of fibers</td>
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<td>Ability to characterize the microwave sources and detectors</td>
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<td>Ability to characterize the microwave components and antenna parameters.</td>
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CO-PO Articulation Matrix
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues
- To equip the students with knowledge of 4G networks and its applications
- To teach the students about various MAC and Routing protocols of Ad hoc and WSN.
- To educate the students on introduction and application of 6 low pan.

UNIT I INTRODUCTION AND APPLICATIONS

UNIT II ROUTING PROTOCOLS

UNIT III OVERVIEW OF WIRELESS SENSOR NETWORKS

UNIT IV NETWORKING OF SENSORS

UNIT V INTRODUCTION AND APPLICATION OF LOWPAN

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: The student would have gained the knowledge on ad hoc and sensor networks

CO3: The student would have the ability to design new MAC and Routing protocols for Ad hoc and sensor network.

CO4: The students have attained the capability to learn new operating systems used for WSN.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

EC5002 ADVANCED WIRELESS COMMUNICATION

OBJECTIVES:
• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• To teach the importance of improving capacity of wireless channel using MIMO
• To teach the characteristic of wireless channel
• To teach techniques for channel improvements 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 INTRODUCTION
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, Alamouti 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 TC 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.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: The student has gained the knowledge about the importance of MIMO in today's communication

CO3: The student had understood and appreciate the various methods for improving the data rate of wireless communication system.

**TEXT BOOKS:**


**REFERENCES:**


**EC5003 COGNITIVE RADIO NETWORKS**

**OBJECTIVES:**

- The students should be made to understand the concepts of cognitive radio
- Learn spectrum sensing and dynamic spectrum access

**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**

UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9

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

UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: The students will be able to understand and compare different SDR architectures.
CO3: The students will be able to identify the role of SDR and Cognitive radio communication in XG networks.

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OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To teach different types of entropy
- To teach entropy in the context of data compression
- To teach channel capacities over different channels

UNIT I QUANTITATIVE STUDY OF INFORMATION 8

UNIT II CAPACITY OF NOISELESS CHANNEL 8
Fundamental theorem for a noiseless channel, Data compression, Kraft inequality, Shannon-Fano codes, Huffman codes, Asymptotic equipartition, Rate distortion theory.

UNIT III CHANNEL CAPACITY 9
Properties of channel capacity, Jointly typical sequences, Channel Coding Theorem, converse to channel coding theorem, Joint source channel coding theorem.

UNIT IV DIFFERENTIAL ENTROPY AND GAUSSIAN CHANNEL 9
AEP for continuous random variables, relationship between continuous and discrete entropy, properties of differential entropy, Gaussian channel definitions, converse to coding theorem for Gaussian channel, channels with colored noise, Gaussian channels with feedback.

UNIT V NETWORK INFORMATION THEORY 11
Gaussian multiple user channels, Multiple access channel, Encoding of correlated sources, Broadcast channel, Relay channel, Source coding and rate distortion with side information, General multi-terminal networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: This course helps to understand insight of source coding
CO3: Students will understand the limitations of the channel
CO4: It helps to understand the data rate that can be offered by the channel in the presence of AWGN

TEXT BOOK:

REFERENCE:
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- 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, Metropoliton - Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT III  WAVELENGTH ROUTING NETWORKS

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

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS


UNIT V  NETWORK DESIGN AND MANAGEMENT

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: At the end of the course, the student will be able to use the backbone infrastructure for our present and future communication needs.
CO3: Discuss the architectures and the protocol stack in use.
CO4: Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods,
CO5: Network management and protection methods in vogue.
CO6: Describe the advances and recent trends in the networking and switching approaches.
EC5006 RF MICROELECTRONICS L T P C 3 0 0 3

OBJECTIVES:
- To introduce radio transceiver architectures
- To understand the design issues in CMOS LNAs, Mixers, Oscillators, PLLs, Synthesizers and Power Amplifiers.

UNIT I TRANSCEIVER ARCHITECTURES 9
Heterodyne and Homodyne architectures, Discrete and CMOS realization passive components for RF, Impedance Matching, Distortion, IIP3 and Blocking Effects, Noise Figure, Noise matching conditions. Friis Formula for cascaded blocks.

UNIT II CMOS LNAs AND MIXERS 9
Noise Figure of and impedance matching issues CS, CG and differential LNAs, Passive mixers and conversion loss, Active mixers, Gilbert cells, linearity and Noise Figure of mixers.

UNIT III OSCILLATORS 9
Negative transconductance, nonlinearity and Differential LC tuned oscillators, Ring oscillators and Colpitts oscillator, Quadrature oscillators–Phase noise.

UNIT IV PLLS AND SYNTHESIZERS 9
Phase Detectors, charge pumps and their transfer functions, Synthesizers based on first, second and third order PLLs and stability issues, Introduction to integer and fractional N synthesizers.

UNIT V POWER AMPLIFIERS 9
Class A, B, C, D, E, F and AB power amplifiers, Linearization and impedance matching issues of power amplifiers.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
The student who undergoes this course will be able to
CO1: Translate the top level wireless communications system specifications into block level specifications of the RF transciever.
CO2: Carry out transistor level design of the entire RF transciever.
CO3: Design and analyze CMOS Inas, mixers, oscillators, pll, synthesizers and power amplifiers.

TEXT BOOKS:
REFERENCES:
2. Recorded lectures and notes available at http://www.ee.iitm.ac.in/~ani/ee6240/

EC5007 SATELLITE COMMUNICATION

OBJECTIVES:

• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• To enable the student to understand the necessity for satellite based communication, the essential elements involved and the transmission methodologies.
• To enable the student to understand the different interferences and attenuation mechanisms affecting the satellite link design
• To expose the student to the advances in satellite based navigation, GPS and the different application scenarios.

UNIT I SATELLITE ORBITS AND TRAJECTORIES
Orbital Mechanics—Orbit Equations, Kepler’s Laws, Orbital Period, Orbits and their types, look angle calculation; Satellite Launch.

UNIT II SATELLITE SUBSYSTEM
Satellite Subsystems—AOCS, TTC&M, Power, Transponders, Antennas; earth control-Effects of earth-Perturbation, suntransit, moontransit, satellite power design, MTBF. Basic Equations; System Noise and G/T ratio; Uplink, Downlink and Design for a specified C/N ratio, with GEO and LEO examples; Atmospheric and Rain effects on link performance.

UNIT III LINK DESIGN, MODULATION AND ERROR CONTROL
Single link design-double link design aspects, PAM, baseband processing, Digital Modulation for satellite links- BPSK,QPSK and QAM; TDM standards for satellite systems; Error control requirements for satellite link—ARQ, Concatenated Codes, Interleaving, Turbo codes.

UNIT IV MULTIPLE ACCESS FOR SATELLITE COMMUNICATIONS
FDM-FM-FDMA - TDMA-structure and system design; Onboard Processing systems; DAMA and PAMA; CDMA-system design and capacity.

