B. Tech. (ECE) – Curriculum (IIITSUGECE16)
Semester-wise Curriculum

I Semester

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List of Electives

V Semester
Programme Electives – I (1 out of 3)
- Display Systems
- Statistical Signal Processing
- Communication Switching Systems

Programme/ Open Electives / Minor from other Dept. - I (1 out of 2)
- Computer Architecture and Organization
- Multimedia Communication Technology

VI Semester
Programme Electives - II (1 out of 3)
- RF MEMS Circuit Design
- Principles of Radar
- Digital Signal Processing for Wireless Communication

Programme/ Open Electives / Minor from other Dept. – II (1 out of 2)
- Arm System Architecture
- Networks and Protocols

VII Semester
Programme Electives - III (1 out of 3)
- Cognitive Radio
- Broadband Access Technologies
- Satellite Communication

Programme/ Open Electives / Minor from other Dept. – III, IV
- Ad hoc Wireless Networks
- Digital Image Processing

VIII Semester
Programme Electives - IV (1 out of 3)
- Microwave Integrated Circuit Design
- Microwave Electronics
- Electronic Packaging

Programme/ Open Electives / Minor from other Dept. – V & VI
- Wireless Sensor Networks
- Digital Speech Processing
- Pattern Recognition
### Electives for B. Tech. (Honors)*

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* - Eligibility Criteria: As per the existing institute norms

### Minors Offered

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<td>ECMI15</td>
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<td>ECMI18</td>
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<td>ECMI19</td>
<td>Wireless Communication</td>
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FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>HSIR11</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>English for Communication</td>
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<tr>
<td>Number of Credits</td>
<td>3</td>
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<tr>
<td>Prerequisites (Course code)</td>
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<tr>
<td>Course Type</td>
<td>GIR</td>
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</table>

**Objective**

The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for academic and social needs.

**Course Material**

Instruction will be provided through appropriate material – articles from popular magazines, newspapers, technical journals, samples from industries and also text books. Practice in the four language skills necessary for their specific technical requirements will be provided in an integrated manner.

**Course Content**

*Communication* An introduction - Its role and importance in the corporate world–Tools of communication – Barriers – Levels of communication – English for Specific purposes and English for technical purposes.

*Listening* Listening process & practice–Exposure to recorded & structured talks, classroom lectures – Problems in comprehension & retention – Note-taking practice – Listening tests-Importance of listening in the corporate world.


*Writing* Effective writing practice–Vocabulary expansion - Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing – Cohesion & coherence in writing – Writing of definitions, descriptions & instructions - Paragraph writing - Introduction to report writing.

**Outcome**

The students will be able to express themselves in a meaningful manner to different levels of people in their academic and social domains.

**Text Books**

Reference Books
Course Code : MAIR11
Course Title : Mathematics I
Number of Credits : 4
Prerequisites (Course code) : NONE
Course Type : GIR

**Objective**

To acquire fundamental knowledge and apply in engineering disciplines.

**Course Content**


Sequences of real numbers – Limit of a sequence – Convergent and divergent sequences – sub sequence- Cauchy’s sequence – monotone convergence theorem (without proof)- Sequence with recurrence relations.


Double integral – Changing the order of Integration – Change of variables from Cartesian to Polar Coordinates – Area using double integral in Cartesian and Polar Coordinates – Triple integral – Change of Variables from Cartesian to Spherical and Cylindrical Coordinates – Volume using double and triple integrals.

**Outcome**

After the completion of the course, students would be able to solve curriculum problems.

**Text Books**


**Reference Books**

Course Code : PHIR11
Course Title : Physics - I
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives
- To make a bridge between the physics in school and engineering courses.
- To introduce the basic concepts of modern science like Photonics, Engineering applications of acoustics, fundamentals of crystal physics and materials science.

Course Content
Lasers

Fiber Optics

Acoustics

Crystallography

Magnetic materials, conductors and superconductors
Conductors: classical free electron theory (Lorentz–Drude theory)–electrical conductivity

Outcome
The student will be able to understand many modern devices and technologies based on lasers and
optical fibers. Student can also appreciate various material properties which are used in engineering applications and devices.

**Text Books**


**Reference Books**


**Laboratory Experiments**

1. Torsional pendulum
2. Numerical aperture of an optical fiber
3. Temperature measurement - Thermocouple
4. Specific rotation of a liquid – Half Shade Polarimeter
5. Thickness of a thin wire – Air Wedge
6. Conversion of galvanometer into ammeter and voltmeter
7. Dispersive power of a prism – Spectrometer
8. Superconductivity- measurement of transition temperature
9. Absorption spectrometer
10. Brewster’s Angle measurement
11. Measurement of Young’s modulus

**Reference Books**

Course Code : CHIR11
Course Title : Chemistry - I
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives
To introduce students to water chemistry, bonding concepts, entropy and basic organic chemistry.

Course Content

Water
Sources, hard & soft water, estimation of hardness by EDTA method, softening of water, zeolite process & demineralization by ion exchangers, boiler feed water, internal treatment methods, specifications for drinking water, BIS & WHO standards, treatment of water for domestic use, desalination - Reverse osmosis & Electrodialysis.

Chemical Bonding
Basic concepts, bonding in metals, electron gas theory, physical properties of metals (electrical & thermal conductivity, opaque & lusture, malleability & ductility), Alloy-substitutional alloys, interstitial alloys.

Coordinate bond, EAN rule, 16 & 18 electron rule, crystal field theory, splitting of ‘d’ orbitals in octahedral, tetrahedral and square planar complexes.

Shape & Intermolecular Interactions
Shape-Lewis dot structures, formal charge, VSEPR method, consequences of shape, dipole moment, valence bond theory; Intermolecular interactions-ion ion interactions, ion-dipole interactions, hydrogen bonding, dipole-dipole interactions, London / dispersion forces, relative strength of intermolecular forces; Consequences-surface tension.

Thermodynamics
Entropy as a thermodynamic quantity, entropy changes in isothermal expansion of an ideal gas, reversible and irreversible processes, physical transformations, work & free energy functions, Helmholtz and Gibbs free energy functions, Gibbs-Helmholtz equation, Gibbs-Duhem equation, Clapeyron-Clausius equation & its applications, Van't Hoff isotherm and applications.

Fuels & Lubricants
Fuels - Classification, examples, relative merits, types of coal, determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion, proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Lubricants - Definition, theories of lubrication, characteristics of lubricants, viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point, additives to lubricants, Solid lubricants.

Outcome
Students will learn about quality of water, bonding theories, entropy change for various processes and basic stereo chemical aspects.
**Text Books**


**Reference Books**


**Laboratory Experiments**

1. Estimation of total alkalinity in the given water sample.
2. Estimation of carbonate, non-carbonate and total hardness in the given water sample.
3. Estimation of dissolved oxygen in the given water sample.
4. Determination of the percentage of Fe in the given steel sample.
   1. Estimation of Ca in limestone.
   2. Estimation of Fe$^{3+}$ by spectrophotometer.

**Reference Books**

1. Laboratory Manual, Department of Chemistry, NITT
Course Code : CSIR11
Course Title : Basics of Programming
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives

- To learn the fundamentals of computers.
- To learn the problem solving techniques writing algorithms and procedures.
- To learn the syntax and semantics for C programming language
- To develop the C code for simple logic
- To understand the constructs of structured programming including conditionals and iterations

Course Content

Introduction to computers – Computer Organization – Characteristics – Hardware and Software – Modes of operation – Types of programming languages – Developing a program.


Modular Programming – Functions and Procedures – Examples – Parameter passing methods.


Outcome

1. Ability to write algorithms for problems
2. Knowledge of the syntax and semantics of C programming language
3. Ability to code a given logic in C language
4. Knowledge in using C language for solving problems

Text Books
2. R.G.Dromey, ‘How to Solve it By Computers?’, Prentice Hall, 2001
Reference Books

Laboratory Experiments
1. Programs using sequence construct
2. Programs using selection construct
3. Programs using Iterative construct
4. Programs using nested for loops
5. Programs using functions with Pass by value
6. Programs using functions with Pass by reference
7. Programs using recursive functions
8. Programs using one dimensional Array
9. Programs using two dimensional Arrays
10. Programs using Pointers and functions
11. Programs using Pointers and Arrays
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<td>Course Type</td>
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Curriculum and Assessments will be decided by the respective department
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Basic Civil Engineering</td>
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<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites</td>
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<td>Course Type</td>
<td>GIR</td>
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</table>

**Objectives**

- To give an overview of the fundamentals of the Civil Engineering fields to the students of all branches of Engineering
- To realize the importance of the Civil Engineering Profession in fulfilling societal needs

**Course Content**

Properties and uses of construction materials - stones, bricks, cement, concrete and steel.

Site selection for buildings - Component of building - Foundation- Shallow and deep foundations - Brick and stone masonry - Plastering - Lintels, beams and columns - Roofs.


Surveying - Classification-Chain Survey-Ranging-Compass Survey-exhibition of different survey equipment.

Sources of Water - Dams- Water Supply-Quality of Water-Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water.

**Outcome**

1. The students will gain knowledge on site selection, construction materials, components of buildings, roads and water resources
2. A basic appreciation of multidisciplinary approach when involved in Civil Related Projects.

**Reference Books**

5. Lecture notes prepared by Department of Civil Engineering, NITT.
Course Code    :   MEIR11
Course Title   :   Basic Mechanical Engineering
Number of Credits :  2
Prerequisites (Course code) :  NONE
Course Type    :   GIR

Objectives

- To explain the importance of concepts of mechanical engineering and conservation equations.
- To introduce the techniques for analyzing the forces, momentum and power.
- To introduce the various properties of materials, and the techniques of selection of materials.
- To identify the basic elements of a mechanical system and write their constitutive equations and performance analysis techniques.

Course Content

**Fundamentals** Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

**Thermal Engineering** Laws of thermodynamics, types of systems, concepts and types of I.C. engine, air compressors, principle of turbomachines, properties of steam and steam generators, automobile engineering, introduction to gas turbines and refrigeration & air-conditioning.

**Engineering Materials** Types of materials, selection of materials, material properties, introduction to materials structure, machine elements, transmission, fasteners, and support systems.

**Manufacturing Technology** Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

Outcome

The terminal objectives of the course is that, on successful completion of teaching-learning and evaluation activities, a student would be able to identify, appreciate and analyze the problems by applying the fundamentals of mechanical engineering and to proceed for the development of the mechanical systems.

Reference Books

1. Lecture notes prepared by Department of Mechanical Engineering, NITT.
2. K. Venugopal, ‘Basic mechanical Engineering’.
Course Code : MEIR12
Course Title : Engineering Graphics
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives

- Irrespective of engineering discipline, it has become mandatory to know the basics of Engineering graphics. The student is expected to possess the efficient drafting skill depending on the operational function in order to perform day to day activity.
- Provide neat structure of industrial drawing
- Enables the knowledge about position of the component and its forms Interpretation of technical graphics assemblies
- Preparation of machine components and related parts

Course Content

Fundamentals Drawing standard - BIS, dimensioning, lettering, type of lines, scaling-conventions.

Geometrical constructions Dividing a given straight line into any number of equal parts,bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and hexagon – conic sections – ellipse – parabola – hyperbola - cycloid – trochoïd.

Orthographic projection Introduction to orthographic projection, drawing orthographic views of objects from their isometric views - Orthographic projections of points lying in four quadrants, Orthographic projection of lines parallel and inclined to one or both planes Orthographic projection of planes inclined to one or both planes. Projections of simple solids - axis perpendicular to HP, axis perpendicular to VP and axis inclined to one or both planes.

Sectioning of solids Section planes perpendicular to one plane and parallel or inclined to other plane.

Intersection of surfaces Intersection of cylinder & cylinder, intersection of cylinder &cone, and intersection of prisms.

Development of surfaces Development of prisms, pyramids and cylindrical &conical surfaces.

Isometric and perspective projection Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection.

Computer aided drafting Introduction to computer aided drafting package to make 2-D drawings.

Self-study only, not to be included in examinations. Demonstration purpose only, not to be included in
Outcome
Towards the end of the course it is expected that the students would be matured to visualize the engineering components. A number of chosen problems will be solved to illustrate the concepts clearly.

Text Books

Reference Books
# SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
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<td>Course Title</td>
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## Objectives
The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs.

## Course Material
Instruction will be provided through appropriate material – articles from popular magazines, newspapers, technical journals, samples from industries and also text books. Practice in the four language skills will be provided in an integrated manner.

## Course Content

**Listening** Barriers to listening: Physical & psychological–Steps to overcome them–Purposive listening practice – Active listening and anticipating the speaker – Use of technology in the professional world.


**Writing** Professional Correspondence–Formal and informal letters–Argument Writing practice – Perspectives in writing – Narrative writing -Different registers - Tone in formal writing – Summary writing practice- Introduction to reports.

**Study Skills** Reference Skills - Use of dictionary, thesaurus etc–Importance of contents page, cover & back pages – Bibliography.

## Outcome
The students will have knowledge of the various uses of English in their professional environment and they will be able to communicate themselves effectively in their chosen profession.

