COURSE CURRICULAM
FOR
4 YEAR
B. TECH UNDERGRADUATE DEGREE COURSE
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable from the academic session 2020-2021)

[An Autonomous Institute]
Haldia, Purba Medinipur, West Bengal, India, 721657

Approved by: All India Council for Technical Education (AICTE)
Affiliated to: Maulana Abul Kalam Azad University of Technology (MAKAUT),
West Bengal
(Formerly Known as - WBUT)
## 1st Year: 1st Semester

### A. Theory

<table>
<thead>
<tr>
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<td>Programming for Problem Solving</td>
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<td>4.</td>
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<td>English Language &amp; Technical Comm.</td>
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<td>Programming Lab</td>
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<td>Language Lab</td>
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## 1st Year: 2nd Semester

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<td>Physics-I</td>
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<td>Basic Electrical &amp; Electronics Engg.</td>
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### C. Non Credit Course

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<td>XC-281</td>
<td>Extra Curricular Activity (NSS, etc.)</td>
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## 2nd Year: 3rd Semester

### A. Theory

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<td>Electronic Devices</td>
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<td>Digital System Design</td>
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<td>EC303</td>
<td>Signals and Systems</td>
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<td>4.</td>
<td>EC304</td>
<td>Network Theory</td>
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<td>5.</td>
<td>ES-CS301</td>
<td>Data Structure (ES)</td>
<td>L:3 T:0 P:0</td>
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<td>Mathematics-III(BS)</td>
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**Total Theory:** 17

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<td>8.</td>
<td>EC392</td>
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<td>HS-HU381</td>
<td>L:0 T:0 P:2</td>
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**Total Practical:** 8

**Total Hours/Credits:** 25 22

### C. Non Credit Course

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<td>12.</td>
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## 2nd Year: 4th Semester

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<tr>
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<td>Analog Communication</td>
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<td>2.</td>
<td>EC402</td>
<td>Analog Electronic Circuits</td>
<td>L:3 T:0 P:0</td>
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<td>3.</td>
<td>EC403</td>
<td>Microprocessor &amp; Microcontrollers</td>
<td>L:3 T:0 P:0</td>
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<td>Design &amp; Analysis of Algorithm(ES)</td>
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<td>Engineering Electromagnetics</td>
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**Total Theory:** 16

### B. Practical

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**Total Practical:** 8

**Total Hours/Credits:** 24 20
# Proposed Syllabus (2021 Batch Onwards)

## 3rd Year: 5th Semester

### A. Theory

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<tr>
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<td>EC501</td>
<td>EM Waves and Transmission Lines</td>
<td>L 3 T 0 P 0</td>
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<td>2.</td>
<td>EC502</td>
<td>Digital Signal Processing</td>
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<td>EC503</td>
<td>Digital Communication</td>
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<td>OE-EC506 A/B/C</td>
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<tr>
<td>7.</td>
<td>EC591</td>
<td>EM Waves and Transmission Lines Lab</td>
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<td>MC581 Essence of Indian Tradition &amp; Culture</td>
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## 3rd Year: 6th Semester

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<td>EC601 Control System &amp; Instrumentation</td>
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<td>EC602 Computer Network</td>
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<tr>
<td>6.</td>
<td>EC691 Control System and Instrumentation Lab.</td>
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<td>EC692 Computer Network Lab.</td>
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<td>EC681 Electronic Design Workshop</td>
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### ELECTRONICS & COMMUNICATION ENGINEERING
### HALDIA INSTITUTE OF TECHNOLOGY
### PROPOSED SYLLABUS (2021 BATCH ONWARDS)

#### 4th Year: 7th Semester

E. Theory

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F. Practical

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<tr>
<td>5.</td>
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<td>Project Stage – I</td>
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#### 4th Year: 8th Semester

G. Theory

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<td>OE-EC804 A/B/C</td>
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H. Practical

|                  |                        |                               |       |     |     |
|------------------|------------------------|-------------------------------|-------|-----|-----|-----|
| 5.               | EC881                   | Internship – II/Industrial Training-II | During Sem Break(7&8) | 4 |
| 6.               | EC882                   | Project Stage – II            | 0 | 0 | 8 | 8 | 4 |
| 7.               | EC883                   | Grand Viva                    |       |     |     | 2 |
|                  |                        | Total Practical               | 8 | 10 |