UNIT V SOME APPLICATIONS
Remote sensing, navigation, scientific and military application, VSAT—Network Architecture, Access Control protocols and techniques, VSAT Earth stations; Satellite Mobile Telephony— Global star, DBS/DTH Television, GPS, Weather satellites.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: The student would be able to demonstrate an understanding of the basic principles of satellite orbits, placement and control, satellite link design and the communication system components.
CO3: The student would be able to demonstrate an understanding of the different communication, sensing and navigational applications of satellite and their implementation.

TEXT BOOKS:

REFERENCES:

EC5008 WIRELESS COMMUNICATION NETWORKS LT P C 3 0 0 3

COURSE OBJECTIVES
- To understand the shortcomings of 4G technology and exploring the architecture of 5G
- To understand the 5G Modulation Schemes and different types of multiple access techniques
- To explore power optimization algorithms for user end data transmission
- To understand and analyse the concept of MIMO and other research areas in 5G

UNIT I EVOLUTION OF 4G AND 5G NETWORKS 9

UNIT II 5G MODULATION SCHEMES 9
Introduction to Equalization- types - Filter-bank based multi-carrier (FBMC), Universal filtered multi carrier (UFMC), Generalized frequency division multicarrier (GFDM) - Principles, Transceiver Block diagram, Frame structure, Resource structure, allocation, mapping, MIMO-GFDM

UNIT III MULTIPLE ACCESS TECHNIQUES IN 5G 9

UNIT IV POWER OPTIMIZATION ALGORITHMS 9

UNIT V MIMO AND OTHER 5G RESEARCH TOPICS 9
Introduction, MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Basic forms of massive MIMO implementation, Hybrid beamforming.
for interference clustering and user grouping, Channel models, Machine type communications, D2D communications and Coordinated Multipoint Transmissions.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

CO1: Ability to comprehend the 4G technology and appreciate the significance of 5G technology and its architecture.

CO2: The student would be capable of characterizing the different 5G potential Candidate Waveforms.

CO3: The student would be capable of understanding the different 5G multiple access Schemes.

CO4: The student would be able to identify suitable signaling and power allocation and optimization techniques for the wireless systems.

CO5: The student would be capable of exploiting multiple antenna techniques for capacity/performance gains and explore other research areas in 5G.

**TEXTBOOKS**


**REFERENCES:**


**EC5072 CRYPTOGRAPHY AND NETWORK SECURITY**

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**OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To teach the importance of security for networks
- To teach the basics of number theory and Galois field concepts
- To teach symmetric and asymmetric key in crypto systems
- To teach authentication and key management techniques
- To teach security specific to network layer

**UNIT I NUMBER THEORETIC AND ALGEBRAIC ALGORITHMS**

Significance of network and data security in today's communication scenario – Overall Classification - Integer Arithmetic Modular Arithmetic – matrices – Linear congruence- Substitution ciphers – Transposition ciphers – Stream cipher- Block ciphers – Algebraic structures – GF(2^n) fields.

**UNIT II MODERN SYMMETRIC KEY CIPHERS**

Modern block ciphers – Modern stream ciphers – DES – AES – uses of modern block ciphers and stream cipher, Application Examples

**UNIT III ASYMMETRIC KEY ENCIIPHERMENT**

UNIT IV INTEGRITY AUTHENTICATION AND KEY MANAGEMENT


UNIT V NETWORK SECURITY


TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: The student have gained the knowledge about the importance of security for networks, use of number theory and Galois field concepts.

CO3: The student would have ability to design new symmetric and Asymmetric key crypto system

CO4: The student would have ability to develop new authentication and key management techniques

CO5: The student would have ability to develop a new network security protocols

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce different types of signaling in digital telephony
- To introduce various transmission schemes for telephony and broadband
- To introduce modeling and analysis techniques for data transmission

UNIT I INTRODUCTION
Overview of existing Voice, Data and Multimedia Networks and Services; Review of Basic Communication principles; Synchronous and Asynchronous transmission, Line Codes

UNIT II TRUNK TRANSMISSION
Multiplexing & Framing - types and standards; Trunk signaling; Optical Transmission-line codes and Muxing: SONET/SDH; ATM; Microwave and Satellite Systems.

UNIT III LOCAL LOOP TRANSMISSION
The Analog Local Loop; ISDN local loop; DSL and ADSL; Wireless Local Loop; Fiber in the loop; Mobile and Satellite Phone local loop.

UNIT IV SWITCHING
Evolution; Space switching, Time switching and Combination Switching; Blocking and Delay characteristics; Message, Packet and ATM switching; Advances in switching techniques – shared memory fast packet switches, shared medium fast packet switches and space division fast packet switches, Photonic switching - Optical TDM, WDM.

UNIT V TELETRAFFIC ENGINEERING
Telecom Network Modeling; Arrival Process; Network Blocking performance; Delay Networks-Queuing system analysis and delay performance.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Ability to understand the different type of signaling, transmission schemes and switching techniques used in digital telephony.
CO3: Ability to model and analyze the different techniques for data transmission.

TEXT BOOKS:

REFERENCES:
EC5073           ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY       L T P C  
                                                     3 0 0 3  

OBJECTIVES:  
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues  
- To tutor the basics of EMI, EMC  
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques  
- To impart comprehensive insight about the current EMC standards and about various measurement techniques  

UNIT I          BASIC CONCEPTS  
Definition of EMI and EMC; Intra and Inter system EMI; Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility; Transient & ESD; Case Histories; Radiation Hazards to humans.  

UNIT II         COUPLING MECHANISM  
Common made coupling; Differential mode coupling; Common impedance coupling; Ground loop coupling; Field to cable coupling; Cable to cable coupling; Power mains and Power supply coupling.  

UNIT III        EMI MITIGATION TECHNIQUES  
Shielding – principle, choice of materials for H, E and free space fields, and thickness; EMI gaskets; Bonding; Grounding – circuits, system and cable grounding; Filtering; Transient EMI control devices and applications; PCB Zoning. Component selection, mounting, trace routing.  

UNIT IV         STANDARDS AND REGULATION  
Units of EMI; National and International EMI Standardizing Organizations – IEC, ANSI, FCC, CISPR, BIS, CENELEC; FCC standards; EN Emission and Susceptibility standards and specifications; MIL461E Standards.  

UNIT V          TEST METHODS AND INSTRUMENTATION  
EMI test sites - Open area site; TEM cell; Shielded chamber; Shielded Anechoic chamber; EMI test receivers; Spectrum Analyzer; Transient EMI Test wave Simulators; EMI coupling Networks - Line impedance Stabilization Networks; Feed through capacitors; Antennas and factors; Current probes and calibration factor; MIL-STD test methods; Civilian STD Test methods, Government policies.  

TOTAL: 45 PERIODS  

COURSE OUTCOMES:  
Ability to comprehend and appreciate the significance and role of this course in the present contemporary world. Upon Completion of the course, the students will be able to:  
CO1: To design a EMI free system.  
CO2: To reduce system level crosstalk.
CO3: To design high speed Printed Circuit board with minimum interference.
CO4: To make our world free from unwanted electromagnetic environment.