## Reference Books
**Course Code**: MAIR12  
**Course Title**: Mathematics II  
**Number of Credits**: 4  
**Prerequisites (Course code)**: NONE  
**Course Type**: GIR

**Objectives**  
To learn mathematical concepts and methods.

**Course Content**


Basic review of first order differential equation - Higher order linear differential equations with constant coefficients – Particular integrals for $x^n e^{ax}, e^{ax} \cos (bx), e^{ax} \sin (bx)$ –

Equation reducible to linear equations with constant coefficients using $x e^t$ - Simultaneous linear equations with constant coefficients – Method of variation of parameters – Applications – Electric circuit problems.

Gradient, Divergence and Curl – Directional Derivative – Tangent Plane and normal to surfaces – Angle between surfaces – Solenoidal and irrotational fields – Line, surface and volume integrals – Green’s Theorem, Stokes’ Theorem and Gauss Divergence Theorem (all without proof) – Verification and applications of these theorems.

Analytic functions – Cauchy – Riemann equations (Cartesian and polar) – Properties of analytic functions – Construction of analytic functions given real or imaginary part – Conformal mapping of standard elementary functions ($z^2, e^z, \sin z, \cos z, z^2 k^2$) and bilinear transformation.

Cauchy’s integral theorem, Cauchy’s integral formula and for derivatives– Taylor’s and Laurent’s expansions (without proof) – Singularities – Residues – Cauchy’s residue theorem – Contour integration involving unit circle.

**Outcome**

After the completion of the course, students are able to solve industrially applicable problems.

**Text Books**


**Reference Books**

Objectives

- To make a bridge between the physics in school and engineering courses.
- To introduce the basic concepts of modern physics like fundamentals of quantum mechanics, nuclear physics and advanced materials.
- To introduce fundamental physics like electrodynamics and semiconductor physics for circuit branch students.

Course Content

Quantum Mechanics

Nuclear and Particle Physics
Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-lives - application in determining the age of rock and fossils-Stellar nucleosynthesis. Fundamental forces - Particle physics - classification of matter - quark model - neutrino properties and their detection.

Advanced Materials


Liquid Crystals: Types–Nematic, Cholesteric, Smectic–Modes: Dynamic scattering,Twistednematic – Display systems.

Shape memory alloys one way and two way memory effect- pseudoelasticity- applications

Electrodynamics


Semiconductor Physics
Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0 K- Intrinsic semiconductor at room temperature-Intrinsic carriers- Electron and Hole concentrations-doping-n-type – p-type-temperature variation of carrier concentration in extrinsic semiconductor-
Extrinsic conductivity-Law of Mass action-Charge neutrality-Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors-Hall effect.

**Outcome**
The student will be able to understand fundamentals of electrodynamics and semiconductor physics which is base of many modern devices and technologies. Student will also get an exposure to modern physics topics like nuclear physics, nanotechnology and advanced materials.

**Text Books**

**Reference Books**
Course Code : CHIR13
Course Title : Chemistry - II
Number of Credits : 4
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives
To introduce the students to basic principles of electrochemistry, cell construction and evaluation, electrochemical power sources, the importance of corrosion in metal/alloy and polymer.

Course Content

Electrochemistry
Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference.

Corrosion
Dry corrosion and wet corrosion, mechanisms, types of corrosion, DMC, DAC, stress, intergranular, atmospheric and soil corrosion, Passivity, Polarization, over potential and its significance, Factors affecting corrosion, protection from corrosion by metallic coatings, electroplating, electroless plating and cathodic protection, Chemical conversion coatings and organic coatings- Paints, enamels.

Batteries

Solid State
Types of solids - close packing of atoms and ions - bcc , fcc structures of rock salt - cesium chloride- spinel - normal and inverse spinels, Stoichiometric Defect, controlled valency&Chalcogen semiconductors, Non-elemental semiconducting Materials, Preparation of Semiconductors-steps followed during the preparation of highly pure materials and further treatments. Semiconductor Devices-p-n junction diode.

Polymer
Outcome
Students would become familiar with the important practical applications of electrochemistry, solids, their properties and applications, and the polymer materials.

Text Books

Reference Books
Course Code : ENIR11
Course Title : Energy and Environmental Engineering
Number of Credits : 2
Prerequisites (Course code) : NONE
Course Type : GIR

Objective
- To teach the principal renewable energy systems.
- To explore the environmental impact of various energy sources and also the effects of different types of pollutants.

Course Content
Present Energy resources in India and its sustainability - Different type of conventional Power Plant--Energy Demand Scenario in India-Advantage and Disadvantage of conventional Power Plants – Conventional vs Non-conventional power generation


Power and energy from wind turbines- India’s wind energy potential- Types of wind turbines- Off shore Wind energy- Environmental benefits and impacts.


Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Water pollution-Sources and impacts, Soil pollution-Sources and impacts, disposal of solid waste.


Outcome
Students will be introduced to the Principal renewable energy systems and explore the environmental impact of various energy sources and also the effects of different types of pollutants.

Text Books

References
Course Code : ECPC21
Course Title : Electrical Circuits and Machines
Number of Credits : 4
Prerequisites (Course code) : NONE
Course Type : GIR

Syllabus, Curriculum and Assessments will be decided by the respective department
Course Code : PRIR11
Course Title : Engineering Practice
Number of Credits : 2
Prerequisites (Course code) : NONE
Course Type : GIR

Objectives

Introduction to the use of tools and machinery in Carpentry, Welding, Foundry, Fitting and Sheet Metal Working.

Carpentry
Wood sizing exercise in planning, marking, sawing, chiseling and grooving to make
1. Half lap joint
2. Cross lap joint

Welding
Exercise in arc welding for making
1. Lap joint
2. Butt joint

Foundry
Preparation of sand mould for the following
1. Flange
2. Anvil

Fitting
Preparation of joints, markings, cutting and filling for making
1. V-joint
2. T-joint

Sheet metal
Making of small parts using sheet metal
1. Tray
2. Funnel
THIRD SEMESTER

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<tr>
<td>Course Title</td>
<td>Real Analysis and Partial Differential Equations</td>
</tr>
<tr>
<td>Number of Credits</td>
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<td>Prerequisites (Course code)</td>
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<tr>
<td>Course Type</td>
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Course Learning Objective
- To expose the students to the basics of real analysis and partial differential equations required for their subsequent course work.

Course Content

Functions of real variables, Limits, continuity and differentiability, Taylor’s formula, Extrema of functions.

Riemann integral, mean value theorems, Differentiation under integral sign, Change-of-variables formula, Sequences and series of functions, Point wise and uniform convergence.

Method of separation of variables-Fourier series solution applications to one dimensional wave equation and one-dimensional heat flow equation.

Laplace and Helmholtz equations, Boundary and initial value problems, Solution by separation of variables and Eigen Function Expansion.

Course outcomes
CO1: Develops an understanding for the construction of proofs and an appreciation for deductive logic.
CO2: Explore the already familiar properties of the derivative and the Riemann Integral, set on a more rigorous and formal footing which is central to avoiding inconsistencies in engineering applications.
CO3: Explore new theoretical dimensions of uniform convergence, completeness and important consequences as interchange of limit operations.
CO4: Develop an intuition for analyzing sets of higher dimension (mostly of the $\mathbb{R}^n$ type) space.
CO5: Solve the most common PDEs, recurrent in engineering using standard techniques and understanding of an appreciation for the need of numerical techniques.

Text Books

Reference Books
Course Code : ECPC31  
Course Title : Signals and Systems  
Number of Credits : 4  
Prerequisites (Course code) : NONE  
Course Type : PC

Course Learning Objectives
The aim of the course is for
- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of vector space, inner product space and orthogonal series.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Course Content

Continuous-time signals, classifications. Periodic signals. Fourier series representation, Hilbert transform and its properties.


Course outcomes
CO1: apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
CO2: analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
CO3: classify systems based on their properties and determine the response of LSI system using convolution.
CO4: analyze system properties based on impulse response and Fourier analysis.
CO5: apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.
CO6: understand the process of sampling and the effects of under sampling.

Text Books
Reference Books
<table>
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<tr>
<th>Course Code</th>
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<td>Course Title</td>
<td>Network Analysis and Synthesis</td>
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<tr>
<td>Number of Credits</td>
<td>3</td>
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<td>NONE</td>
</tr>
<tr>
<td>Course Type</td>
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</table>

**Course Learning Objectives**
- To make the students capable of analyzing any given electrical network.
- To make the students to learn synthesis of an electrical network for a given impedance/admittance function.

**Course Content**


**Course outcomes**
CO1: analyze the electric circuit using network theorems
CO2: understand and Obtain Transient & Forced response
CO3: determine Sinusoidal steady state response; understand the real time applications of maximum power transfer theorem and equalizer
CO4: understand the two–port network parameters, are able to find out two-port network parameters & overall response for interconnection of two-port networks.
CO5: synthesize one port network using Foster form, Cauer form.

**Text Books**

**Reference Books**
Course Code : ECPC33
Course Title : Electrodynamics and Electromagnetic Waves
Number of Credits : 4
Prerequisites (Course code) : NONE
Course Type : PC

Course Learning Objectives
- To expose the students to the rudiments of Electromagnetic theory and wave propagation essential for subsequent courses on microwave engineering, antennas and wireless communication

Course Content


Course outcomes
CO1: recognize and classify the basic Electrostatic theorems and laws and to derive them.
CO2: discuss the behavior of Electric fields in matter and Polarization concepts.
CO3: classify the basic Magneto static theorems and laws and infer the magnetic properties of matter.
CO4: summarize the concepts of electrodynamics &to derive and discuss the Maxwell’s equations.
CO5: students are expected to be familiar with Electromagnetic wave propagation and wave polarization.

Text Books

Reference Books
Course Code : ECPC34
Course Title : Semiconductor Physics and Devices
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : PC

Course Learning Objectives
- To make the students understand the fundamentals of electronic devices.
- To train them to apply these devices in mostly used and important applications.

Course Content
Semiconductor materials: crystal growth, film formation, lithography, etching and doping. Formation of energy bands in solids, Concept of hole, Intrinsic and extrinsic semiconductors, conductivity, Equilibrium Carrier concentration, Density of states and Fermi level, Carrier transport – Drift and Diffusion, continuity equation, Hall effect and its applications.

P-N junction diodes, Energy band diagram, biasing, V-I characteristics, capacitances. Diode models, Break down Mechanisms, Rectifiers, Limiting and Clamping Circuits, types of diodes.

BJT Physics and Characteristics modes of operation, Ebers-Moll Model, BJT as a switch and Amplifier, breakdown mechanisms, Photo devices.

MOSFET: Ideal I-V characteristics, non-ideal I-V effects, MOS Capacitor, MOSFET as switch, CMOS Logic gate Circuits, Bi-CMOS circuits, CCDs.

Power devices, operation and characteristics. Thyristor family. Power diodes. Power transistors. Display devices, Operation of LCDs, Plasma, LED and HDTV

Course outcomes
CO1: Apply the knowledge of basic semiconductor material physics and understand fabrication processes.
CO2: Analyze the characteristics of various electronic devices like diode, transistor etc.,
CO3: Classify and analyze the various circuit configurations of Transistor and MOSFETs.
CO4: Illustrate the qualitative knowledge of Power electronic Devices.
CO5: Become Aware of the latest technological changes in Display Devices.

Text Books
1. S.M.Sze, Semiconductors Devices, Physics and Technology, (2/e), Wiley, 2002

Reference Books
Course Code : ECPC35
Course Title : Digital Circuits and Systems
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : PC

Course Learning Objectives
- To introduce the theoretical and circuit aspects of digital electronics, which is the backbone for the basics of the hardware aspect of digital computers?

Course Content
Review of number systems-representation-conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms-minterm and maxterm, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates.

Combinational logic circuits- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions- using decoders-using multiplexers. Memories – ROM- organization, expansion. PROMs. Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.


Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine- serial binary adder, sequence recogniser, state table reduction, state assignment. Hazard; Overview and comparison of logic families.

Introduction to Verilog HDL, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits.

Course outcomes
CO1: Apply the knowledge of Boolean algebra and simplification of Boolean expressions to deduce optimal digital networks.
CO2: Study and examine the SSI, MSI and Programmable combinational networks.
CO3: Study and investigate the sequential networks suing counters and shift registers; summarize the performance of logic families with respect to their speed, power consumption, number of ICs and cost.
CO4: Work out SSI and MSI digital networks given a state diagram based on Mealy and Moore configurations.
CO5: Code combinational and sequential networks using Virology HDL.