Total Contact /Credits

|       |                     |                               |       |     |     |
|-------|---------------------|-------------------------------|-------|-----|-----|-----|
|       |                     |                               | 17 | 19 |     |     |
# LIST OF PROGRAM ELECTIVES

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<th>Credits</th>
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<td>PE-EC505A</td>
<td>Information Theory and Coding</td>
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<td>2</td>
<td>PE-EC505B</td>
<td>Mixed Signal Design</td>
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<td>3</td>
<td>PE-EC505C</td>
<td>Power Electronics</td>
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<td>PE-EC603A</td>
<td>Microwave Theory and Techniques</td>
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<td>PE-EC603B</td>
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<td>Speech and Audio Processing</td>
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## LIST OF OPEN ELECTIVES

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<tr>
<th>Sl No.</th>
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<th>Hours/week</th>
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<td>Organisational Behaviour</td>
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Course Objectives

- Providing the core concepts of higher Engineering Mathematics and describing the techniques, this works as an essential tool to solve the problems in their field of applications.
- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

Module-1[8L]
Matrix& Determinant:
Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Rank and nullity; Determinants; minors and cofactors; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module-2[9L]
Differential Calculus:
Successive derivative, Leibnitz’s Theorem; Rolle’s Theorem, Mean value theorem, Taylor’s and Maclaurin’s theorems with remainders;

Sequence and Series:
Basic concept of Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy’s Root test, D’ Alembert’s Ratio test(statements and related problems on these tests), Raabe’s test; Alternating series; Leibnitz’s Test (statement only); Absolute convergence and Conditional convergence.

Module-3[8L]
Integral calculus:
Improper integrals; Beta and Gamma functions and their properties; Convergence of improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Differentiation under integral sign.

Module-4[10L]
Calculus of function of several variables:
Introduction to functions of several variables; Limit and continuity, Partial derivatives, Homogeneous functions and Euler’s theorem up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their applications, Jacobians up to three variables Maxima, minima; Saddle points of functions; Lagrange Multiplier method and their applications; Concept of line integrals, Double and triple integrals.

Module-5[10L]
Vector Calculus:
Scalar and vector triple products with related problems, Equation of straight line, plane and sphere. Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics. Green’s theorem, Gauss Divergence Theorem and Stoke’s theorem (Applications only, proofs not required).

Course Outcomes (COs)
CO1. To provide students with skills in algebra and calculus which would enable them to devise engineering solutions for given situations they may encounter in their profession.
CO2. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice by enhancing the power of knowledge and imagination
CO3. Prepare students for realization of journal papers outcomes, and expose them to the world of research. Illustrate the current research works and publications of the subjects in different fields adopted by the students as per course curriculum in various journals and literature.
CO4. To explore and enhance research potential explain how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals executing the knowledge adopted from the course.
CO5. An ability to function on multi-disciplinary teams. Lighten on the latest and modern developments in the fields.
CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources
1. Advanced Engineering Mathematics, by Erwin Kreyszig is published by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
Course Objectives

- Providing the core concepts of higher Engineering Mathematics and describing the Techniques, this works as an essential tool to solve the problems in their field of applications.
- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

Module -1[10L]
Ordinary differential equation (ODE)- First order and first degree: Exact equations, Necessary and sufficient condition for exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear and non-linear differential equation, Bernoulli’s equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut’s equation).
Second order and first degree: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations.

Module -2[5L]
Basics of Graph Theory: Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph.; Walks, Paths, Circuits, Euler Graph, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.

Module -3[10L]
Laplace Transform: Introduction to integral transformation, functions of exponential order, Definition and existence of LT (initial and final value theorem with applications proofs not required), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine, cosine and exponential integrals using LT, LT of periodic and step functions.
Definition and properties of inverse LT Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Module -4[12L]

Complex Integration: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Cauchy’s theorem (statement only). Cauchy-Goursat theorem (statement only). Cauchy’s integral formula, Cauchy’s integral formula for the derivative of an analytic function, Cauchy’s integral formula for the successive derivatives of an analytic function.
Module -5[8L]

Zeros and Singularities of an Analytic Function & Residue Theorem.