TEXT BOOKS:

REFERENCES:

EC5010 OPTOELECTRONICS L T P C 3 0 0 3

OBJECTIVES:
- To review basic semiconductor theory
- To introduce the concepts of LED
- To teach the principle of stimulated emission and devices based on it
- To equip the student with the knowledge of Photovoltaics and display devices
- To introduce the knowledge of optoelectronic modulators

UNIT I SEMICONDUCTOR THEORY
Basic quantum mechanics, semiconductor statistics, carrier transport, optical processes, and junction theory, Properties of simple and compound semiconductors, Optical absorption, Optical recombination, Recombination and carrier lifetime.

UNIT II LIGHT EMITTING DIODES

UNIT III STIMULATED EMISSION DEVICES
UNIT IV  PHOTOVOLTAICS AND DISPLAY DEVICES  9
Photovoltaic Device Principles. pn Junction Photovoltaic I-V Characteristics. Solar Cells Materials, Devices and Efficiencies. Liquid crystal displays, Reflective and Trans reflective types, TFT displays, Plasma displays, LED TV

UNIT V  POLARIZATION AND MODULATION OF LIGHT  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completing this course, the students will be able to
CO1: Understand various kinds of semiconductor materials used in optoelectronics
CO2: Understand the mechanisms of light absorption and emission in p-n junctions
CO3: Use photodiodes, LEDs, and laser diodes for various applications.

TEXT BOOKS:

REFERENCES:

EC5011  ADVANCED DIGITAL SIGNAL PROCESSING  L T P C  3 0 0 3

OBJECTIVES:
• To bring out the concepts related to stationary and non-stationary random signals
• To emphasize the importance of true estimation of power spectral density
• To introduce the design of linear and adaptive systems for filtering and linear prediction
• To introduce signal processing concepts in the systems having more than one sampling frequency

UNIT I  DISCRETE-TIME RANDOM SIGNALS  9
Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral

UNIT II  SPECTRUM ESTIMATION  9
Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion.

UNIT III  LINEAR ESTIMATION AND PREDICTION  9
Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters.

UNIT IV  ADAPTIVE FILTERS  9

UNIT V  MULTIRATE SIGNAL PROCESSING  9
Introduction to Multirate signal processing- Decimation-Interpolation-Polyphase Decomposition of FIR filter-Multistage implementation of sampling rate conversion - Applications of Multirate signal processing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To analyze statistical characteristics of random signals
CO2: To identify appropriate spectrum estimation method based on type of random signal
CO3: To design optimum filters for processing random signal
CO4: To design filters for quasi stationary signals
CO5: To analyze and design systems with varying sample rate

TEXT BOOKS:

REFERENCES:

EC5012  VLSI SIGNAL PROCESSING  L T P C
  3 0 0 3

OBJECTIVES:
• To design DSP architectures that are suitable for VLSI implementation for a given algorithm
• To learn high-level algorithms that reduce the number of multipliers, area of implementation and power consumption.
• To address issues related to high performance VLSI architectures such as pipelining styles.

UNIT I  PIPELINING AND PARALLEL PROCESSING  9
Introduction to DSP Systems, Typical DSP algorithms, Data flow graph representations, Loop bound and Iteration bound, Longest Path Matrix algorithm; Pipelining and Parallel processing of FIR digital filters, Pipelining and Parallel processing for low power.

UNIT II  RETIMING AND ALGORITHMIC STRENGTH REDUCTION  9
Retiming - definitions and properties; Unfolding – an algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, Odd-Even Merge-Sort architecture, Parallel Rank-Order filters.

UNIT III  FAST CONVOLUTION AND COMBINED PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS  9

UNIT IV  BIT-LEVEL ARITHMETIC ARCHITECTURES  9
Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh-Wooley carry-save multiplication tabular form and implementation, Bit-serial FIR filter, CSD representation, CSD multiplication using Horner’s rule for precision improvement, Distributed Arithmetic

UNIT V  NUMERICAL STRENGTH REDUCTION AND WAVE PIPELINING  9
Numerical Strength Reduction – subexpression elimination, Multiple Constant Multiplications, Synchronous pipelining and Clocking styles, Clock skew in edge-triggered single-phase clocking, Wave pipelining.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to determine the parameters influencing the efficiency of DSP architectures and apply pipelining and parallel processing techniques to alter FIR structures for efficiency.
CO2: Ability to analyze and modify the design equations leading to efficient DSP architectures.
CO3: Ability to speed up convolution process and develop fast and area efficient IIR structures.
CO4: Ability to develop fast and area efficient multiplier architectures.
CO5: Ability to reduce multiplications and build fast hardware for synchronous digital systems.

TEXT BOOK:
REFERENCES:

EC5080 SPEECH PROCESSING L T P C
3 0 0 3

OBJECTIVES:
• To introduce speech production and related parameters of speech
• To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech
• To understand different speech modeling procedures such as Markov and their implementation issues
• To introduce speech recognition and synthesis techniques

UNIT I BASIC CONCEPTS 10

UNIT II SPEECH ANALYSIS 10

UNIT III SPEECH MODELING 8

UNIT IV SPEECH RECOGNITION 8
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent subword units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9
Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: Ability to use speech related parameters
CO2: Ability to extract significant features from speech to reduce redundancy in speech by using several distortion measures
CO3: Ability to develop models for speech signals
CO4: Ability to develop speech recognition algorithms
CO5: Ability to develop artificial speech generation of human speech

TEXT BOOKS:

REFERENCES:

EC5076 MULTIMEDIA COMPRESSION AND NETWORKS L T P C 3 0 0 3

OBJECTIVES:
• To introduce probability related study of the characteristics of text, voice, image and video data
• To introduce various compression schemes for text, voice, image and video
• To analyse the compression schemes
• To introduce communication protocols for voice over internet and multimedia networking

UNIT I MULTIMEDIA COMPONENTS 9
Introduction- Multimedia skills- Multimedia components and their characteristics- Text, sound, images, graphics, animation, video, hardware.

UNIT II AUDIO AND VIDEO COMPRESSION 9
UNIT III  TEXT AND IMAGE COMPRESSION
Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding–source encoding -text compression–static Huffman coding
dynamic Huffman coding–arithmetic coding–Lempel Ziv-Welsh Compression-image compression

UNIT IV  VoIP TECHNOLOGY

UNIT V  MULTIMEDIA NETWORKING
Multimedia networking- Applications-streamed stored and audio-making – Best Effort service protocols for real time interactive Applications-distributing multimedia-beyond best effort service secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

COURSE OUTCOMES:
CO1: Ability to characterize the features of multimedia components
CO2: Ability to develop audio and video processing systems
CO3: Ability to develop compression algorithms for processing text and images
CO4: Ability to tackle network issues in the transmission of text, audio and video signals

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Marcus Goncalves —Voice over IP Networks, McGraw Hill,
OBJECTIVES:
- To study the formation of an image and its acquisition
- To introduce the use and application of transforms in image processing
- To study techniques for improving quality of information in spoilt images
- To introduce schemes for compressing images to save storage space

UNIT I DIGITAL IMAGE FUNDAMENTALS
Elements of digital image processing systems, Vidicon and Digital Camera working principles, - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT
Point processing, Histograms, Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION

UNIT IV IMAGE SEGMENTATION AND MORPHOLOGY
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation– Region growing – Region splitting and Merging, Morphological Operations – Dilation, Erosion, Opening , Closing- Segmentation by morphological watersheds – Hybrid methods

UNIT V IMAGE COMPRESSION
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To analyze the sampling and quantization effects in images
CO2: To utilize appropriate preprocessing techniques for manipulation of images
CO3: To apply restoration techniques to recover degraded images
CO4: To employ image processing algorithms for extraction of region of interest
CO5: To utilize various image compression techniques

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EC5014 CMOS ANALOG IC DESIGN L T P C

3 0 0 3

OBJECTIVES:
- To study the DC biasing conditions and small signal model of various MOS amplifier configurations
- To understand gm/Id design methodology of various MOS circuits
- To study the noise modeling and analysis procedure associated with various MOS circuits
- To study stability conditions and various compensation techniques in OPAMP and negative feedback amplifiers

UNIT I BASIC BUILDING BLOCKS 9
NMOS and PMOS device operation in saturation and sub-threshold regions, device transconductance, output impedance and equivalent circuit. Introduction to Device models for simulation. CG, CG, and source follower circuits. gm/Id design methodology.