Text Books

Reference Books
<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Devices and Networks Laboratory</td>
</tr>
<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>ECPC32 &amp; ECPC34</td>
</tr>
<tr>
<td>Course Type</td>
<td>ELR</td>
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</tbody>
</table>

**List of Experiments:**

1. Study Experiment
2. PN Junction Diode Characteristics
3. Zener diode characteristics and its application
4. Characteristics study of Bipolar Junction Transistor (BJT)
5. Characteristics study of JFET
6. Response study of Series RLC
7. Constant K High pass Filter
8. Attenuators
9. Equalizers
10. Clippers and Clampers
11. SCR Characteristics
12. LAB view implementation

<table>
<thead>
<tr>
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<td>Course Title</td>
<td>Digital Electronics Laboratory</td>
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<tr>
<td>Course Type</td>
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</table>

**List of Experiments:**

1. Study of logic gates and verification of Boolean Laws.
2. Design of adders and subtractors.
3. Design of code converters.
4. Design of Multiplexers.
5. Design of De-multiplexers.
7. 2-bit and 8-bit magnitude comparators.
8. Study of flip-flops.
10. Design and implementation of shift registers.
### Course Code
MAIR45

### Course Title
Probability Theory and Random Processes

### Number of Credits
3

### Prerequisites (Course code)
MAIR 34

### Course Type
GIR

### Course Learning Objectives
- To expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.

### Course Content

Random variables and random vectors. Distributions and densities. Independent random variables. Functions of one and two random variables.

Moments and characteristic functions. Inequalities of Chebyshev and Schwartz. Convergence concepts.


### Course Outcomes
- CO1: understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
- CO2: characterize probability models and function of random variables based on single & multiples random variables.
- CO3: evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
- CO4: understand the concept of random processes and determine covariance and spectral density of stationary random processes.
- CO5: demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.

### Text Books

### Reference Books
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<tr>
<th>Course Code</th>
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<tr>
<td>Course Title</td>
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PROFESSIONAL ETHICS: This Course will be provided by the Department of Humanities
Course Code : ECPC41  
Course Title : Digital Signal Processing  
Number of Credits : 4  
Prerequisites (Course code) : ECPC31  
Course Type : PC  

Course Learning Objectives  
- The subject aims to introduce the mathematical approach to manipulate discrete time signals, which are useful to learn digital tele-communication.

Course Content  
Review of VLSI system theory, DTFT, Frequency response of discrete time systems, All pass inverse and minimum phase systems.

DFT, Relationship of DFT to other transforms, FFT, DIT and DIF, FFT algorithm, Linear filtering using DFT and FFT.

Frequency response of FIR filter types, Design of FIR filters, IIR filter design, Mapping formulas, Frequency transformations.

Direct form realization of FIR and IIR systems, Lattice structure for FIR and IIR systems, Finite-word length effects. Limit cycle oscillations.

Sampling rate conversion by an integer and rational factor, Poly phase FIR structures for sampling rate conversion.

Course outcomes  
CO1: analyze discrete-time systems in both time & transform domain and also through pole-zero placement.  
CO2: analyze discrete-time signals and systems using DFT and FFT.  
CO3: design and implement digital finite impulse response (FIR) filters.  
CO4: design and implement digital infinite impulse response (IIR) filters.  
CO5: understand and develop multirate digital signal processing systems.

Text Books  

Reference Books  
Course Learning Objectives

- To expose students to the complete fundamentals and essential feature of waveguides, resonators and microwave components and also able to give an introduction to microwave integrated circuit design.

Course Content

Classification of guided wave solutions-TE, TM and TEM waves. Field analysis transmission lines.


Impedance transformation and matching. Smith Chart, Quarter-wave and half-wave transformers. Binomial and Tchebyshev transformers. Single, double and triple stub matching.

Microstriplines, stripline, slot lines, coplanar waveguide and fin line. Micro strip MIC design aspects. Computer-aided analysis and synthesis.

Course outcomes
CO1: classify the Guided Wave solutions -TE, TM, and TEM.
CO2: analyze and design rectangular waveguides and understand the propagation of electromagnetic waves.
CO3: evaluate the resonance frequency of cavity Resonators and the associated modal field.
CO4: analyze the transmission lines and their parameters using the Smith Chart.
CO5: apply the knowledge to understand various planar transmission lines.

Text Books

Reference Books
Course Learning Objectives

- To make the students understand the fundamentals of electronic circuits.

Course Content
Load line, operating point, biasing methods for BJT and MOSFET. Low frequency and high models of BJT and MOSFET, Small signal Analysis of CE, CS, CD and Cascode amplifier

MOSFET amplifiers: Current mirrors: Basic current mirror, Cascode current mirror, Single-ended amplifiers: CS amplifier – with resistive load, diode connected load, current source load, triode load, source degeneration. CG and CD amplifiers, Cascode amplifier,

Frequency response of amplifiers, Differential Amplifiers, CMRR, Differential amplifiers with active load, Two stage amplifiers

Feedback concept, Properties, Feedback amplifiers, Stability analysis, Condition for oscillation, Sinusoidal oscillators.

Power amplifiers- class A, class B, class AB, Biasing circuits, class C and class D

Course outcomes
CO1: illustrate about rectifiers, transistor and FET amplifiers and its biasing. Also compare the performances of its low frequency models.
CO 2: discuss about the frequency response of MOSFET and BJT amplifiers.
CO 3: illustrate about MOS and BJT differential amplifiers and its characteristics.
CO4: discuss about the feedback concepts and construct feedback amplifiers and oscillators. Also summarizes its performance parameters.
CO 5: explain about power amplifiers and its types and also analyze its characteristics.

Text Books

Reference Books
Course Code : ECPC44  
Course Title : Microprocessors and Micro Controllers  
Number of Credits : 3  
Prerequisites (Course code) : ECPC35  
Course Type : PC

Course Learning Objectives
This subject deals about the basics of 16-bit Microprocessor, 8-bit and 16-bit Micro controllers, their architectures, internal organization and their functions, peripherals, and interfacing.

Course Content


Course outcomes
CO1: recall and apply the basic concept of digital fundamentals to Microprocessor based personal computer system.
CO2: identify the detailed s/w & h/w structure of the Microprocessor.
CO3: illustrate how the different peripherals are interfaced with Microprocessor.
CO4: distinguish and analyze the properties of Microprocessors & Microcontrollers.
CO5: analyze the data transfer information through serial & parallel ports.
CO6: train their practical knowledge through laboratory experiments.

Text Books

Reference Books
Course Code     : ECLR41
Course Title    : Electronic Circuits Laboratory
Number of Credits : 2
Prerequisites (Course code) : ECPC43
Course Type     : ELR

List of Experiments:

Hardware Experiments

1. Stability of Q point
2. Single stage RC coupled CE amplifier
3. Single stage RC coupled Current series CE feedback amplifier
4. Darlington emitter follower
5. Differential Amplifier
6. RC phase shift oscillator
7. Colpitt’s Oscillator
8. Power amplifier – Class A & class AB

Simulation Experiments

9. MOS CS amplifier with resistive load, diode connected load, current source load
10. MOS current mirrors

Course Code     : ECLR42
Course Title    : Microprocessor and Microcontroller Laboratory
Number of Credits : 2
Prerequisites (Course code) : ECPC44
Course Type     : ELR

List of Experiments

Intel 8086 – 16bit μP- Emulator.
1. Addressing modes of 8086 Microprocessor .
2. Block move and simple arithmetic operations .
3. Identification and displaying the activated key using DOS and BIOS function calls.

Intel 8051 (8-bit Microcontroller) - Proteus VSM Simulator and Trainer Kit
6. Toggling the ports and counting the pulses.
7. LCD Interfacing.
8. Generation of different waveforms using DAC (0808)
9. ADC interfacing.

Mixed-Signal Microcontroller – 16bit – MSP430 series
10. PWM generation and speed control of Motors using MSP430.
FIFTH SEMESTER

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Statistical Theory of Communication</td>
</tr>
<tr>
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<tr>
<td>Prerequisites (Course code)</td>
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<tr>
<td>Course Type</td>
<td>PC</td>
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</table>

Course Learning Objectives
- The subject aims to make the students to understand the statistical theory of telecommunication, which are the basics to learn analog and digital telecommunication.

Course Content


Coherent signal detection in the presence of additive white and non-white Gaussian noise. Matched filter.


Course outcomes
CO1: show how the information is measured and able to use it for effective coding.
CO2: summarize how the channel capacity is computed for various channels.
CO3: use various techniques involved in basic detection and estimation theory to solve the problem.
CO4: summarize the applications of detection theory in telecommunication.
CO5: summarize the application of estimation theory in telecommunication.

Text Books

Reference Books
Course Code : ECPC52
Course Title : Digital Signal Processors and Applications
Number of Credits : 3
Prerequisites (Course code) : ECPC41
Course Type : PC

Course Learning Objectives

- To give an exposure to the various fixed point and floating point DSP architectures, to understand the techniques to interface sensors and I/O circuits and to implement applications using these processors.

Course Content


Course outcomes

CO1: learn the architecture details of fixed point DSPs.
CO2: learn the architecture details of floating point DSPs
CO3: infer about the control instructions, interrupts, pipeline operations, memory and buses.
CO4: illustrate the features of on-chip peripheral devices and its interfacing with real time application devices.
CO5: learn to implement the signal processing algorithms and applications in DSPs

Text Books

Reference Books

Course Code : ECPC53
Course Title : Analog Communication
Number of Credits : 3
Prerequisites (Course code) : ECPC31
Course Type : PC

Course Learning Objectives

- To develop a fundamental understanding on Communication Systems with emphasis on analog modulation techniques and noise performance.

Course Content


Noise - Internal and External Noise, Noise Calculation, Noise Figure. Noise in linear and nonlinear AM receivers, Threshold effect.

Noise in FM receivers, Threshold effect, Capture effect, FM Threshold reduction, Pre-emphasis and De-emphasis.


Course outcomes

CO1: Understand the basics of communication system and analog modulation techniques
CO2: Apply the basic knowledge of signals and systems and understand the concept of Frequency modulation.
CO3: Apply the basic knowledge of electronic circuits and understand the effect of Noise in communication system and noise performance of AM system
CO4: Understand the effect of noise performance of FM system.
CO5: Understand TDM and Pulse Modulation techniques.

Text Books

Reference Books
Course Code: ECPC54
Course Title: Analog Integrated Circuits
Number of Credits: 3
Prerequisites (Course code): ECPC43
Course Type: PC

Course Learning Objectives
- To introduce the theoretical & circuit aspects of an Op-amp.

Course Content

Active filters: Second order filter transfer function (low pass, high pass, band pass and band reject), Butterworth, Chebyshev and Bessel filters. Switched capacitor filter. notch filter, All pass filters, self-tuned filters

Opamp as a comparator, Schmitt trigger, Astable and monostable multivibrators, Triangular wave generator, Multivibrators using 555 timer, Data converters: A/D and D/A converters

PLL- basic block diagram and operation, Four quadrant multipliers. Phase detector, VCO, Applications of PLL:Frequency synthesizers, AM detection, FM detection and FSK demodulation.

CMOS differential amplifiers: DC analysis and small signal analysis of differential amplifier with resistive load, current mirror load and current source load, Input common-mode range and Common-mode feedback circuits. OTAs vs Opamps. Slew rate, CMRR, PSRR. Two stage amplifiers, Compensation in amplifiers (Dominant pole compensation).

Course outcomes
CO1: infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
CO2: elucidate and design the linear and non linear applications of an opamp and special application Ics.
CO3: explain and compare the working of multi vibrators using special application IC 555 and general purpose opamp.
CO4: classify and comprehend the working principle of data converters.
CO5: illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication.

Text Books
2. Sedra and Smith, Microelectronics Circuits, Oxford Univ. Press, 2004
**Course Code**: ECLR51  
**Course Title**: Analog Integrated Circuits Laboratory  
**Number of Credits**: 2  
**Prerequisites (Course code)**: ECPC54  
**Course Type**: ELR

**List of Experiments:**

**Hardware Experiments**
1. Study the characteristics of negative feedback amplifier  
2. Design of an instrumentation amplifier  
3. Study the characteristics of regenerative feedback system-Schmitt trigger  
4. Study the characteristics of integrator circuit  
5. Design of a second order butterworth band-pass filter for the given higher and lower cut-off frequencies  
6. Design of a high-Q Band pass self-tuned filter for a given center frequency  
7. Design of a function generator- Square, Triangular  
8. Design of a Voltage Controlled Oscillator  
9. Design of a Phase Locked Loop(PLL) (Mini project)

**Simulation Experiments**  
DC and small signal analysis of differential amplifier with resistive load, current mirror load and current source load, Input common-mode range and Common-mode feedback circuits, CMRR, PSRR.

**Course Code**: ECLR52  
**Course Title**: Digital Signal Processing and Simulation Laboratory  
**Number of Credits**: 2  
**Prerequisites (Course code)**: ECPC41 & ECPC52  
**Course Type**: ELR

**List of Experiments:**

**MATLAB Experiments**
1. Realization of correlation of two discrete signals  
2. Realization of sub band filter using linear convolution  
3. Design and implementation of FIR filter  
4. Design and implementation of IIR filter  
5. Realization of STFT using FFT  
6. Demonstration of Bayes technique  
7. Demonstration of Min-max technique  
8. Realization of FIR Wiener filter

**TMS320C54X Processor Experiments**
9. Study of various addressing modes  
10. Sequence generation and number sorting  
11. Convolution using overlap add and overlap save methods  
12. Wave pattern generation  
13. FIR filter implementation
SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>Course Title</td>
<td>Digital Communication</td>
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<td>Course Type</td>
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</table>

**Course Learning Objectives**

- To understand the key modules of digital communication systems with emphasis on digital modulation techniques.
- To get introduced to the basics of source and channel coding/decoding and Spread Spectrum Modulation.