Residue, Cauchy’s Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: \( \int_0^\infty \frac{\sin x}{x} \, dx \), \( \int_0^{2\pi} \frac{d\theta}{a + b\cos\theta + c\sin\theta} \), \( \oint \frac{p(z)}{Q(z)} \, dz \) (elementary cases, P(z) & Q(z) are polynomials of 2nd order or less). Evaluation of certain improper integrals using the Bromwich contour.

Course Outcomes (COs)
CO1. Recall the earlier mathematical thoughts, such as idea of derivative, integration, ordinary differential equations and complex algebra.
CO2. Exhibit the idea of ordinary differential equation of first and higher order. Recognize the concept of graph theory and Laplace transform and complex variable.
CO3. Apply the knowledge of Laplace transform to reduce the complexity of differential equation. Use different graphical algorithm to find optimal solutions.
CO4. Analyze the ideas of mentioned mathematical tools so that it can be implemented to real time engineering problems
CO5. Justify and make gradation of above mentioned mathematical tools and determine the right approach to solve multidisciplinary engineering problems.
CO6. Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry.

Learning Resources
1. Probability and Statistics for Engineers, Miller & Freund R.A. Johnson, Prentice Hall of India
3. Graph Theory: V. K. Balakrishnan, (Schaum’s Outline, TMH)
5. Introductory Course in Differential Equations: Daniel A. Murray (Longmans & Green).
6. Graph Theory: N. Deo (Prentice-Hall of India)
**Total Lecture: 42L**

**Course Objectives**
- To introduce the rudimental and relevant concepts of physics to different branches of Engineering and Technology.
- To compile all the knowledge acquired from the course and to apply in industry, academia, and research keeping in the mind about ethical awareness and impact in the field of environmental (pollution), social (legal) and safety.

**Module-1 [10L]**

**Vector Calculus**
Gradient of a Scalar function, Divergence and Curl of Vector field, Vector Integration – Line-, surface and volume integration - Divergence and Stoke’s Theorem

**Oscillations And Waves**

**Module -2 [11L]**

**Interference** – Division of wave front and division of amplitude - Two-and Multiple Beam Interference, Interference in parallel and wedge shaped films - Newton’s rings - determination of wave length and thickness - Thin film Interference - Anti-reflection Coating – its application.

**Diffraction** – Fresnel and Fraunhofer diffraction - Single Slit, Double Slit and N-Slit Diffraction (Qualitative discussion only)

**Polarization** – Introductory discussion of Polarization – States of Polarization – Brewster’s law –Malus Law – Phase Retardation Plate –Optical Activity

**Lasers** – Characteristics of Laser – Classification of Laser - construction and working - Einstein’s coefficients – Example of Gas Laser, Solid state laser and semiconductor lasers - Applications of Laser

**Module -3 [5L]**

**Statistical Mechanics**
Phase Space (μ- and Γ- phase space) – Macro states and Microstates – Density of States - Statistical Ensemble and Thermodynamic Probability
Classical Statistical systems (Maxwell - Boltzman statistics) and quantum statistical systems (Fermi-Dirac and Bose-Einstein Statistics) and their applications

**Module -4 [10L]**
Quantum Mechanics

Module -5[6L]
Dielectric Polarization
Fundamentals of Dielectric polarization – Macroscopic and microscopic field – Electronic, Ionic, Orientational and Space charge polarization (Qualitative overview) - dielectric loss- Loss tangent - Application of dielectric materials

Magnetic Properties
Fundamentals of magnetic properties – Classification (Dia, Para, Ferro, Anti-ferro, Ferri, Super-para) of magnetic materials – Curie temperature – Magnetic domain – Hysteresis – hard and soft magnetic materials – Applications of Magnetic materials

Course Outcomes(COs)
CO1. Describe how different electronic tools, various parameters & variables of fundamental physics related to the programme. To overcome & eliminate different constraints those may arises by solving the physical and numerical problems.
CO2. Overall enhancement of innovative problems solving ability by enhancing the power of knowledge and imagination.
CO3. Describe the current research works and publications of the subjects in different fields adopted by the students as per course curriculum in various journals and literature.
CO4. Describe how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals to execute the knowledge adopted from the course.
CO5. Define how the ideas can be share with the multi-disciplinary personals. Lighten on the latest and modern developments in the fields.
CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources
1. Vector Analysis – M.R.Spiegel
2. Waves and Oscillation – N.k.Bajaj
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
7. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
8. Solid State Physics, S.O.Pillai
Total Lecture: 42L

Course Objective

- To develop the interest among the students regarding chemistry and their applications in engineering
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

Module I [11L]
Thermodynamics: (6L)
Preliminary information on First Law of Thermodynamics (Principle, Molar Heat Capacity; Relation of \( C_p \) and \( C_v \) (for Ideal and Real Gas); Joule’s Experiment, Joule-Thompson Co-efficient, throttling, Adiabatic Relationship); Second Law, Engine; Carnot’s Cycle; Entropy, Entropy change; Entropy of system/surrounding/Universe; Free Energy, Free energy expression; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations.