UNIT II MULTIPLE TRANSISTOR STAGES 9
Cascode circuits. folded cascode circuits, , Differential amplifier circuits, quantitative analysis of differential pair, CMRR, Differential pair with MOS loads, Gilbert Cell, Current Mirrors.
UNIT III  FREQUENCY RESPONSE, NOISE  9
Frequency response of CS and CG stages. Miller effect and association of poles with nodes.
Characteristics of noise – thermal and flicker noise. Noise in CS, CG, Cascode and source
gain leader stages.

UNIT IV  OPERATIONAL AMPLIFIERS  9
Two stage op-amps, gain boosting, common mode feedback, input range limitation, slew rate,
power supply rejection, noise in op-amps.

UNIT V  FEEDBACK AND STABILITY  9
Properties of feedback circuits, topologies, effect of loading and noise in feedback circuits.
Stability in multipole systems, phase margin, frequency compensation in two stage op-amps,
other compensation techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students who complete this course would be in a position

CO1: To carry out design of the various building blocks used in CMOS analog ICs. These
include current mirror, cascades, common source amplifiers, differential amplifiers, two
stage OTAs, source followers.

CO2: To carry out the paper design based on hand calculations for the above important building
blocks. This is normally the first mandatory step in the complete design and fabrication of
CMOS Analog ICs, and enables the student to carry out circuit simulations and layout
design. In conjunction with other similar courses in this area.

CO3: To pursue design and/or research carriers in the broad field of electronics and
communication.

TEXT BOOKS:

REFERENCES:
2. NPTEL Course: http://nptel.ac.in/courses/117106030/#

EC5075  MIXED SIGNAL IC DESIGN  L T P C
3 0 0 3

OBJECTIVES:

- To introduce various functional modules of Mixed Signal ICs
- To introduce the design issues of analog and digital circuit interoperability
- To introduce power management modules of Mixed Signal ICs
UNIT I    REFERENCE CIRCUITS
Performance Metrics, Current Mirrors, Self Biased Current Reference, startup circuits, VBE based Current Reference, VT Based Current Reference, Band Gap Reference , Supply Independent Biasing, Temperature Independent Biasing, PTAT and CTAT Current Generation, Constant Gm Biasing

UNIT II    LOW DROP OUT REGULATORS

UNIT III    FREQUENCY SYNTHESIZERS
Integer-N Phase Lock Loop(PLL), Fractional-N Phase Lock Loop, Delay-Lock Loop (DLL), multiplying-DLL, Injection-locked PLLs, and Sub-sampled PLLs.

UNIT IV    ACTIVE FILTER DESIGN
Butterworth Filter approximations, Chebyshev Filter approximations, Frequency Transformations, Continuous time filters- Biquad and Ladder based designs, Active RC and Gm-C Filters, Switch Capacitor Filters, Integrator realization and nonidealities

UNIT V    CLOCK AND DATA RECOVERY CIRCUITS
Channel characteristics-intersymbol interference, eye diagrams, Linear equalization at the transmitter and receiver; CDR Architectures, Trans Impedance Amplifiers, Linear Half Rate CDR Circuits, Wide capture Range CDR Circuits.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
The student who undergoes this course will be able to
CO1: Design Band gap reference circuits and Low Drop Out regulator for a given specification.
CO2: Design Frequency synthesizers meeting a given specification.
CO3: Choose active filter topology and design for a given specification.
CO4: Design clock generation circuits in the context of high speed I/Os, High speed Broad Band Communication circuits and Data Conversion Circuits.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To design MOS circuits applied for various data conversion stages namely, sample and hold, comparators, switched capacitor amplifiers
- To study the various CMOS design considerations of ADC architectures used in practice including SAR, Pipeline, Flash ADCs
- To study the general design principles design sigma delta converters

UNIT I  INTRODUCTION  9
Quantization noise, anti aliasing filters, gain and offset errors, definitions of INL and DNL, SNR, SFDR, ENOB of ADC/DACs, finite duration pulse aperture effects, transistor matching, Bandgap reference design.

UNIT II  D/A CONVERTER DESIGN, SAMPLE AND HOLD CIRCUITS  9
Current Steering DACs, current cell design issues. Properties of MOS Switches, charge injection, bootstrapping, sampling jitter, thermal noise, Quantization noise and nonlinearity effects.

UNIT III  COMPARATOR DESIGN  9
Comparator architectures, metastability and yield, Clock feed through effects, switched capacitor amplifiers and offset cancellation.

UNIT IV  ADC/DAC ARCHITECTURES  9
SAR, Flash, Pipeline and time interleaved ADC topologies and their CMOS realizations issues. Error correction procedures for ADCs.

UNIT V  OVER SAMPLING CONVERTERS  9
Delta sigma modulators, alternative modulator architectures, quantization and noise shaping, decimation filtering, implementation of Delta sigma modulators, delta sigma DACs.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Students who complete this course would be in a position
CO1: To carry out the design of the various building blocks used in mixed signal (A/D and D/A converters) CMOS IC Design. These include sample and hold circuits, comparators and switched capacitor amplifiers, and simple designs of flash ADCs, pipeline ADCs, Current Steering DACs and sigma delta converters.
CO2: To carry out the paper design based on hand calculations for the above important functional blocks and enables the student to carry out circuit simulations and layout design.
CO3: To pursue design and/or research carriers in the broad field of electronics and communication.
TEXT BOOKS:

REFERENCES:
1. Franco Malobreti "Data Converters", Springer Verlag, 2007
2. VLSI Data Conversion Circuits EE658 recorded lectures available at http://www.ee.iitm.ac.in/~nagendra/ videolecture

EC5016 INTRODUCTION TO EMBEDDED CONTROLLERS

OBJECTIVES:
• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• To learn about the designing of an embedded system for commercial applications
• To learn the features, architecture and programming of PIC microcontrollers
• Interfacing Input/Output devices with the PIC microcontroller
• To learn about the communication protocols in a microcomputer system

UNIT I 8-BIT CONTROLLER
Microprocessors and microcontrollers, introducing PIC 16F877- architecture, memory technologies, timing circuits, power-up and reset, parallel ports, ADC, interrupt, serial peripheral buses (UART, I2C, SPI), PWM, counters and timers, instruction set and assembly language programming.