**Course Content**


BASK, BFSK, and BPSK- Transmitter, Receiver, Signal space diagram, Error probabilities.

M-ary PSK, M-ary FSK, QAM, MSK and GMSK- Optimum detector, Signal constellation, error probability.

Linear block codes- Encoding and decoding. Cyclic codes – Encoder, Syndrome Calculator. Convolutional codes – encoding, Viterbi decoding. TCM.

Spread Spectrum (SS) Techniques- Direct Sequence Spread Spectrum modulation, Frequency-hop Spread Spectrum modulation - Processing gain and jamming margin.

**Course outcomes**

CO1: Apply the knowledge of signals and system and explain the conventional digital communication system.

CO2: Apply the knowledge of statistical theory of communication and evaluate the performance of digital communication system in the presence of noise.

CO3: Describe and analyze the performance of advance modulation techniques.

CO4: Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.

CO5: Describe and analyze the digital communication system with spread spectrum modulation.

**Text Books**


**Reference Books**

Course Code : ECPC62
Course Title : Wireless Communication
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : PC

Course Learning Objectives

- To get an understanding of mobile radio communication principles, types and to study the recent trends adopted in cellular and wireless systems and standards.

Course Content


Path loss prediction over hilly terrain. Practical link budget design using Path loss models. Design parameters at base station. Antenna location, spacing, heights and configurations.

Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum. Power control. WCDMA. CDMA network design. OFDM and MC-CDMA.


Course outcomes

CO1: Apply the knowledge of basic communication systems and its principles.
CO2: Describe the cellular concept and analyze capacity improvement Techniques.
CO3: Mathematically analyze mobile radio propagation mechanisms.
CO4: Summarize diversity reception techniques.
CO5: Design Base Station (BS) parameters and analyze the antenna configurations.
CO6: Analyze and examine the multiple access techniques and its application.
CO7: Assess the latest wireless technologies.

Text Books:

Reference Books:
Course Code                      : ECPC63
Course Title                    : VLSI Systems
Number of Credits               : 3
Prerequisites (Course code)     : ECPC35
Course Type                     : PC

Course Learning Objectives
• To introduce various aspects of VLSI circuits and their design including testing.

Course Content
VLSI design methodology, VLSI technology- NMOS, CMOS and BICMOS circuit fabrication. Layout design rules. Stick diagram. Latch up.

Characteristics of MOS and CMOS switches. Implementation of logic circuits using MOS and CMOS technology, multiplexers and memory, MOS transistors, threshold voltage, MOS device design equations. MOS models, small-signal AC analysis. CMOS inverters, propagation delay of inverters, Pseudo NMOS, Dynamic CMOS logic circuits, power dissipation.


An overview of the features of advanced FPGAs, IP cores, Softcore processors, Various factors determining the cost of a VLSI, Comparison of ASICs, FPGAs, PDSPs and CBICs. Fault tolerant VLSI architectures

VLSI testing -need for testing, manufacturing test principles, design strategies for test, chip level and system level test techniques.

Course outcomes
CO1: Describe the techniques used for VLSI fabrication, design of CMOS logic circuits, switches and memory
CO2: Describe the techniques used the design of CMOS logic circuits, switches and memory in VLSI
CO3: Generalize the design techniques and analyze the characteristics of VLSI circuits such as area, speed and power dissipation
CO4: Explain and compare the architectures for FPGA, PAL and PLDs and evaluate their characteristics such as area, power dissipation and reliability
CO4: Use the advanced FPGAs to realize Digital signal processing systems
CO5: Describe the techniques for fault tolerant VLSI circuits
CO6: Explain and compare the techniques for chip level and board level testing

Text Books

Reference Books
Course Code : ECPC64  
Course Title : Antennas and Propagation  
Number of Credits : 3  
Prerequisites (Course code) : ECPC33  
Course Type : PC

Course Learning Objectives

- To impart knowledge on basics of antenna theory and to analyze and design a start of art antenna for wireless communications.

Course Content


Wave Propagation: Propagation in free space. Propagation around the earth, surface wave propagation, structure of the ionosphere, propagation of plane waves in ionized medium, Determination of critical frequency, MUF. Fading, tropospheric propagation, Super refraction.

Course outcomes

CO1: select the appropriate portion of electromagnetic theory and its application to antennas.  
CO2: distinguish the receiving antennas from transmitting antennas, analyze and justify their characteristics.  
CO3: assess the need for antenna arrays and mathematically analyze the types of antenna arrays.  
CO4: distinguish primary from secondary antennas and analyze their characteristics by applying optics and acoustics principles.  
CO5: outline the factors involved in the propagation of radio waves using practical antennas.

Text Books


Reference Books

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<td>Course Title</td>
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<td>Number of Credits</td>
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</tr>
<tr>
<td>Course Type</td>
<td>: ELR</td>
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**List of Experiments:**
1. AM Modulation and Demodulation
2. DSB-SC Modulation
3. Pulse Amplitude Modulation and Demodulation
4. Pulse Width Modulation and Demodulation
5. Pulse Position Modulation using PLL(IC 565)
6. Amplitude Shift Keying (ASK) Modulation and Demodulation
7. Frequency Shift Keying (FSK) Modulation and Demodulation
8. Frequency Multiplier using PLL
9. Analog and digital modulation using COMMSIM simulation tool
10. Analog and digital modulation using MATLAB
11. Study of wireless communication system using Wi-Comm Kit

<table>
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<th>Course Code</th>
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<tr>
<td>Course Title</td>
<td>: VLSI and Embedded System Design Laboratory</td>
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<td>: ECPC63</td>
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<td>Course Type</td>
<td>: ELR</td>
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**List of Experiments:**

**USING QUARTUS II**
1. Adders and subtractors
2. Mux &Demux
3. Encoders & Decoders
4. Flip-Flops
5. Shift-Registers & Counters

**USING XILINX**
6. Working with RAM
7. Comparators, parity generators & ALU
8. Counters and Shift Registers
9. Carry look ahead adder
10. MULTIPLIERS

**WARP DESIGN**
- Lab1: Introduction to WARP Design Flows
- Lab2: Building a Simple Transmitter
- Lab3: Building a Simple and Unidirectional MAC
- Lab4: Building a single-carrier streaming PHY.
SEVENTH SEMESTER

<table>
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<tr>
<th>Course Code</th>
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<tr>
<td>Course Title</td>
<td>Microwave Components and Circuits</td>
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<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>ECPC42</td>
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<tr>
<td>Course Type</td>
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</table>

Course Learning Objectives
- The subject introduces the essential Microwave Circuit Theory and the design aspects of Microwave Integrated Circuit components.

Course Content
Scattering matrix formulation. Passive microwave devices; terminations, bends, corners, attenuators, phase changers, directional couplers and hybrid junctions. Basics and design considerations of Microstripline, strip line, coplanar waveguide, Slot line and Finline.

Microwave measurements; frequency, wavelength, VSWR. Impedance determination. S-parameter measurements. Network analyzer.


MIC filter design. Low pass to high pass, band pass and band stop transformations. Realization using microstriplines and strip lines.

Design and realization of MIC components. 3 dB hybrid design. Ratrace Hybrid Ring, Backward wave directional coupler, power divider; realization using microstrip lines and strip lines.

Course outcomes
CO1: Learn the basics of S parameters and use them in describing the components
CO2: Expose to the Microwave Measurements Principle
CO3: Realize the importance of the theory of Microwave circuit theory.
CO4: Work out the complete design aspects of various M.I.C. Filters
CO5: Confidently design all M.I.C. components to meet the industry standard

Text Books

Reference Books
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<tr>
<th>Course Code</th>
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<td>Course Title</td>
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**INDUSTRIAL ECONOMICS AND FOREIGN TRADE:** This Course will be provided by the Department of Humanities.
EIGHTH SEMESTER

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<td>Course Title</td>
<td>Fiber Optic Communication</td>
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<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>ECPC33 &amp; ECPC53</td>
</tr>
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<td>Course Type</td>
<td>PC</td>
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</tbody>
</table>

Course Learning Objectives
- To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Course Content


Optical sources and detectors. Laser fundamentals. Semiconductor Laser basics. LEDs. PIN and Avalanche photodiodes, Optical Tx/Rx Circuits.


Course outcomes
CO1: Recognize and classify the structures of Optical fiber and types.
CO2: Discuss the channel impairments like losses and dispersion.
CO3: Analyze various coupling losses.
CO4: Classify the Optical sources and detectors and to discuss their principle.
CO5: Familiar with Design considerations of fiber optic systems.

Text Books

Reference Books
PROGRAMME ELECTIVES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>: ECPE11</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>: Display Systems</td>
</tr>
<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>: ECPC34</td>
</tr>
<tr>
<td>Course Type</td>
<td>: PE</td>
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</tbody>
</table>

Course Learning Objectives

- To expose the students to the basics of the display systems and to illustrate the current design practices of the display systems.

Course Content

Introduction to displays, Requirements of displays, Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays.

Head mounted displays. Displays less than and greater than 0.5 m diagonal. Low power and light emitting displays.

Operation of TFTs and MIMS. LCDs, Brightness. Types of LCD displays.

Emissive displays, ACTFEL, Plasma display and Field emission displays, operating principle and performance.

Types of Displays: 3D, HDTV, LED, Touch screen.

Course outcomes

CO1: appreciate the technical requirement of different types of display systems
CO2: analyze the various low power lighting systems
CO3: understand the operation of TFTs and LCD displays.
CO4: analyze the various kinds of emissive displays
CO5: critically evaluate the recent advancements in the displays device technology.

Text Books


Reference Books

Course Code : ECPE12
Course Title : Statistical Signal Processing
Number of Credits : 3
Prerequisites (Course code) : ECPC41
Course Type : PE

Course learning Objectives

- To develop algorithms for optimum filtering (and prediction) and for adaptive filtering for the given observation processes.
- To enable the students understand the frequency analysis and estimation methods

Course Content


Course outcomes

CO1: apply the knowledge of the discrete-time stochastic processes & its measures and understand various stochastic models.

CO2: develop algorithms for optimum linear filtering and prediction for the given observation processes.

CO3: develop steepest descent, Least Mean Square (LMS), and Recursive Least Squares (RLS) adaptive filter algorithms.

CO4: derive and analyze the statistical properties of the conventional spectral estimators, namely the periodogram, averaged & modified periodogram and Blackman-Tukey methods.

CO5: formulate parametric spectral estimators based upon autoregressive (AR), moving average (MA), and autoregressive moving average (ARMA) models, and detail their statistical properties.

CO6: select an appropriate array processing algorithms for frequency estimation based on the observation models.
Text Books

Course Code : ECPE13
Course Title : Communication Switching Systems
Number of Credits : 3
Prerequisites (Course code) : ECPC53
Course Type : PE

Course learning Objectives
- To understand the working principles of switching systems from manual and electromechanical systems to stored program control systems.

Course Content
Basic elements of communication network. Switching systems. Signaling and signaling functions.


Space division switching. Multiple-stage switching. Design examples. Switching matrix control. Time division switching. Multiple-stage time and space switching.


Course outcomes
CO1: explain the working principle of switching systems involved in telecommunication switching
CO2: assess the need for voice digitization and T Carrier systems
CO3: compare and analyze Line coding techniques and examine its error performance
CO4: design multi stage switching structures involving time and space switching stages
CO5: analyze basic telecommunication traffic theory

Text Books

Reference Books
Course Code : ECPE14  
Course Title : RF MEMS Circuit Design  
Number of Credits : 3  
Prerequisites (Course code) : ECPC42 & ECPC71  
Course Type : PE

Course learning Objectives
- To impart knowledge on basics of MEMS and their applications in RF circuit design.

Course Content


Course outcomes
CO1: learn the Micro machining Processes  
CO2: learn the design and applications of RF MEMS inductors and capacitors.  
CO3: learn about RF MEMS Filters and RF MEMS Phase Shifters.  
CO4: learn about the suitability of micro machined transmission lines for RF MEMS  
CO5: learn about the Micro machined Antennas and Reconfigurable Antennas

Text Book

Reference Books
Course Code : ECPE15
Course Title : Principles of Radar
Number of Credits : 3
Prerequisites (Course code) : ECPC51
Course Type : PE

Course learning Objectives
- To expose the students to the working principles of a radar from a signal processing perspective.

Course content


Radar detection. Optimum Bayesian decision rules. Detection criteria for different target models.


Angle measurement and tracking. Angle measurement and tracking by conical scan and mono pulse. Optimum mono pulse systems.

Course outcomes
CO1: Understand the principle behind radar range equation and different types of targets available.
CO2: Appreciate the different compression techniques of radar pulse signals.
CO3: Distinguish between different detection methods of radar signals.
CO4: Appreciate the building blocks for optimum receiver and Doppler measurements.
CO5: Understand the tracking and scanning methods in the mono pulse systems.