Electrochemistry: (2L)
Cell construction; Primary and Secondary Cell; Nernst Equation; Relation with \( \Delta G \), \( \Delta H \) and \( \Delta S \); pH of Cell; Batteries; Fuel Cell

Chemical Kinetics: (3L)
Rate equation; Collision and Activation Theory; Temperature dependency; Complex Reaction; Parallel reaction; Consecutive reaction; Chain Reaction; Homogeneous and Heterogeneous Catalyst; Acid base catalysis; Enzyme Catalysis; Michaelis Menten equation.

Module II [8L]
Atomic structure: (3L)
Preliminary Accounts on Bohr-Sommerfeld model of the atom (Electronic configuration and Quantum numbers; Shapes of \( s, p, d, f \) orbitals - Pauli’s exclusion principle - Hund’s Rule of maximum multiplicity – Aufbau principle). Emission and absorption spectra, line and band spectra; Hydrogen spectrum – Lyman, Balmer, Paschen, Brackett and Pfund series; de-Broglie’s hypothesis; Heisenberg’s uncertainty principle – wave nature of electron – Schrodinger wave equation (No derivation). Eigenfunctions and eigenvalues.

Chemical bonding and Coordination Chemistry: (5L)
Elementary information on Chemical bonding including VBT, Shapes of molecules with hybridization, Valency shell electron pair repulsion (VSEPR) theory. Molecular orbital of diatomic molecules (e.g. \( \text{H}_2, \text{O}_2, \text{N}_2, \text{CO}, \text{HF}, \text{CN}^-, \text{NO}^+ \)). Pi-molecular orbital of butadiene and benzene. Crystal field theory of coordination compounds- magnetism, spin and orbital contribution, quenching of magnetic moment: d-d transitions, color. Metallic bond – concept of conductor, semiconductor, insulator; photoelectric effect.

Module III [7L]
Organic Spectroscopy (7L)
UV-Visible Spectroscopy: Types of electronic transitions, chromophores and auxochromes;
Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects); application of Woodward’s Rules for calculation of $\lambda_{\text{max}}$ for the following systems: conjugated dienes, relative positions of $\lambda_{\text{max}}$ considering conjugative effect, steric effect, solvent effect.

**IR Spectroscopy:** Introduction; modes of molecular vibrations (fundamental and nonfundamental); IR active molecules.

**NMR Spectroscopy:** Basic principles of Proton Magnetic Resonance; NMR active molecules; equivalent and non-equivalent protons with examples; chemical shift. Significance of the terms: up-/downfield, shielded and deshielded protons. Fluorescence, phosphorescence and their application.

**Mass Spectroscopy:** Introduction; Principles, Ion sources, Fragmentation and analysis of mass spectra.

**Module IV [6L]**

**Polymer (3L)**
Molecular weight of Polymers (number average, weight average, viscosity average), Polymerization processes (addition and condensation), Mechanism of addition polymerization (free radical, cationic, anionic, coordination), Poly Dispersity Index (PDI), Degree of Polymerization, Stereo-regularity of polymers (crystallinity and amorphicity). Vulcanization. Conducting, semi-conducting polymers and doping.

**Corrosion (3L)**
Types of corrosion (dry, wet),Pitting corrosion, Crevice corrosion, Galvanic series, Stress corrosion cracking, Corrosion of polymers. Protection from Corrosion (Surface treatments, Reactive coatings, Anodization, Biofilm coatings) Sacrificial anode protection, Rust removal, Passivation, Water treatment (waste, surface), Alkalinity, Scale-sludge.