UNIT II 16-BIT CONTROLLER
DsPIC30F microcontroller- architecture, DSP engine, memory, parallel ports, system and power management, ADC, interrupt, PWM.

UNIT III PIC DEVELOPMENT TOOLS AND PROGRAMMING
Software development tools- editor, assembler, compiler, cross-compiler and simulator, Hardware development tools- development board, device programmer, in-circuit emulator and debuggers. Embedded C Programming, data types and variables, data type modifiers, storage Class modifiers, C statements, structures and operations, pointers, libraries, in-line assembly programming, optimizing and testing embedded C programs.

UNIT IV MULTITASKING AND THE REAL-TIME OPERATING SYSTEM
The challenge of multitasking and real time, multitasking with sequential programming, State machines, Real time operating system, RTOS services, synchronization and messaging tools, CCS PIC C Compiler RTOS. Design example: Voltmeter with RS232 serial output.
UNIT V  PERIPHERAL INTERFACING WITH PIC MICROCONTROLLER

Human and physical interfaces- switches to keyboard, LED display, liquid crystal display, actuators and sensors, PWM, serial communication protocols (UART, I2C, SPI), programming interrupt, timers and counter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to design and develop PIC microcontroller based systems.
CO2: Ability to comprehend and appreciate DSP in PIC microcontrollers.
CO3: Ability to analyze, demonstrate and apply proper development tools for PIC microcontrollers.
CO4: Ability to apply the concept of multitasking and RTOS in embedded system design.
CO5: Ability to implement various communication protocols and interfacing concepts in embedded system.

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OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the concept of microcontroller based system development.
- To introduce the concept of RISC and CISC microcontrollers.
- To study the architecture of PIC, R8C and MSP430 family microcontrollers

UNIT I  RISC PROCESSORS
RISC Vs CISC, RISC properties and evolution, Advanced RISC microcontrollers, PIC18xx microcontroller family, Architecture, Instruction set, ROM, RAM, Timer programming, Serial port programming, Interrupt programming, ADC and DAC interfacing, CCP module and programming.

UNIT II  CISC PROCESSORS
RL78 16 BIT Microcontroller architecture, addressing modes, on-Chip memory, ADC, interrupts, MAC unit, Barrel shifter, internal and external clock generation, memory CRC, on chip debug function and self programming.

UNIT III  MSP430 16 - BIT MICROCONTROLLER
The MSP430 Architecture, CPU Registers, Instruction Set, addressing modes, the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x. Low power aspects of MSP430 : low power modes, active Vs standby current consumption, FRAM Vs Flash for low power and reliability.

UNIT IV  PROGRAMMING AND PERIPHERAL INTERFACE USING MSP430 FAMILIES
Memory mapped peripherals, I/O pin multiplexing, Timers, RTC, watchdog timer, PWM control, Analog interfacing and data acquisition, DMA, programming with above internal peripherals using optimal power consumption. Case study: Remote control of air conditioner and home appliances.

UNIT V  COMMUNICATION INTERFACE USING MSP 430 MICROCONTROLLER
Serial and parallel communication, synchronous and asynchronous interfaces , Implementing and programming of : UART, I2C and SPI protocol. wireless connectivity : NFC, Zigbee, bluetooth and WiFi. MSP430 development tools. Case study: Implementing WiFi connectivity in smart electric meter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to discriminate RISC and CISC processors, and work with PIC microcontrollers.
CO2: Ability to work with the 16 bit microcontroller RL78 and design microcontroller based systems for a Real world application.
CO3: Gaining design knowledge and concepts on MSP430 family of Microcontroller.
CO4: Ability to design real time systems by deploy the Interfacing peripherals.
CO5: Ability to design and develop microcontroller based smart electronic system and home appliances.

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EC5017

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To enable the student to understand the basic principles of sensors and actuators, materials and fabrication aspects of MEMS and Microsystems.
- To make the student familiar with the mechanical and the electrostatic design and the associated system issues.

UNIT I

INTRODUCTION TO MEMS
MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro fabrication
UNIT II MECHANICS FOR MEMS DESIGN 9
Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics

UNIT III ELECTRO STATIC DESIGN AND SYSTEM ISSUES 9
Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators. Electronic Interfaces, Feed back systems, Noise, Circuit and system issues.

UNIT IV MEMS APLICATION 9
Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS 9
Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies- MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems – design basics, case study – Capacitive RF MEMS switch, performance issues.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop electrical and mechanical model MEMS sensors and actuators
CO2: Analyse circuit issues in MEMs
CO3: Simulate electro mechanical model of MEMS
CO4: Model static and dynamic characteristic of MEMS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the architecture and programming of ARM processors.
- To introduce the basic concepts of hard real time multiprocessing.
- To introduce the analytical concepts for effective programming.

UNIT I  INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS  9
Complex systems and microprocessors – Embedded system design process – Formalism for system design– Design example: Model train controller- ARM Processor Fundamentals- Instruction Set and Programming using ARM Processor

UNIT II  COMPUTING PLATFORM  9
CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption- CPU buses – Memory devices – I/O devices – Component interfacing- System Level Performance Analysis- Parallelism. Design Example: Data Compressor.

UNIT III  PROGRAM DESIGN AND ANALYSIS  9
Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Program Optimization- Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Example: Software Modem.

UNIT IV  PROCESS AND OPERATING SYSTEMS  9

UNIT V  HARDWARE ACCELERATORS & NETWORKS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to design and develop ARM processor based systems.
CO2: Ability to comprehend and appreciate the significance and role of microcontrollers in embedded systems.
CO3: Ability to analyze and demonstrate program design and optimization and proper scheduling of the process.
CO4: Ability to apply the concept of process, multiprocesses and operating systems in embedded system design.
CO5: Ability to implement various communication protocols in distributed embedded computing platform.

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EC5078 ROBOTICS

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the electronics and software aspects in the design of robots
- To bring out the different languages for programming robot
- To specify robot requirements in the industry
• To introduce latest state of the art robots

UNIT I  SCOPE OF ROBOTS  9
The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots – Economic and Social Issues- applications.

UNIT II  ROBOT COMPONENTS  9

UNIT III  ROBOT PROGRAMMING  9
Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages.

UNIT IV  ROBOT WORK CELL  9
Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.

UNIT V  FUTURE TRENDS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: Ability to design and develop robotic based systems.
CO3: Ability to develop system for industrial automation and medical applications.
CO4: Ability to provide automatic solution for replacing humans in life threatening area.

TEXT BOOKS:

REFERENCES:

EC5018 DISPLAY TECHNOLOGIES  L T P C  3 0 0 3

OBJECTIVES:
• To introduce the different display technologies available for the Electronics Technology
• To understand the different 3D display techniques available
• To explore the applications of Display Technologies in daily life.

UNIT I  INTRODUCTION TO OPTICS

UNIT II  DISPLAY GLASSES
Display Glasses, Inorganic Semiconductor TFT Technology, Organic TFT Technology; Transparent Conductors, Patterning Processes: Photolithography for Thin Film LCD, Wet Etching, Dry Etching; Flexible Displays: Attributes, Technologies Compatible with Flexible Substrate and Applications, Touch Screen Technologies.