Text books:

Reference Books:
Course Code : ECPE16
Course Title : Digital Signal Processing for Wireless Communication
Number of Credits : 3
Prerequisites (Course code) : ECPC41 & ECPC62
Course Type : PE

Course learning Objectives
- The subject aims to make the students to understand the signal processing approach for wireless communication

Course Content
Physical model for wireless channel- Input /Output models for wireless channel: System function and impulse response of LTV system-Doppler spread-Coherence time-Delay spread-Coherence frequency-Base band system functions and impulse response.
Statistical channel model-Binary detection in flat Rayleigh fading- Non-coherent detection in flat Rician fading-Channel measurement-Use of probing signals to estimate the channel-Rake receiver-Jakes model- Jakes spectrum-Ground reflections-Okumura model-Log normal shadowing- Hatamodel.
Cellular communication-Frequency reuse- Practical Link budget design using path loss models- Design parameters at base station-Antennal location, spacing, heights and configurations- Tele traffic theory.
Multiple access techniques: TDMA, FDMA, CDMA: PN sequences-Multipath diversity-Rake receiver- Receiver synchronization-Multicarrier modulation. Orthogonal frequency division Multiplexing (OFDM): Cyclic prefix-Frequency offset-Peak to average power ratio problem.

Course outcomes
CO1: describe the Coherence time, Coherence frequency, Doppler spread and Delay spread
CO2: model the wireless channel using statistical approach
CO3: prepare the link budget for the wireless communication
CO4: describe various multiple access techniques and diversity techniques
CO5: compare various wireless standards

Textbooks

Reference Books
Course Code : ECPE17
Course Title : Cognitive Radio
Number of Credits : 3
Prerequisites (Course code) : ECPC41
Course Type : PE

Course learning Objectives
- introduces the fundamentals of multi rate signal processing and cognitive radio.

Course Content


Course outcomes
CO1: gain knowledge on multirate systems.
CO2: develop the ability to analyze, design, and implement any application using FPGA.
CO3: be aware of how signal processing concepts can be used for efficient FPGA based system design.
CO4: understand the rapid advances in Cognitive radio technologies.
CO5: explore DDFS, CORDIC and its application

Text Books

Reference Books
Course Code       : ECPE18
Course Title      : Broadband Access Technologies
Number of Credits : 3
Prerequisites (Course code) : ECPC53 & ECPC61
Course Type       : PE

Course learning Objectives
- To impart fundamentals and latest technologies related to the design of broadband last mile-Access technologies for multimedia communication

Course Content
Wired access technologies using Phone line modem, ISDN modem. Comparison-Cable, DSL, fiber and wireless access technologies.

Last mile copper access, Flavors of Digital subscriber lines, DSL deployment, Common local loop impairments, discrete multitone modulation, VDSL deployment and frequency plans. Standards for XDSL and comparison.

Last mile HFC access, Cable modems. Modulation schemes, DOCSIS. Standards- comparison, physical and MAC layer protocols for HFC networks, ATM and IP-centric modem. Switched digital video.

Fiber access technologies and architectures. ATM passive optical networks, Upstream and downstream transport, Frame format, Ethernet passive optical network, Gigabit passive optical networks.

Survey on emerging broadband wireless access technologies. LMDS,MMDS,WIMAX and WIFI, Satellite technologies serving as last mile solutions, Wireless LAN, Wireless personal area networking, 3G and 4G wireless systems.

Course outcomes
CO1: recall and identify the basics of broadband technology systems and differentiate the differences between the various wired and wireless technology system
CO2: illustrate the aspects of last mile data transport on copper wire networks and flavors of DSL
CO3: summarize the versions of cable network standard and MAC protocols for HFC networks
CO4: distinguish the cost effective broadband services for residential users and ATM based and Ethernet based passive optical networks
CO5: outline the types of broadband wireless access technologies and their characteristics.

Text Books
1. N.Jayant, “Broadband last mile”-Taylor and Francisgroup,2005

Reference Books
4. DOCSIS 2.0 “Radio frequency interface specification”www.cablemodem.com
<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Satellite Communication</td>
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<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>ECPC61</td>
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<tr>
<td>Course Type</td>
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</tbody>
</table>

**Course learning Objectives**

- To introduce and to make understand the radio propagation channel for Earth station to satellite & satellite to Earth station.
- To introduce various aspects in the design of communication & multiple access systems for satellite communication.
- To introduce the concept of launchers and design of Earth station and satellite link.

**Course Content**


Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.

Multiple access techniques. FDMA, TDMA, CDMA. Random access techniques. Satellite onboard processing.

Satellite Link Design: Performance requirement and standards. VSAT, Mobile satellite services: GSM, GPS, DBS, DTH, MATV, CATV, Satellite based personal communication.


**Course outcomes**

CO1: understand how analog and digital technologies are used for satellite communication networks.
CO2: To understand the radio frequency channel from earth station to satellite.
CO3: learn the dynamics of the satellite
CO4: learn the keplerian elements
CO5: study the design of Earth station and tracking of the satellites

**Text books:**


**Reference Books:**

Course Code : ECPE20
Course Title : Microwave Integrated Circuit Design
Number of Credits : 3
Prerequisites (Course code) : ECPC42 & ECPC71
Course Type : PE

Course learning Objectives
- To impart knowledge on basics of microwave electron beam devices and their applications in X band frequency.

Course Content
Design and realization of power dividers, hybrids, directional couplers etc using strip lines and microstrip lines.

Course outcomes
CO1: the topics will make students design of the important and essential M.I.C. components
CO2: Filter is the most needed circuit for many applications and the unit will make the student confident in filter design
CO3: All aspects and different parameters, design factors and properties will me made thorough
CO4: One will be confident to handle any oscillator design
CO5: The student will become familiar and confident in the design of Mixers, the other essential circuits.

Text Books

Reference Books
Course Code : ECPC21  
Course Title : Microwave Electronics  
Number of Credits : 3  
Prerequisites (Course code) : ECPC71  
Course Type : PC

Course Learning Objectives

- To impart knowledge on basics of microwave electron beam devices and their applications in X band frequency.

Course Content

Limitations of conventional vacuum tubes, Klystrons: Reentrant cavities, Two cavity klystron, Velocity modulation process, Bunching process, Power output and efficiency; Multi-cavity klystron, Reflex klystron-Velocity modulation process, Mode Characteristics, Electronic admittance spiral.

Travelling-wave tubes: Slow-wave structures, Helix TWT- Amplification process, Convection current, Wave modes and gain; Coupled cavity TWT, Backward wave oscillator.

Crossed -field devices: Magnetrons- Principle of operation, characteristics, Hull cut-off condition; Carcinotron, Gyrotron.

Microwave transistors and FETs: Microwave bipolar transistors-Physical structures, characteristics, Power-frequency limitations; Microwave tunnel diode, Microwave unipolar transistor – Physical structure, principle of operation, characteristics, High electron-mobility transistors.

Transferred electron and Avalanche transit-time devices: Gunn diode, Gunn diode as an oscillator. IMPATT, TRAPATT and BARITT.

Course outcomes

CO1: Apply the basic knowledge of waveguide and microwave resonator circuits.  
CO2: Assess the methods used for generation and amplification of the microwave power.  
CO3: Distinguish between the linear and cross field electron beam microwave tubes.  
CO4: Critically analyze the operating principles and performances of the microwave semiconductor devices.  
CO5: Identify the suitable microwave power sources of given specification for the selected application.  
CO6: Aware of current technological changes in the engineering aspects of microwave components.

Text Book


Reference Books

Course Code : ECPE22
Course Title : Electronic Packaging
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : PE

Course learning Objectives
- To introduce and discuss various issues related to the system packaging.

Course Content


Course outcomes
CO1: describe the functions and applications of packages and materials used for packaging.
CO2: explain the procedure used for evaluating the electrical aspects of packaging including delay, cross talk
CO3: apply the design technique and analyse the electrical characteristics of VLSI circuits.
CO4: describe about the single chip and multi chip packages and techniques.
CO5: explain the techniques for bonding the packages to dies.
CO6: explain the technique used for fabrication and characteristics of single layer and multi layer PCBs and compare their performances.
CO7: describe about thermal management techniques for packages and reliability of packages.
Text Book


Reference Books

OPEN ELECTIVES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>: ECOE 11</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Computer Architecture and Organization</td>
</tr>
<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>NONE</td>
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<tr>
<td>Course Type</td>
<td>OE</td>
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</tbody>
</table>

Course learning Objectives
- To understand how computers are constructed out of a set of functional units and how the functional units operate, interact, and communicate.
- To make the students to understand the concept of interfacing memory and various I/O devices to a computer system using a suitable bus system.

Course Content

**Introduction**: Function and structure of a computer, Functional components of a Computer, Interconnection of components, Performance of a computer.

**Representation of Instructions**: Machine instructions, Memory locations & Addresses, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures, Super scalar Architectures, Fixed point and floating point operations.

**Basic Processing Unit**: Fundamental concepts, ALU, Control unit, Multiple bus organization, Hardwired control, Micro programmed control, Pipelining, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Performance considerations.

**Memory organization**: Basic concepts, Semiconductor RAM memories, ROM, Speed - Size and cost, Memory Interfacing circuits, Cache memory, Improving cache performance, Memory management unit, Shared/Distributed Memory, Cache coherency in multiprocessor, Segmentation, Paging, Concept of virtual memory, Address translation, Secondary storage devices.

**I/O Organization**: Accessing I/O devices, Input/output programming, Interrupts, Exception Handling, DMA, Buses, I/O interfaces- Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini band, I/O peripherals.

Course outcomes
- CO1: apply the basic knowledge of digital concept to the functional components of a Computer System.
- CO2: analyze the addressing mode concepts and design the instruction set Architecture.
- CO3: identify the functions of various processing units within the CPU of a Computer System.
- CO4: analyze the function of the memory management unit and create suitable memory interface to the CPU.
- CO5: recognize the need for recent Bus standards and I/O devices.

Text Books
Reference Books

1. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design,
Course Code : ECOE12
Course Title : Multimedia Communication Technology
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : OE

Course learning Objectives
- To made the students to understand various encoding and decoding techniques of audios and videos in multimedia systems.

Course content
Components of multimedia system, Desirable features, Applications of multimedia systems, Introduction to different types, Multimedia storage device.


Feature of MPEG 1, structure of encoding and decoding process, MPEG 2 enhancements, different blocks of MPEG video encoder.


Course outcomes
CO1: analyze various components of the multimedia systems and its storage devices.
CO2: appreciate the different coding standards for the digital audio and musical synthesizers.
CO3: understand the various types of DCT based image encoding algorithms
CO4: understand the encoding and decoding process of the MPEG standards
CO5: analyse the different content based video processing techniques.

Text Books

Reference Books
<table>
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<tr>
<th>Course Code</th>
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<tr>
<td>Course Title</td>
<td>ARM System Architecture</td>
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<tr>
<td>Number of Credits</td>
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<td>Course Type</td>
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</tbody>
</table>

**Course learning Objectives**
- The objective of this course is to give the students a thorough exposure to ARM architecture and make the students to learn the ARM programming & Thumb programming models.

**Course content**
RISC machine. ARM programmer’s model. ARM Instruction Set. Assembly level language programming. Development tools.

ARM organization. ARM instruction execution. ARM implementation. ARM coprocessor interface. Interrupt response.


Thumb programmer’s model. Thumb Instruction set. Thumb implementation.


**Course outcomes**
CO1: describe the programmer’s model of ARM processor and create and test assembly level programming.
CO2: analyze various types of coprocessors and design suitable co-processor interface to ARM processor.
CO3: analyze floating point processor architecture and its architectural support for higher level language.
CO4: become aware of the Thumb mode of operation of ARM.
CO5: identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.

**Text Books**

**Reference Books**
1. Technical reference manual for ARM processor cores, including Cortex, ARM 11, ARM 9 & ARM 7 processor families.
Course Code : ECOE14
Course Title : Networks and Protocols
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : OE

Course Learning Objectives
- To get an understanding on the fundamentals of networks and issues involved.
- To acquire an understanding on the set of rules and procedures that mediates the exchange of information between communicating devices.

Course Content
Network Components, Topologies, Network hardware and software, Network Models: OSI Model & TCP/IP Protocol stack, HTTP FTP, SMTP, POP, SNMP, DNS, Socket programming with TCP and UDP.

Transport Layer services, UDP, TCP, SCTP, Principles of reliable data transfer, Flow control, Congestion Control, Quality of Service.

Network Layer services, Datagram and Virtual circuit service, DHCP, IPV4, IPV6, ICMP, Unicast routing protocols: DV, LS and Path vector routing, Multicast routing.

Data Link Layer services, Overview of Circuit and Packet switches, ARP, Data link control: HDLC & PPP, Multiple access protocols, Wireless LAN, Comparison wired and wireless LAN.


Course outcomes
CO1: Compare and examine, OSI and TCP/IP protocol stacks
CO2: Categorize services offered by all layers in TCP/IP protocol stack
CO3: Analyze a network under congestion and propose solutions for reliable data transfer
CO4: Examine the protocols operating at different layers of TCP/IP model
CO5: Assess the cryptographic techniques.
CO6: Manage a network and propose solutions under network security threats.

Text Books

Reference Books
Course Code : ECOE15  
Course Title : Ad hoc Wireless Networks  
Number of Credits : 3  
Prerequisites (Course code) : NONE  
Course Type : OE

Course learning Objectives
- To analyse the various design issues and challenges in the layered architecture of Ad hoc wireless networks

Course Content

Design goals of a MAC protocol, Contention based protocols; Contention based protocols with reservation mechanisms and scheduling mechanisms, MAC protocols using directional antennas.