**Module V [6L]**

**Stereochemistry (4L)**
Different types of isomerism;concept of chirality and optical activity (upto two carbon atoms); elements of symmetry [plane ($\sigma$), center (i) and alternating axis (Sn) of symmetry]; interconversion of Fischer and Newman representations; threo and erythro, D and L, CIP Rules: R/S (upto 2 chiral carbon atoms),E/Z nomenclature. Conformational analysis of ethane, $n$-butane.

**Structure and reactivity of Organic molecule (2L)**
Molecular Effects: Inductive, resonance, hyperconjugation, steric effects. Oxidation and reduction reactions for organic compounds. Some name reactions: Aldol, Cannizzaro, Michael, Claisen-Schmidt, Wittig reactions.

**Module VI [4L]**

**Elementary Chemical Biology:**
Origin of Life and Chemical Elements; Role of concentration of ions/small molecules in the growth profile of cells; Trace and Ultratrace elements; Basic Biomolecules, Elementary reactions in the biological system and roles of metal ions. Function of Fe (with special reference to Hemoglobin and Myoglobin) and Cu (with special reference to Hemocyanin) in Biological system. Toxicity of Hg, As, Pb, F, P(V).Synthesis of some commonly used drug molecules (Aspirin, Paracetamol, Salbutamol and Ibuprofen). Synthesis of some commonly used Pesticides and Insecticides in Agriculture: DDT, Gammaxene/Lindane (organochlorine group), Parathion (organophosphate group) and Carbaryl (carbamate group).
Course Outcomes (COs)

CO1. To memorize the elementary topics of chemistry such as chemical thermodynamics, atomic structures, electromagnetic spectroscopy, corrosion chemistry, electrochemistry, organic reactions and synthesis of drug molecules.

CO2. To acquire knowledge on the fundamental concepts of chemical thermodynamics, atomic structures, electromagnetic spectroscopy, corrosion chemistry, electrochemistry, organic reactions, polymers and synthesis of drug molecules.

CO3. Making use of concepts of drug molecules, polymer chemistry, corrosion chemistry and battery technology to meet day to day necessities including application of the organic synthesis, Maxwell’s equations, spontaneity and equilibrium reactions etc.

CO4. Analyse versatile and novel problems and sorting them out, covering all the topics of the entire course.

CO5. Rationalize, explain and corroborate several chemical problems, determine the most plausible approach of solving real life interdisciplinary chemical complications.

CO6. To construct a purposeful and efficient model through which learners can be able to develop and solve trivial as well as up to date problems recognized by academia, researchers and industries.

Learning Resources

1. P. C. Rakshit, , Physical Chemistry Sarat Book House
2. S. Pahari, , Physical Chemistry New Central Book Agency
4. J. D. Lee, Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd.
13. B. K. Sharma, Industrial Chemistry (including Chemical Engineering), GOEL Publishing House
Course Objectives

- To introduce to students to the field of programming using language.
- To enhance their analyzing and problem solving skills.

Module 1 [12L]
Unit 1: Introduction to Programming (4 L)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2: Arithmetic expressions and precedence (2 L)
Unit 3: Conditional Branching and Loops (6 L)
Writing and evaluation of conditionals and consequent branching
Iteration and loops

Module 2 [12L]
Unit 1: Arrays (6 L)
Arrays (1-D, 2-D), Character arrays and Strings
Unit 2: Basic Algorithms (6 L)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 3 [9L]
Unit 1: Function (5 L)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference
Unit 2: Recursion (4 L)
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 4 [7 L]
Unit 1: Structure (4 L)
Structures, Defining structures and Array of Structures
Unit 2: Pointers (2 L)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list, dynamic memory allocation, Union (no implementation)
Unit 3: File handling (1 L)
Basic idea about read, write, append operation if time is available, otherwise should be done as part of the lab)

Course Outcomes (COs)
CO1. To formulate simple algorithms for arithmetic and logical problems.
CO2. To test and execute the programs and correct syntax and logical errors.
CO3. To implement conditional branching, iteration and recursion.
CO4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach. To use arrays, pointers and structures to formulate algorithms and programs.
CO5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO6. To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources
Total Lecture: 45L

Course Objectives

- To understand the impact of technology in a global and societal context.
- To provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.

Module 1 [3L]
Electromagnetism:
Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faradays’ law, self and mutual inductance, Hysteresis and Eddy current losses, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss

Module 2 [10L]
Circuits Analysis

Module 3 [6L]
Transformers
Single phase transformer: Core and shell type construction, ideal and practical transformer, EMF equation, no load and on load, operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation, Auto-transformer.