UNIT III  DISPLAY DEVICES

UNIT IV  3-D DISPLAY TECHNOLOGY

UNIT V  MICRO DISPLAY TECHNOLOGY
Micro display Technologies: Liquid Crystals on Silicon Reflective Micro display, Transmissive Liquid Crystal Micro display, MEMs Microdisplay, DLP Projection Technology; Micro display Applications: Projection Systems, Head Worn Displays; Electronic View Finders, Multi focal
Displays, Occlusion Displays, Cognitive Engineering and Information Displays; Display Metrology, Standard Measurement Procedures;

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Understand the material properties of display devices
CO2: Understand the projection technology of 3D display devices

TEXT BOOK:

REFERENCES:

EC5019 DIGITAL CONTROL ENGINEERING

OBJECTIVES:
• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• This course is extended to deliver the concepts of continuous-time control systems to digital domain where the design and stability aspects are introduced.

UNIT I CONTINUOUS TIME SYSTEMS 6
Review of frequency and time response analysis and specifications of control systems, need for controllers, continuous time compensations, continuous time PI, PD, PID controllers.

UNIT II SIGNAL PROCESSING IN DIGITAL CONTROL 12
Sampling, time and frequency domain descriptions, aliasing, hold operations, mathematical model of sample and hold, zero and first order hold, factors limiting the choice of sample rate, reconstruction, Difference equation description, Z-transform method of description, pulse transfer function, time and frequency response of discrete time control systems.

UNIT III DESIGN OF DIGITAL CONTROL ALGORITHMS 9
Review of principle of compensator design, Z-plane specifications, digital compensator design using frequency response plots, discrete integrator, discrete differentiator, development of digital PID controller, transfer function, design in Z-plane.
UNIT IV  STATE VARIABLE TECHNIQUES  
Discrete State Variable concepts, Characteristic equation, Eigen values and Eigenvectors, Jordan canonical models, Phase Variable companion forms.

UNIT V  CONTROLLABILITY, OBSERVABILITY AND STABILITY  
Definitions and Theorems of Controllability and Observability, Relationships between Controllability, Observability and Transfer Functions, Jury, Routh, Lyapunov stability analysis, Principles of state and output feedback.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: Acquire working knowledge of discrete system science related mathematics.
CO3: Design a discrete system, component or process to meet desired needs.
CO4: Identify, formulate and solve discrete control engineering problems.
CO5: Use the techniques, tools and skills related to discrete signals, computer science and modern discrete control engineering in modern engineering practice.
CO6: Communicate system related concepts effectively.

TEXT BOOK:

REFERENCES:

EC5020  MEASUREMENTS AND INSTRUMENTATION  
L T P C  
3 0 0 3

OBJECTIVES:
• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
• To introduce principles of various measurement techniques using analog and digital equipments
• To teach Importance of signal generators and analyzers in measurements
• To emphasize the need for data acquisition systems and optical domain measurement techniques
UNIT I  SCIENCE OF MEASUREMENT
Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

UNIT II  TRANSUCERS

UNIT III  SIGNAL CONDITIONING AND SIGNAL ANALYZERS

UNIT IV  DIGITAL INSTRUMENTS

UNIT V  DATA DISPLAY RECORDING AND SYSTEMS
Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Discuss about the principles of various measurement techniques.
CO2: Analyze the transducers and its impact.
CO3: Explain about the signal conditioning system and signal analyzers.
CO4: Illustrate the digital measurement equipments.
CO5: Emphasize the need for data acquisition, recording and display systems.

TEXT BOOKS:

REFERENCE:
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.

- The objectives of the course is to introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems.

UNIT I  INTRODUCTION TO QUANTUM MECHANICS  9
Particles, waves, probability amplitudes, schrodinger equation, wave packets solutions, operators, expectation values, eigenfunctions, piecewise constant potentials.

UNIT II  SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS  9
SHM Operators, SHM wavepacket solutions, Quantum LC circuit, WKB approximations, variational methods.

UNIT III  SYSTEMS WITH TWO AND MANY DEGREES OF FREEDOM  9
Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states.

UNIT IV  STATISTICAL MECHANICS  9
Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors.

UNIT V  APPLICATIONS  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.

CO2: The student would have gained the knowledge on quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems.

TEXT BOOKS:

REFERENCES:

EC502
MEDICAL ELECTRONICS

OBJECTIVES:
• To gain knowledge about the various physiological parameters both electrical and non electrical, 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 BIOPOTENTIAL RECORDING
The origin of Bio-potentials, biopotential electrodes, bioamplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT
pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse rate, Blood cell counters.

UNIT III ASSIST DEVICES
Cardiac pacemakers – Need, different types, DC defibrillators - asynchronous and synchronous, Hemodialyser- Membrane, Dialysate. Heart lung machine - Block diagram, oxygenators and pumps

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electrical safety

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION
Thermography- principle, detectors, Endoscopy unit, Applications of Laser in medicine, cryogenic application, Introduction to telemedicine

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course the students will be able to
CO1: Acquire and analyze the various biosignals and vital parameters.
CO2: Explain the function and application of various diagnostic and therapeutic equipment.
CO3: Explain about the recent developments in the field of biomedical engineering

TEXT BOOKS:

REFERENCES:

EC5022 IoT ENABLED SYSTEMS DESIGN

OBJECTIVES:
- To understand the basics of IoT.
- To get knowledge about the various services provided by IoT.
- To familiarize themselves with various communication techniques and networking.
- To know the implementation of IoT with different tools.
- To understand the various applications in IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS

UNIT II MIDDLEWARE AND PROTOCOLS OF IOT

UNIT III COMMUNICATION AND NETWORKING
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions,
UNIT IV       IOT IMPLEMENTATION TOOLS
Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python, Implementation of IoT with Raspberry Pi.

UNIT V       APPLICATIONS AND CASE STUDIES:

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students should be able to
CO1: Articulate the main concepts, key technologies, strength and limitations of IoT.
CO2: Identify the architecture, infrastructure models of IoT.
CO3: Analyze the networking and how the sensors are communicated in IoT.
CO4: Analyze and design different models for IoT implementation.
CO5: Identify and design the new models for market strategic interaction.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- The design of all VLSI circuits is carried out by making extensive use of Computer Aided Design (CAD) VLSI design tools. Due to continuous scaling of semiconductor technology, most of the VLSI designs employ millions of transistors and circuits of this size can only be carried out with the aid of CAD VLSI design tools.
- The VLSI design professional needs to have a good understanding of the operation of these CAD VLSI design tools as these are developed primarily for and by the VLSI design professionals.
- As part of the present introductory course the principles of operation of all the important modules that go into the construction of a complete VLSI CAD tool will be discussed. These include the design flow organization for VLSI, the standard cell based synthesis methodologies for digital VLSI, floor planning and placement principles and related topics will all be covered.

UNIT I  VLSI DESIGN METHODOLOGIES  9

UNIT II  DESIGN RULES  9
Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms – partitioning

UNIT III  FLOOR PLANNING  9
Floor planning concepts - shape functions and floor plan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

UNIT IV  SIMULATION  9
Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

UNIT V  MODELLING AND SYNTHESIS  9
High level Synthesis - Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Apply VLSI design methodologies and design rules for digital circuits.
CO3: Use floor planning and rooting concepts for digital circuits.
CO4: Apply Gate level and Switch level modelling and Simulation.
CO5: Apply high level logic synthesis and scheduling.