Table driven routing protocols, On demand routing protocols, hybrid routing protocols, Hierarchical routing protocols, Power aware routing protocols, Tree based and mesh based multicast routing protocols

Network security requirements-Issues and challenges, network security attacks, key management, secure routing protocols

Energy management schemes-Battery management, transmission power management, system power management schemes. Quality of service solutions in ad hoc wireless networks.

Course outcomes
CO1: compare the differences between cellular and ad hoc networks and the analyse the challenges at various layers and applications
CO2: summarize the protocols used at the MAC layer and scheduling mechanisms
CO3: compare and analyze types of routing protocols used for unicast and multicast routing
CO4: examine the network security solution and routing mechanism
CO5: evaluate the energy management schemes and Quality of service solution in ad hoc networks

Text books
2. S.Basagni, M.Conti, “Mobile ad hoc networking”, Wielyinterscience2004
3. C. E.Perkins ,”Ad hoc networking”, AddisonWesley,2001

Reference books
**Course Code**: ECOE16  
**Course Title**: Digital Image Processing  
**Number of Credits**: 3  
**Prerequisites (Course code)**: NONE  
**Course Type**: OE

### Course learning Objectives
- To treat the 2D systems as an extension of 1D system design and discuss techniques specific to 2D systems.

### Course Content
Linearity and space-invariance. PSF, Discrete images and image transforms, 2-D sampling and reconstruction, Image quantization, 2-D transforms and properties.


### Course outcomes
CO1: analyze the need for image transforms, types and their properties.
CO2: become skilled at different techniques employed for the enhancement of images both in spatial and frequency domain.
CO3: explore causes for image degradation and to teach various restoration techniques.
CO4: evaluate the image compression techniques in spatial and frequency domain.
CO5: gain knowledge of feature extraction techniques for image analysis and recognition.

### Text Books

### Reference Books
Course Code : ECOE17
Course Title : Wireless Sensor Networks
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : OE

Course learning Objectives

- To overview the various design issues and challenges in the layered architecture of Wireless sensor networks

Course Content

Motivation for a network of wireless sensor nodes-Definitions and background-challenges and constraints for wireless sensor networks-Applications. Node architecture-sensing subsystems, processing Subsystems, Communication interfaces, Prototypes.

Physical layer- Introduction, wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication, packet transmission and synchronization, quality of wireless channels and measures for improvement, physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, PowerManagement

Data link layer- Fundamentals of wireless MAC protocols, Characteristics of MAC protocol in wireless sensor networks contention-based protocols, Contention free MAC protocols,HybridMACprotocols


Case study-Target detection tracking, Habitat monitoring, Environmental disaster monitoring, Practical implementation issues, IEEE 802.15.4 low rate WPAN, Operating System Design Issues. Simulationtools.

Course outcomes

CO1: analyze the challenges and constraints of wireless sensor network and its subsystems
CO2: examine the physical layer specification, modulation and transceiver design considerations
CO3: analyze the protocols used at the MAC layer and scheduling mechanisms
CO4: compare and analyse the types of routing protocols and data aggregation techniques
CO5: identify the application areas and practical implementation issues.

Text books


Reference Books

**Course Code**: ECOE18  
**Course Title**: Digital Speech Processing  
**Number of Credits**: 3  
**Prerequisites (Course code)**: NONE  
**Course Type**: OE

**Course learning Objectives**
- The purpose of this course is to explain how DSP techniques could be used for solving problems in speech communication.

**Course Content**

Feature extraction of the speech signal: Endpoint detection-Dynamic time warping- Pitch frequency estimation: Autocorrelation approach- Homomorphic approach-Formant frequency estimation using vocal tract model and Homomorphic approach-Linear predictive co-efficient - Poles of the vocal tract-Reflection co-efficient-Log Arearatio.

Cepstrum- Line spectral frequencies- Functional blocks of the ear- Mel frequency cepstral co-efficients- Spectrogram-Time resolution versus frequency resolution-Discrete wavelet transformation.


**Course outcomes**
CO1: illustrate how the speech production is modeled  
CO2: summarize the various techniques involved in collecting the features from the speech signal in both time and frequency domain  
CO3: summarize the functional blocks of the ear  
CO4: compare the various pattern recognition techniques involved in speech and speaker detection  
CO5: summarize the various speech compression techniques

**Text Books**
1. L.R.Rabiner and R.W.Schafer,” Introduction to Digital speech processing”,now publishers USA,2007  
Reference Books

Course Code : ECOE19
Course Title : Pattern Recognition
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : OE

Course learning Objectives

- The subject aims to make the students to understand the mathematical approach for pattern recognition.

Course Content


Linear models for regression and classification: Linear basis function models for regression - Bias variance decomposition-Bayesian linear regression-Discriminant functions - Fisher’s linear discriminant analysis (LDA) - Principal Component Analysis (PCA) - Probabilistic generative model - Probabilistic discriminative model.


Neural networks: Feed-forward Network functions-Network training - Error Back propagation - The Hessian Matrix - Regularization in Neural Network - Mixture density networks – Bayesian Neural Networks

Course outcomes

CO1: summarize the various techniques involved in pattern recognition
CO2: identify the suitable pattern recognition techniques for the particular applications.
CO3: categorize the various pattern recognition techniques into supervised and unsupervised.
CO4: summarize the mixture models based pattern recognition techniques
CO5: summarize the artificial neural network based pattern recognition techniques

Text Books


Reference Books

## Minors Offered

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Signals and Systems</td>
</tr>
<tr>
<td>Number of Credits</td>
<td>3</td>
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<tr>
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<td>MI</td>
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### Course Learning Objectives
- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of vector space, inner product space and orthogonal series.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

### Course Content
- Continuous-time signals, classifications. Periodic signals. Fourier series representation, Hilbert transform and its properties.

### Course outcomes
- CO1: apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
- CO2: analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
- CO3: classify systems based on their properties and determine the response of LSI system using convolution.
- CO4: analyze system properties based on impulse response and Fourier analysis.
- CO5: apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.
- CO6: understand the process of sampling and the effects of under sampling.

### Text Books
Reference Books
Course Code : ECMI12
Course Title : Network Analysis and Synthesis
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : MI

Course Learning Objectives
- To make the students capable of analyzing any given electrical network.
- To make the students to learn synthesis of an electrical network for a given impedance/admittance function.

Course Content

Course outcomes
CO1: analyze the electric circuit using network theorems
CO2: understand and Obtain Transient & Forced response
CO3: determine Sinusoidal steady state response; understand the real time applications of maximum power transfer theorem and equalizer
CO4: understand the two–port network parameters, are able to find out two-port network parameters & overall response for interconnection of two-port networks.
CO5: synthesize one port network using Foster form, Cauer form.

Text Books

Reference Books
Course Code : ECMI11
Course Title : Electrodynamics and Electromagnetic Waves
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : MI

Course Learning Objective
- To expose the students to the rudiments of Electromagnetic theory and wave propagation essential for subsequent courses on microwave engineering, antennas and wireless communication

Course Content


Course outcomes
CO1: recognize and classify the basic Electrostatic theorems and laws and to derive them.
CO2: discuss the behaviour of Electric fields in matter and Polarization concepts.
CO3: classify the basic Magneto static theorems and laws and infer the magnetic properties of matter.
CO4: summarize the concepts of electrodynamics &to derive and discuss the Maxwell’s equations.
CO5: students are expected to be familiar with Electromagnetic wave propagation and wave polarization.

Text Books

Reference Books
Course Code : ECMI14
Course Title : Semiconductor Physics and Devices
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : MI

Course Learning Objective
- To make the students understand the fundamentals of electronic devices.
- To train them to apply these devices in mostly used and important applications.

Course Content
Semiconductor materials: crystal growth, film formation, lithography, etching and doping. Formation of energy bands in solids, Concept of hole, Intrinsic and extrinsic semiconductors, conductivity, Equilibrium Carrier concentration, Density of states and Fermi level, Carrier transport – Drift and Diffusion, continuity equation, Hall effect and its applications.

P-N junction diodes, Energy band diagram, biasing, V-I characteristics, capacitances. Diode models, Break down Mechanisms, Rectifiers, Limiting and Clamping Circuits, types of diodes.

BJT Physics and Characteristics modes of operation, Ebers-Moll Model, BJT as a switch and Amplifier, breakdown mechanisms, Photo devices.

MOSFET: Ideal I-V characteristics, non-ideal I-V effects, MOS Capacitor, MOSFET as switch, CMOS Logic gate Circuits, Bi-CMOS circuits, CCDs.

Power devices, operation and characteristics. Thyristor family. Power diodes. Power transistors. Display devices, Operation of LCDs, Plasma, LED and HDTV

Course outcomes
CO1: Apply the knowledge of basic semiconductor material physics and understand fabrication processes.
CO2: Analyze the characteristics of various electronic devices like diode, transistor etc.,
CO3: Classify and analyze the various circuit configurations of Transistor and MOSFETs.
CO4: Illustrate the qualitative knowledge of Power electronic Devices.
CO5: Become Aware of the latest technological changes in Display Devices.

Text Books

Reference Books
Course Code : ECMI15
Course Title : Digital Circuits and Systems
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : MI

Course Learning Objective

- To introduce the theoretical and circuit aspects of digital electronics, which is the backbone for the basics of the hardware aspect of digital computers?

Course Content

Review of number systems-representation-conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms-minterm and maxterm, Simplification of Boolean expressions- Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates.

Combinational logic circuits- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions- using decoders-using multiplexers. Memories – ROM- organization, expansion. PROMs. Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.


Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine- serial binary adder, sequence recogniser, state table reduction, state assignment. Hazard; Overview and comparison of logic families.

Introduction to Verilog HDL, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits.

Course outcomes

CO1: Apply the knowledge of Boolean algebra and simplification of Boolean expressions to deduce optimal digital networks.

CO2: Study and examine the SSI, MSI and Programmable combinational networks.

CO3: Study and investigate the sequential networks suing counters and shift registers; summarize the performance of logic families with respect to their speed, power consumption, number of ICs and cost.

CO4: Work out SSI and MSI digital networks given a state diagram based on Mealy and Moore configurations.

CO5: Code combinational and sequential networks using Virology HDL.

Text Books


Reference Books
Course Code : ECMI16
Course Title : Digital Signal Processing
Number of Credits : 3
Prerequisites (Course code) : ECMI11
Course Type : MI

Course Learning Objective
- The subject aims to introduce the mathematical approach to manipulate discrete time signals, which are useful to learn digital tele-communication.

Course Content
Review of VLSI system theory, DTFT, Frequency response of discrete time systems, all pass inverse and minimum phase systems.
DFT, Relationship of DFT to other transforms, FFT, DIT and DIF, FFT algorithm, Linear filtering using DFT and FFT.
Frequency response of FIR filter types, Design of FIR filters, IIR filter design, Mapping formulas, Frequency transformations.
Direct form realization of FIR and IIR systems, Lattice structure for FIR and IIR systems, Finite-word length effects. Limit cycle oscillations.
Sampling rate conversion by an integer and rational factor, Poly phase FIR structures for sampling rate conversion.

Course outcomes
CO1: analyze discrete-time systems in both time & transform domain and also through pole-zero placement.
CO2: analyze discrete-time signals and systems using DFT and FFT.
CO3: design and implement digital finite impulse response (FIR) filters.
CO4: design and implement digital infinite impulse response (IIR) filters.
CO5: understand and develop multirate digital signal processing systems.

Text Books

Reference Books
Course Code : ECMI17
Course Title : Analog Communication
Number of Credits : 3
Prerequisites (Course code) : ECMI11
Course Type : MI

Course Learning Objective
- To develop a fundamental understanding on Communication Systems with emphasis on analog modulation techniques and noise performance.

Course Content

Course outcomes
CO1: Understand the basics of communication system and analog modulation techniques
CO2: Apply the basic knowledge of signals and systems and understand the concept of Frequency modulation.
CO3: Apply the basic knowledge of electronic circuits and understand the effect of Noise in communication system and noise performance of AM system
CO4: Understand the effect of noise performance of FM system.
CO5: Understand TDM and Pulse Modulation techniques.

Text Books

Reference Books
Course Code : ECMI18
Course Title : Digital Communication
Number of Credits : 3
Prerequisites (Course code) : ECMI17
Course Type : MI

Course Learning Objectives
- To understand the key modules of digital communication systems with emphasis on digital modulation techniques.
- To get introduced to the basics of source and channel coding/decoding and Spread Spectrum Modulation.

Course Content

BASK, BFSK, and BPSK- Transmitter, Receiver, Signal space diagram, Error probabilities.

M-ary PSK, M-ary FSK, QAM, MSK and GMSK- Optimum detector, Signal constellation, error probability.

Linear block codes-Encoding and decoding, Cyclic codes – Encoder, Syndrome Calculator. Convolutional codes – encoding, Viterbi decoding, TCM.

Spread Spectrum (SS) Techniques- Direct Sequence Spread Spectrum modulation, Frequency-hop Spread Spectrum modulation - Processing gain and jamming margin.