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EC5024 FUNDAMENTALS OF OPERATING SYSTEMS L T P C 3 0 0 3

OBJECTIVES:
- To learn the concepts of operating systems.
- To learn about the various issues in operating systems.
- To familiarize with the important mechanisms in operating systems. To appreciate the emerging trends in operating systems

UNIT I OPERATING SYSTEMS OVERVIEW 9

UNIT II  PROCESS MANAGEMENT  9
Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple-
processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section
problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of
synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System
model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention –
Deadlock Avoidance – Deadlock detection – Recovery from deadlock

UNIT III  STORAGE MANAGEMENT  9
Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation –
Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write –
Page replacement – Allocation of frames – Thrashing.

UNIT IV  I/O SYSTEMS  9
Directory implementation – Allocation methods – Free-space management – Disk scheduling –
Disk management – Swap-space management – Protection

UNIT V  CASE STUDY  9
Scheduling – Memory management – File systems – Input and Output – Inter-process

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On Completion of the course, the students will be able to:
CO1: Articulate the main concepts, key ideas, strengths and limitations of operating systems
CO2: Explain the core issues of operating systems
CO3: Know the usage and strengths of various algorithms of operating systems

TEXT BOOK:
1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts

REFERENCES:
   Education, 1996.
INTRODUCTION TO WEB TECHNOLOGY

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the features of object oriented programming languages using Java
- To design and create user interfaces using Java frames and applets
- To have a basic idea about network programming using Java
- To create simple Web pages and provide client side validation
- To create dynamic web pages using server side scripting

UNIT I  JAVA FUNDAMENTALS  9

UNIT II  JAVA NETWORKING FUNDAMENTALS  9

UNIT III  CLIENT SIDE TECHNOLOGIES  9

UNIT IV  SERVER SIDE TECHNOLOGIES  9

UNIT V  APPLICATION DEVELOPMENT ENVIRONMENT  9

TOTAL: 45 PERIODS
COURSE OUT COMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: The students will gain knowledge about Java and basic Web concepts and enable the student to create simple Web based applications.

TEXT BOOK:

REFERENCES:
1. Marty Hall and Larry Brown, "Core Servlets And Javaserver Pages", 2nd Edition
2. Bryan Basham, Kathy Siegra, Bert Bates, Head First Servlets and JSP, 2nd Edition

EC5079 SOFT COMPUTING AND APPLICATIONS L T P C

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- This course gives an idea and principles of various soft computing techniques, which are applicable to core areas such as networks, pattern recognition, image processing
- To introduce fuzzy set theory
- To teach different optimization techniques
- To introduce neural networks and neuro-fuzzy modeling
- To teach various applications of computational intelligence

UNIT I FUZZY SET THEORY 10

UNIT II OPTIMIZATION 8
UNIT III NEURAL NETWORKS

UNIT IV NEURO FUZZY MODELING

UNIT V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Apply various soft computing frame works.
CO2: Design of various neural networks.
CO3: Use fuzzy logic.
CO4: Discuss hybrid soft computing

TEXT BOOKS:

REFERENCES:
EC5026 PARALLEL AND DISTRIBUTED PROCESSING  L T P C  3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the principles of parallel processing
- To understand the concept of shared memory architecture in multiprocessing
- To study the parallel programming models.

UNIT I  PARALLEL ARCHITECTURE  9
Parallel Computer Models, Program and Network properties, Principles of scalable performance

UNIT II  PROCESSORS AND MEMORY HIERARCHY, BUS  9
Advanced processor Technology, Super scalar and vector processor, Memory hierarchy technology, Virtual Memory Technology, Backplane Bus systems.

UNIT III  PIPELINING AND SUPER SCALAR TECHNIQUES  9
Linear Pipeline, Nonlinear pipeline, Instruction pipeline, Arithmetic pipeline, Superscalar and super pipeline design, Parallel and scalable architectures- Multiprocessor and Multicomputers.

UNIT IV  SOFTWARE FOR PARALLEL PROGRAMMING  9
Parallel programming models, languages, compliers- Parallel Program Development and Environments.

UNIT V  DISTRIBUTED SYSTEMS  9
Models, Hardware concepts, communication, synchronization mechanism, case study: MPI and PVM, Distributed file systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Use different Processor and memory hierarchy technology.
CO2: Apply various types of Pipelining methodologies.
CO3: Identify models, Languages and compilers for Parallel Programming
CO4: Design distributed systems

TEXT BOOKS:

REFERENCES:

GE5073 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 in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN


UNIT III DESIGN AND TESTING


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


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Define, formulate and analyze a problem
CO2: Solve specific problems independently or as part of a team
CO3: Gain knowledge of the Innovation & Product Development process in the Business Context
CO4: Work independently as well as in teams
CO5: Manage a project from start to finish

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

EC5027 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

OBJECTIVES:
- To understand problem solving methods and learning design of intelligent systems.
- To understand the concepts of machine learning
- To appreciate supervised and unsupervised learning and their applications
- To build systems that learn and adapt using real-world applications.
- Writing software/project implementations of learning algorithms applied to real-world

UNIT I INTRODUCTION TO AI
Computerized reasoning - Artificial Intelligence (AI) - characteristics of an AI problem - Problem representation in AI - State space representation - problem reduction - Concept of small talk programming.

UNIT II SEARCH PROCESS:


UNIT III INTRODUCTION TO MACHINE LEARNING

UNIT IV UNSUPERVISED LEARNING

TOTAL : 45 PERIODS

TEXTBOOKS:

REFERENCES:

OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES
UNIT III ORGANs OF GOVERNANCE
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS

UNIT V LOCAL ADMINISTRATION
District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

TEXTBOOKS:
4. The Constitution of India (Bare Act), Government Publication,1950

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• Interpret social empowerment with value education

UNIT I      INTRODUCTION TO VALUE EDUCATION  9
Values and self-development – Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II      IMPORTANCE OF VALUES  9
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III      INFLUENCE OF VALUE EDUCATION  9
Personality and Behaviour development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV      REINCARNATION THROUGH VALUE EDUCATION  9

UNIT V      VALUE EDUCATION IN SOCIAL EMPOWERMENT  9
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1: Gain knowledge of self-development
CO2: Learn the importance of Human values
CO3: Develop the overall personality through value education
CO4: Overcome the self-destructive habits with value education
CO5: Interpret social empowerment with value education

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AD5093 PEDAGOGY STUDIES
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OBJECTIVES:
- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes.

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: Understand the methodology of pedagogy.
CO2: Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
CO3: Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
CO4: Know the factors necessary for professional development.
CO5: Identify the Research gaps in pedagogy.