Course outcomes
CO1: Apply the knowledge of signals and system and explain the conventional digital communication system.
CO2: Apply the knowledge of statistical theory of communication and evaluate the performance of digital communication system in the presence of noise.
CO3: Describe and analyze the performance of advance modulation techniques.
CO4: Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.
CO5: Describe and analyze the digital communication system with spread spectrum modulation.

Text Books

Reference Books
Course Learning Objective

- To get an understanding of mobile radio communication principles, types and to study the recent trends adopted in cellular and wireless systems and standards.

Course Content


Path loss prediction over hilly terrain. Practical link budget design using Path loss models. Design parameters at base station. Antenna location, spacing, heights and configurations.

Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum. Power control. WCDMA, CDMA network design. OFDM and MC-CDMA.


Course outcomes

CO1: Apply the knowledge of basic communication systems and its principles.
CO2: Describe the cellular concept and analyze capacity improvement Techniques.
CO3: Mathematically analyze mobile radio propagation mechanisms.
CO4: Summarize diversity reception techniques.
CO5: Design Base Station (BS) parameters and analyze the antenna configurations.
CO6: Analyze and examine the multiple access techniques and its application.
CO7: Assess the latest wireless technologies.

Text Books:

Reference Books:
**HONORS**

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<th>Course Code</th>
<th>ECHO11</th>
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<tr>
<td>Course Title</td>
<td>Advanced Digital Signal Processing</td>
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<tr>
<td>Number of Credits</td>
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<td>ECPC41</td>
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<td>Course Type</td>
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**Course learning Objectives**

- To provide rigorous foundations in multirate signal processing, power spectrum estimation and adaptive filters.

**Course Content**

Review of sampling theory. Sampling rate conversion by integer and rational factors. Efficient realization and applications of sampling rate conversion.


**Course outcomes**

CO1: summarize multirate DSP and design efficient digital filters.
CO2: construct multi-channel filter banks.
CO3: select linear filtering techniques to engineering problems.
CO4: describe the most important adaptive filter generic problems.
CO5: describe the various adaptive filter algorithms.
CO6: describe the statistical properties of the conventional spectral estimators.

**Text books**


**Reference Books**

Course Code : ECHO12
Course Title : Spectral Analysis of Signals
Number of Credits : 3
Prerequisites (Course code) : ECPC41
Course Type : HO

Course learning Objectives
- To give an exhaustive survey of methods available for power spectrum estimation.

Course Content


Course outcomes
CO1: derive and analyse the statistical properties of the conventional spectral estimators, namely the periodogram, averaged & modified periodogram and Blackman-Tukey methods.
CO2: formulate modern, parametric, spectral estimators based upon autoregressive (AR), moving average (MA), and autoregressive moving average (ARMA) models, and detail their statistical properties. Describe the consequence of the term resolution as applied to a spectral estimator.
CO3: define techniques for calculating moments in spectral and temporal domains; Analyze filter bank method, capon methods for spectrum estimation.
CO4: demonstrate knowledge and understanding of the principles of parametric and non-parametric array processing algorithms.
CO5: select an appropriate array processing algorithms for frequency estimation and sonar, radar applications.

Text books

Reference Books
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<td>Course Title</td>
<td>Detection and Estimation</td>
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<td>Prerequisites</td>
<td>MAIR45</td>
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**Course learning Objectives**

- The objective of this course is to make the students conversant with those aspects of statistical decision and estimation which are indispensable tools required for the optimal design of digital communication systems.

**Course Content**

Binary hypothesis testing; Bayes, minimax and Neyman-Pearson tests. Composite hypothesis testing.


Signal detection in continuous time: Detection of deterministic signals in Gaussian noise. Coherent detection in white Gaussian noise.

**Course outcomes**

CO1: summarize the fundamental concept on Statistical Decision Theory and Hypothesis Testing
CO2: summarize the various signal estimation techniques with additive noise
CO3: summarizer with Bayesian parameter estimation (minimum mean square error (MMSE), minimum mean absolute error (MMAE), maximum a-posteriori probability (MAP) estimation methods).
CO4: compare optimal filtering, linear estimation, and Wiener/Kalman filtering. CO5: construct Wiener and Kalman filters (time discrete) and state space models.

**Text Books**


**Reference Books**

Course Code: ECHO14
Course Title: Wavelet Signal Processing
Number of Credits: 3
Prerequisites (Course code): ECPC41
Course Type: HO

Course learning Objectives
- To expose the students to the basics of wavelet theory and to illustrate the use of wavelet processing for data compression and noise suppression.

Course Content


Wavelet methods for image processing. Burt-Adelson and Mallat’s pyramidal decomposition schemes. 2D-dyadic wavelet transform.

Course outcomes
CO1: understand about windowed Fourier transform and difference between windowed Fourier transform and wavelet transform.
CO2: understand wavelet basis and characterize continuous and discrete wavelet transforms.
CO3: understand multi resolution analysis and identify various wavelets and evaluate their time-frequency resolution properties.
CO4: implement discrete wavelet transforms with multirate digital filters.
CO5: understand about wavelet packets.
CO6: design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

Text books

Reference Books
1. A.Teolis, Computational Signal Processing with Wavelets, Birkhauser, 1998
Course Code : ECHO15
Course Title : RF Circuits
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : HO

Course learning Objectives
- To impart knowledge on basics of IC design at RF frequencies.

Course Content
Characteristics of passive IC components at RF frequencies – interconnects, resistors, capacitors, inductors and transformers – Transmission lines. Noise – classical two-port noise theory, noise models for active and passive components High frequency amplifier design – zeros as bandwidth enhancers, shunt-series amplifier, f doublers, neutralization and unilateralization

Low noise amplifier design – LNA topologies, power constrained noise optimization, linearity and large signal performance

Mixers – multiplier-based mixers, subsampling mixers, diode-ringmixers

RF power amplifiers – Class A, AB, B, C, D, E and F amplifiers, modulation of power amplifiers, linearity considerations

Oscillators & synthesizers – describing functions, resonators, negative resistance oscillators, synthesis with static moduli, synthesis with dithering moduli, combination synthesizers – phase noise considerations.

Course outcomes
CO1: Understand the Noise models for passive components and noise theory
CO2: Analyse the design of a high frequency amplifier
CO3: Appreciate the different LNA topologies & design techniques
CO4: Distinguish between different types of mixers
CO5: Analyse the various types of synthesizers, oscillators and their characteristics.

Text Books

Reference Books
Course Code : ECHO16
Course Title : Numerical Techniques for MIC
Number of Credits : 3
Prerequisites (Course code) : ECPC71
Course Type : HO

Course learning Objectives
- This subject will prepare the student to face the challenging problem of the most important component of Research namely the numerical analysis.

Course Content

The Finite Element Method Introduction The Method of Weighted Residuals The Variational Method Using a Variational Expression The Finite Element Method Integral Formulation of Problems Antennas and Scattering from Conductors Waveguides-Hollow,Dielectric and Optical Finite Difference in space and Time Matrix Computations A Finite Element Computer Program forMicrostrips

Planar Circuit Analysis Introduction Planar Circuit Analysis’ Function Approach Impedence Green’s Functions Contour Integral Approach Analysis of Planar Components of Composite Configurations Planar Circuits with Anisotropic Spacing Media Applications of the Planar Circuits Concept Summary

Spectral Domain Approach Introduction General Approach for Shielded Microstrip Lines The Immittance Approach Formulations for Slot lines, Fin lines, and Coplanar Waveguides Numerical Computation

Transverse Resonance Technique Introduction Inhomogeneous Waveguides Uniform Along a Traverse Coordinate Conventional Traverse Resonance Technique for Transversely Discontinuous Waveguides Generalized Transverse Resonance Technique for Transversely Discontinuous Inhomogeneous Analysis of Discontinuities and Junctions by the Generalized Transverse Resonance Technique Examples of Computer Programs

Course outcomes
CO1: bring awareness of the need for numerical analysis of M.I.C. And prepare to formulate all popular numerical techniques of M.I.C.
CO2: make one formulate and write coding for Finite Element Method
CO3: prepare a person to be strong in the planar circuit Analysis
CO4: bring awareness of the most popular Quasi state analysis Spectral Domain Techniques
CO5: prepare the student formulate and write coding for the Transverse Resonance Techniques

Text Book
Course Code : ECHO17
Course Title : Applied Photonics
Number of Credits : 3
Prerequisites (Course code) : NONE
Course Type : HO

Course learning Objectives
- To prepare the students understand the fundamental principles of light-matter interaction and photonic band gap structures.
- To enable the students appreciate the diverse applications of fiber optic sensors.

Course Content
Introduction to photonics; optical waveguide theory; Interference of light waves - numerical techniques and simulation

Photonic waveguide components Optical Modulators and Switches Electro-optics - Acousto-optics - Magneto-optics

Photonic Band gap Structures: Concept of photonic crystal; bandgap and band structures in 1D, 2D and 3D photonic crystal structures;

Photo-refractive materials, non-linear optics, recent trends in bio and nano-photonics

Optical fiber sensors - Sensing using optical fibers - Types:- Amplitude, Interferometric, Wavelength, Polarimetric – Distributed Sensors

Course outcomes
CO1: understand the interference of light and optical waveguide theory.
CO2: understand the significance of photonic band gap structures and their application
CO3: analyse the different types of optical modulators.
CO4: compare the merits and demerits of different types of fiber optic sensors.
CO5: understand the application of nonlinear optics in bio and nanophotonics.

Text Books
2. Pochi Yeh and Amnon Yariv Photonics,” Optical Electronics in Modern Communications”, 2007

Reference Books
Course Code : ECHO18  
Course Title : Advanced Radiation Systems  
Number of Credits : 3  
Prerequisites (Course code) : ECPC64  
Course Type : HO  

Course learning Objectives
- To prepare the students understand the operating principles of various RF radiating systems.
- To enable the students appreciate the diverse applications of radiating systems.
- To design the suitable antenna systems to serve a defined application.

Course Content
Antenna Fundamentals: Antenna fundamental parameters, Radiation integrals, Radiation from surface and line current distributions – dipole, monopole, loop antenna; Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.
Apertures Antennas: Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.
Arrays: General structure of phased array, linear array theory, variation of gain as a function of pointing direction, frequency scanned arrays, digital beam forming, and MEMS technology in phased arrays-Retro directive and self phased arrays.
Micro Strip Antenna: Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from transmission line model, cavity model; input impedance of rectangular and circular patch antenna; Application of microstrip array antenna.

Course outcomes
CO1: understand the various antenna parameters and different impedance matching techniques.
CO2: understand the working principle of apertures antennas.
CO3: analyze how the electronic beam formation is done using array of antennas.
CO4: compare the merits and demerits of various microwave patch antenna structures.
CO5: understand the photonic band gap structures and its application in terahertz antennas.

Text Books

Reference Books
Course Code: ECHO19
Course Title: Bio MEMS
Number of Credits: 3
Prerequisites (Course code): ECPC44
Course Type: HO

Course learning Objectives
- To train the students in the design aspects of Bio MEMS devices and Systems. To make the students aware of applications in various medical specialists especially the Comparison of conventions methods and Bio MEMS usage.

Course Content

Introduction: The driving force behind Biomedical Applications-Biocompatibility-Reliability Considerations-Regularity Considerations-Organizations-Education of Bio MEMS-Silicon Micro fabrication-Soft Fabrication techniques


Sensor Principles and Micro Sensors: Introduction-Fabrication-Basic Sensors-Optical fibers-Piezo electricity and SAW devices-Electrochemical detection-Applications in Medicine


Micro Total Analysis: Lab on Chip-Capillary Electrophoresis Arrays-cell, molecule and Particle Handling-Surface Modification-Microsphere-Cell based Bioassay Systems

Detection and Measurement Methods: Emerging Bio MEMS Technology-Packaging, Power, Data and RF Safety-Biocompatibility, Standards

Course outcomes
CO1: learn and realize the MEMS applications in Bio Medical Engineering
CO2: understand the Micro fluidic Principles and study its applications.
CO3: learn the applications of Sensors in Health Engineering.
CO4: learn the principles of Micro Actuators and Drug Delivery system
CO5: learn the principles and applications of Micro Total Analysis

Text Book

Reference Books
Course Code : ECHO20
Course Title : Analog IC Design
Number of Credits : 3
Prerequisites (Course code) : ECPC54
Course Type : HO

Course learning Objectives
- To develop the ability design and analyze MOS based Analog VLSI circuits to draw the equivalent circuits of MOS based Analog VLSI and analyze their performance.
- To develop the skills to design analog VLSI circuits for a given specification.

Course Content
Basic MOS Device Physics – General Considerations, MOS I/V Characteristics, Second Order effects, MOS Device models. Short Channel Effects and Device Models. Single Stage Amplifiers – Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascade Stage.


Bandgap References, Introduction to Switched Capacitor Circuits, Nonlinearity and Mismatch.

Course outcomes
CO1: draw the equivalent circuits of MOS based Analog VLSI and analyze their performance.
CO2: design analog VLSI circuits for a given specification.
CO3: Analyse the frequency response of the different configurations of a amplifier.
CO4: Understand the feedback topologies involved in the amplifier design.
CO5: Appreciate the design features of the differential amplifiers.