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AD5094          STRESS MANAGEMENT BY YOGA          L T P C
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OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’t’s in life through Yam
- Categorize Do’s and Don’t’s in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam
UNIT I       INTRODUCTION TO YOGA
Definitions of Eight parts of yog. ( Ashtanga )

UNIT II       YAM
Do’s and Don’t’s in life.
Shauucha, santoosh, tapa, swadhyay, ishwarpranidhan

UNIT III      NIYAM
Do’s and Don’t’s in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV       ASAN
Various yog poses and their benefits for mind & body

UNIT V        PRANAYAM
Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health and improve efficiency
CO2 – Learn Do’s and Don’t’s in life through Yam
CO3 – Learn Do’s and Don’t’s in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

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REFERENCES:
1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. ‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur
OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I  9
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II  9
Verses- 52,53,59 (dont’s) - Verses- 71,73,75,78 (do’s)

UNIT III  APPROACH TO DAY TO DAY WORK AND DUTIES  9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV  STATEMENTS OF BASIC KNOWLEDGE – I  9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V  PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA  9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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REFERENCES:
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi, 2010

AD5097  ESSENCE OF INDIAN KNOWLEDGE TRADITION   L T P C
3 0 0 0

COURSE OBJECTIVES
The course will introduce the students to
- Get a knowledge about Indian Culture
- Know Indian Languages and Literature, religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I  INTRODUCTION TO CULTURE  9
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II  INDIAN LANGUAGES AND LITERATURE  9
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III  RELIGION AND PHILOSOPHY  9
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV  FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)  9
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V  EDUCATION SYSTEM IN INDIA  9
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
• Acquire the information about the fine arts in India.
• Know the contribution of scientists of different eras.
• Understand education systems in India

REFERENCES:
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:

1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitru paththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9
Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature’s Grammar- Tamil Sangam Literature'sparables.

UNIT II ‘AGATHINAI’ AND ‘PURATHINAI’ 9
Tholkappiyar’s Meaningful Verses–Three literature materials–Agathinai’s message- History of Culture from Agathinai–Purathinai–Classification–Mesaage to Society from Purathinai.

UNITIII ‘ATTRUPPADAI’. 9

138
UNITIV ‘PURANAANURU’

Puranaanuru on Good Administration, Ruler and Subjects—Emotion & its Effect in Puranaanuru.

UNITV ‘PATHITRU PATHTHU’

Pathitupaththu in’Ettruthogai’—Pathitru paththu’s Parables—Tamil dynasty: Valor, Administration, Charity in Pathitru paththu- Message to Society from Pathitru paththu.

TOTAL (L:45) = 45 PERIODS

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

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Puthathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitru paththu’ in their personal and societal life.

REFERENCES:

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C 3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- To familiarize students with the concept of communication using linguistic and non-linguistic resources.
- To help students ask critical questions regarding facts and opinions.
- To provide students with the material to discuss issues such as language and power structures.
- To help students think critically about false propaganda and fake news.

Learning Outcomes

- Students will be able to use linguistic and non-linguistic resources of language in an integrated manner for communication.
- Students will be able to analyse communication in terms of facts and opinions.
- Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing
UNIT III  POWER STRUCTURE AND LANGUAGE USE: 9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV  MEDIA COMMUNICATION: 9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

HU5172  VALUES AND ETHICS  L T P C
3 0 0 3

OBJECTIVES:
• Teach definition and classification of values.
• Explain Purusartha.
• Describe Sarvodaya idea.
• Summarize sustenance of life.
• Conclude views of hierarchy of values.

UNIT I  DEFINITION AND CLASSIFICATION OF VALUES 9
Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

Attested
DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
UNIT II CONCEPTS RELATED TO VALUES
Purusartha- Virtue, Right- duty, justice, Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA
Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

OUTCOMES:
CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

TOTAL: 45 PERIODS

TEXTBOOKS:
2. Little, William: An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)

HU5173 HUMAN RELATIONS AT WORK L T P C
3 0 0 3

OBJECTIVES:
- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.
UNIT I UNDERSTANDING AND MANAGING YOURSELF 9
Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9
Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

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TEXT BOOK:

REFERENCES:

HU5174  PSYCHOLOGICAL PROCESSES  L T P C

3 0 0 3

COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

UNIT 2: SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set · motivation & emotion · cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT
UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY
COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
➢ To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
➢ Understand the various apps of technology apps and use them to access, generate and present information effectively.
➢ Apply technology based resources and other media formats equitably, ethically and legally.
➢ Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION
As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY L T P C
3 0 0 3

OBJECTIVES
- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.

UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD
UNIT IV KNOWLEDGE AS POWER/OPPRESSION


UNIT V SELF KNOWLEDGE/BRAHMAN


OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE L T P C
3 0 0 3

UNIT I INTRODUCTION
Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS
Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH
Abnormality, symptoms and causes psychological disorders
UNIT IV  PSYCHOLOGY AND COUNSELING  7
Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V  PSYCHOLOGY AND SOCIAL BEHAVIOUR  11
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS
COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives
- To familiarize students with the concepts of sex and gender through literary and media texts.
- To help students ask critical questions regarding gender roles in society.
- To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- To help students think critically about gender based problems and solutions.

Learning Outcomes
- Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- Students will be able to analyse current social events in the light of gender perspectives.
- Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender
- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations
- Types of Gender Roles
- Gender Roles and Relationships Matrix
• Gender-based Division and Valuation of Labour
Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)

UNIT III: Gender Development Issues
• Identifying Gender Issues
• Gender Sensitive Language
• Gender, Governance and Sustainable Development
• Gender and Human Rights
• Gender and Mainstreaming
Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence
• The concept of violence
• Types of Gender-based violence
• The relationship between gender, development and violence
• Gender-based violence from a human rights perspective
Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture
• Gender and Film
• Gender, Media and Advertisement
Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE L T P C
3 0 0 3

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

TOTAL:45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273  LAW AND ENGINEERING  L T P C  3 0 0 3

UNIT I  THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE  9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II  LAWS  9
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III  BUSINESS ORGANISATIONS  9
Sole traders (Business has no separate identity from you, all business property belongs to you).


UNIT IV  LAW AND SOCIETY  9
Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.
UNIT V CASE STUDIES
Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION

COURSE DESCRIPTION
This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:
- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS
Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM

UNIT III FILMS ACROSS THE WORLD

UNIT IV INDIAN FILMS

UNIT V INTERPRETING FILMS
Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.
OUTCOMES
On completion of the course, the students will be able to:
- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods
- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation
- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)
- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS :

UNIT I  LANGUAGE AND LINGUISTICS: AN OVERVIEW

UNIT II  MORPHOLOGY - WORDS OF LANGUAGE

UNIT III  SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE

UNIT IV  PHONETICS – THE SOUNDS OF LANGUAGE

UNIT V  APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :
Lectures, discussion.

Evaluation Internal and External :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)
REFERENCES:

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral - Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II READING CULTURE
Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel’s ‘The night of the Scorpion’. ‘Nothing’s Changed’- Tatamkhulu Afrika-Apartheid. Ruskin Bond- ‘Night train at Deoli’- How real life is different from movies.

UNIT III IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V RETURNING To PICTURES

Reading list
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies

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5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert: *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter’s night a traveler*

**OUTCOME**
- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.

### EC5512 SUMMER INTERNSHIP /SUMMER PROJECT

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<th>CO No.</th>
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<td>Ability to formulate a problem and build the project frame work</td>
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**CO-PO Articulation Matrix**

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