Text Books

Reference Books
Course Code : ECHO21
Course Title : VLSI System Testing
Number of Credits : 3
Prerequisites (Course code) : ECPC63
Course Type : HO

Course learning Objectives
- To expose the students, the basics of testing techniques for VLSI circuits and Test Economics.

Course Content

**Basics of Testing**: Fault models, Combinational logic and fault simulation, Test generation for Combinational Circuits. Current sensing based testing. Classification of sequential ATPG methods. Fault collapsing and simulation

**Universal test sets**: Pseudo-exhaustive and iterative logic array testing. Clocking schemes for delay fault testing. Testability classifications for path delay faults. Test generation and fault simulation for path and gate delay faults.


**Design for testability**: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, MemoryTesting.

**Built-in self-test**: Pattern Generators, Estimation of test length, Test points to improve testability, Analysis of aliasing in linear compression, BIST methodologies, BIST for delay fault testing.

Course outcomes
CO1: apply the concepts in testing which can help them design a better yield in IC design.
CO2: tackle the problems associated with testing of semiconductor circuits at earlier design levels so as to significantly reduce the testing costs.
CO3: analyse the various test generation methods for static & dynamic CMOS circuits
CO4: identify the design for testability methods for combinational & sequential CMOS circuits.
CO5: recognize the BIST techniques for Improving testability.

Text Books

Reference Books
Course Code : ECHO22  
Course Title : Electronic Design Automation Tools  
Number of Credits : 3  
Prerequisites (Course code) : NONE  
Course Type : HO  

Course learning Objectives

- To make the students exposed to Front end and Back end VLSI CAD tools.

Course Content


System Verilog- Introduction, Design hierarchy, Data types, Operators and language constructs. Functional coverage, Assertions, Interfaces and test bench structures.


Course outcomes

CO1: understand the special features of VLSI back end and front end CAD tools and Unix shell script.

CO2: write synthesizable verilog and VHDL code.

CO3: write Pspice code for any electronics circuit and to perform monte-carlo analysis and sensitivity/worst case analysis.

CO4: understand the difference between verilog and system verilog and are able to write system verilog code.

CO5: understand Cypress PSOC structure, modules and interconnects.

Text Books


Reference Books

Course Code : ECHO23  
Course Title : Design Of ASICs  
Number of Credits : 3  
Prerequisites (Course code) : NONE  
Course Type : HO

Course learning Objectives
- To prepare the student to be an entry-level industrial standard ASIC or FPGA designer.
- To give the student an understanding of issues and tools related to ASIC/FPGA design and implementation.
- To give the student an understanding of basics of System on Chip and Platform based design.

Course Content
Types of ASICs, VLSI Design flow, Programmable ASICs - Antifuse, SRAM, EPROM, EEPROM based ASICs. Programmable ASIC logic cells and I/O cells. Programmable interconnects. Latest Version - FPGAs and CPLDs and Soft-core processors.
Trade off issues at System Level: Optimization with regard to speed, area and power, asynchronous and low power system design. ASIC physical design issues, System Partitioning, Power Dissipation, Partitioning Methods.
ASIC floor planning, Placement and Routing.
High performance algorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC, USB controllers, OMAP.

Course outcomes
CO1: demonstrate VLSI tool-flow and appreciate FPGA architecture.
CO2: understand the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design.
CO3: understand the algorithms used for ASIC construction
CO4: understand the basics of System on Chip, On chip communication architectures like AMBA, AXI and utilizing Platform based design.
CO5: appreciate high performance algorithms available for ASICs

Text Book

Reference Books
Course Code : ECHO24
Course Title : Digital System Design
Number of Credits : 3
Prerequisites (Course code) : ECPC35
Course Type : HO

Course learning Objectives
- To get an idea about designing complex, high speed digital systems and how to implement such design.

Course Content
Mapping algorithms into Architectures: Data path synthesis, control structures, critical path and worst case timing analysis. FSM and Hazards.
Data path and array subsystems: Addition / Subtraction, Comparators, counters, coding, multiplication and division. SRAM, DRAM, ROM, serial access memory, context addressable memory.
Reconfigurable Computing- Fine grain and Coarse grain architectures, Configuration architectures-Single context, Multi context, Partially reconfigurable, Pipeline reconfigurable, Block Configurable, Parallel processing.

Course outcomes
CO1: identify mapping algorithms into architectures.
CO2: summarize various delays in combinational circuit and its optimization methods.
CO3: summarize circuit design of latches and flip-flops.
CO4: construct combinational and sequential circuits of medium complexity that is based on VLSIs, and programmable logic devices.
CO5: summarize the advanced topics such as reconfigurable computing, partially reconfigurable, Pipeline reconfigurable architectures and block configurable.

Text Books

Reference Books
Course Code : ECHO25
Course Title : Digital Signal Processing Structures for VLSI
Number of Credits : 3
Prerequisites (Course code) : ECPC52 & ECPC63
Course Type : HO

Course learning Objectives
- To make an in depth study of DSP structures amenable to VLSI implementation.
- To enable students to design VLSI system with high speed and low power.
- To make the students to implement DSP algorithm in an optimized method.

Course Content
An overview of DSP concepts, Representations of DSP algorithms. Loop bound and iteration bound. Transformation Techniques: Retiming, Folding and Unfolding
Synchronous pipelining and clocking styles, clock skew and clock distribution in bit level pipelined VLSI designs. Wave pipelining, constraint space diagram and degree of wave pipelining, Implementation of wave- pipelined systems, Asynchronous pipelining.

Course outcomes
CO1: understand the overview of DSP concepts
CO2: improve the speed of digital system through transformation techniques.
CO3: perform Pipelining and parallel processing in FIR systems to achieve high speed and low power.
CO4: perform Pipelining and parallel processing in IIR systems and adaptive filters
CO5: understand clocking issues and asynchronous system.

Text Book

Reference Book
Course Code : ECHO26  
Course Title : Low Power VLSI Circuits  
Number of Credits : 3  
Prerequisites (Course code) : ECPC63  
Course Type : HO  

Course learning Objectives
- To expose the students to the low voltage device modeling, low voltage, low power VLSI CMOS circuit design.

Course Content
Evolution of CMOS technology, 0.25 µm and 0.1 µm technologies. Shallow trench isolation. Lightly-doped drain. Buried channel. BiCMOS and SOI CMOS technologies. Second order effects and capacitance of MOS devices.

CMOS inverters, static logic circuits of CMOS, pass transistor, BiCMOS, SOI CMOS and low power CMOS techniques.

Basic concepts of dynamic logic circuits. Various problems associated with dynamic logic circuits. Differential, BiCMOS and low voltage dynamic logic circuits.

Different types of memory circuits.
Adder circuits, Multipliers and advanced structures – PLA, PLL and Processing unit.

Course outcomes
CO1: acquire the knowledge about various CMOS fabrication process and its modeling.
CO2: infer about the second order effects of MOS transistor characteristics.
CO3: analyze and implement various CMOS static logic circuits.
CO4: learn the design of various CMOS dynamic logic circuits.
CO5: learn the design techniques low voltage and low power CMOS circuits for various applications.
CO6: learn the different types of memory circuits and their design.
CO7: design and implementation of various structures for low power applications.

Text Books

Reference Book
Course Code: ECHO27  
Course Title: VLSI Digital Signal Processing Systems  
Number of Credits: 3  
Prerequisites (Course code): ECPC41 & ECPC63  
Course Type: HO

Course learning Objectives
- To give an in-depth coverage of advanced VLSI Digital Signal Processing Systems.
- To provide knowledge about the effect of finite wordlength.
- To learn regarding the efficient implementation of arithmetic units.

Course Content
Algorithms for fast convolution, Algorithmic strength reduction in filters and transforms: Parallel FIR Filters, DCT and inverse DCT, Parallel Architectures for Rank-Order Filters.


Bit level arithmetic Architectures- parallel multipliers, interleaved floor-plan and bit-plane-based digital filters, Bit serial multipliers, Bit serial filter design and implementation, Canonic signed digit arithmetic, Distributed arithmetic.

Redundant arithmetic - Redundant number representations, carry free radix-2 addition and subtraction, Hybrid radix-4 addition, Radix-2 hybrid redundant multiplication architectures, data format conversion, Redundant to Nonredundant converter.

Numerical Strength Reduction - Subexpression Elimination, Multiple Constant Multiplication, Subexpression Sharing in Digital Filters, Additive and Multiplicative Number Splitting.

Course outcomes
CO1: learn various transforms and its corresponding architectures  
CO2: acquire the knowledge of effect of round off noise computation  
CO3: design Bit level arithmetic Architectures and optimize the implementation of FIR filters and constant multipliers  
CO4: design basic arithmetic units and realize their architecture for higher radices  
CO5: learn different numerical strength reduction techniques

Text Book

Reference Book
Course Code: ECHO28
Course Title: Asynchronous System Design
Number of Credits: 3
Prerequisites (Course code): ECPC35
Course Type: HO

Course learning Objectives
- This subject introduces the fundamentals and performance of Asynchronous system
- To familiarize the dependency graphical analysis of signal transmission graphs
- To learn software languages and its syntax and operations for implementing Asynchronous Designs

Course Content
Fundamentals: Handshake protocols, Muller C-element, Muller pipeline, Circuit implementation styles, theory. Static data-flow structures: Pipelines and rings, Building blocks, examples
High-level languages and tools: Concurrency and message passing in CSP, Tangram program examples, Tangram syntax-directed compilation, Martin’s translation process, Using VHDL for Asynchronous Design. An Introduction to Balsa: Basic concepts, Tool set and design flow, Ancillary Balsa Tools

Course outcomes
CO1: understand the fundamentals of Asynchronous protocols
CO2: analyze the performance of Asynchronous System and implement handshake circuits
CO3: understand the various control circuits and Asynchronous system modules
CO4: gain the experience in using high level languages and tools for Asynchronous Design
CO5: learn commands and control flow of Balsa language for implementing Asynchronous Designs

Text Books

Reference Book
3. A Designer's Guide to Asynchronous VLSI, Peter A. Beerel, Recep O. Ozdag, Marcos Ferretti,2010
**Course Code**: ECHO29  
**Course Title**: Physical Design Automation  
**Number of Credits**: 3  
**Prerequisites (Course code)**: NONE  
**Course Type**: HO

**Course learning Objectives**
- Understand the concepts of Physical Design Process such as partitioning, Floor planning, Placement and Routing.
- Discuss the concepts of design optimization algorithms and their application to physical design automation.
- Understand the concepts of simulation and synthesis in VLSI Design Automation
- Formulate CAD design problems using algorithmic methods

**Course Content**

**Course outcomes**
CO1: know how to place the blocks and how to partition the blocks while for designing the layout for IC.  
CO2: solve the performance issues in circuit layout.  
CO3: analyze physical design problems and Employ appropriate automation algorithms for partitioning, floor planning, placement and routing  
CO4: decompose large mapping problem into pieces, including logic optimization with partitioning, placement and routing  
CO5: analyze circuits using both analytical and CAD tools

**TextBooks**

**Reference Books**
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<th>Course Code</th>
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<td>Course Title</td>
<td>Mixed - Signal Circuit Design</td>
</tr>
<tr>
<td>Number of Credits</td>
<td>3</td>
</tr>
<tr>
<td>Prerequisites (Course code)</td>
<td>NONE</td>
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<tr>
<td>Course Type</td>
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**Course learning Objectives**

- To make the students to understand the design and performance measures concept of mixed signal circuit.

**Course Content**


**Course outcomes**

CO1: Appreciate the fundamentals of data converters and also optimized their performances.
CO2: Understand the design methodology for mixed signal IC design using gm/Id concept.
CO3: Analyze the design of current mirrors and operational amplifiers
CO4: Design the CMOS digital circuits and implement its layout.
CO5: design the frequency and Q tunable time domain filters.

**Text Books**

<table>
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<tr>
<th>Course Code</th>
<th>ECHO31</th>
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<tbody>
<tr>
<td>Course Title</td>
<td>Digital Signal Processing For Medical Imaging</td>
</tr>
<tr>
<td>Number of Credits</td>
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<tr>
<td>Prerequisites (Course code)</td>
<td>ECPC52</td>
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**Course Content**


Introduction to Magnetic resonance imaging-Bloch equation-Larmor frequency and the tip angle –Trick on MRI- Selecting the human slice and the corresponding external RF pulse- Measurement of the Transverse component using the receiver antenna-Sampling the MRI image in the frequency domain-Practical difficulties and remedies in MRI Proton-Density, MRI image – $T_2$ MRI image using Spin-Echo and Cartesian scanning -$T_2$ MRI image using spin-echo and polar scanning - $T_1$ MRI image.


**Course outcomes**

CO1: Describe the signal processing techniques involved in CT based Imaging techniques  
CO2: Describe the signal processing techniques involved in MRI based Imaging techniques  
CO3: Describe the signal processing techniques involved in Nuclear Imaging  
CO4: Describe the signal processing techniques involved in Ultra sound Imaging  
CO5: Describe the signal processing techniques involved in Medical image processing

**Text Books**


**Reference Books**