Module 4 [10L]
Electrical Machines
DC Machine: Construction, working, torque speed characteristic and speed control of separately excited dc motor.
AC Machine: Construction, Generation of rotating magnetic fields and working of a three-phase induction motor, Torque-slip characteristic, Brief idea about Single Phase Induction Motor and Synchronous generators

Module 6 [8L]
Transistors
Transistor Biasing and Bias stability; calculation of stability factor with variation of Ico Different operating modes; CE, CB, CC and their properties; small signal low frequency operation of transistors; equivalent circuits h parameters as a two port network. Transistors as amplifier: expression of voltage gain, current gain, input impedance and output impedance, frequency...
response for CE amplifier with and without source impedance (qualitative)

Module 7 [5L]
Field Effect Transistor
Construction and characteristics of JFET (N channel only), Transfer characteristics; construction and characteristics of MOSFET (N channel only), depletion and enhancement type; CS, CG, CD configuration

Module 8 [3L]
Operational Amplifier
Concept of virtual earth, inverting and non-inverting mode of operation, voltage summing, difference, constant gain multiplier, voltage follower, comparator, integrator, differentiator.

Course Outcomes (COs)
CO1. To acquire knowledge of different theorems for electric and magnetic circuits analysis. Explain the working principle, construction, applications of Transformer, DC machines, AC machines. Concept of 3 phase power, JFET, MOSFET, OPAMP, sinusoidal voltages and currents in different machines and circuits. Explain fundamental laws and theorems governing the working different electrical machines and circuits. Able to identify the procedures for calculations of different circuit parameters.
CO2. Use the concepts of applying mathematics and science principles, trigonometry, complex algebra, phasor operations to provide solution of different simple problems; critical circuit problems related to electrical systems.
CO3. Analyze series circuits, flow of currents, algebraic sum of voltages (voltage drops) in any closed path in a circuit to examine the behavior of electric circuits and performance characteristics and efficiency of electrical machines.
CO4. Evaluate and judge whether the solutions obtained are correct and matches the required parameters and characteristics.
CO5. Use the knowledge acquired to investigate unknown problems and design and assemble to find a solution to the problem.

Learning Resources
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Nath & Chakraborti
7. Advance Electrical Technology, H.Cotton, Reem Publication
8. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
Paper Name: English Language and Technical Communication  
Category: Humanities and Social Sciences including Management course  

Paper Code: HM-HU 101  
Semester: First  
L-T-P: 2-0-0  
Credit: 2

Total Lecture: 32L

Course Objectives
- To acquire language skills,
- to develop linguistic and communicative competencies for Engineering students.
- to study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

Module 1: Theories of Communication [6L]
Theories and Principles of Communication: Definition, Process, Model (Schematic diagram of Shannon and Weaver’s Model of Communication), Types of Communication – Verbal and Non-verbal communication, Flows of communication Barriers to communication Workplace/ Business Communication which can have the following items:

a) Scope of Oral Communication  
b) Oral Business Communication: Introducing oneself in a professional setup - brevity, context, understatement, body language –  
Task: Introducing others - introducing a junior professional to a senior professional, introducing an employee to a customer, introducing a colleague from your firm to an employee of another firm.  
c) Telephone (audio and video) communication: choice of words, body language, paralinguistic elements of speech, enunciation, brevity, clarification, effective closure

Module 2 : Applied Grammar [9L]
Common Errors in English
- Subject-verb agreement  
- Tenses  
- Noun-pronoun agreement  
- Articles and Prepositions  
- Misplaced or dangling modifiers  
- Redundancies  
- Cliché

Transformation of Sentences
- Active and Passive voice  
- Direct and Indirect speech  
- Degrees of Comparison

Use of phrases and clauses in sentences  
Synthesis of Sentences: Simple, Complex and Compound
Module 3 Vocabulary Building [3L]
The concept of word formation: Compounding, Backformation, Clipping and Blending
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form
derivatives.
Synonym, antonym, phrasal verbs, one word substitution and standard abbreviation

Module 4 Basic Writing Skills [4L]
Documenting: definition, meaning, basic concept of documenting (print and online media),
types of technical documents
Importance of proper punctuation
Creating coherence: Arranging paragraphs & Sentences in logical order
Creating Cohesion: Organizing principles of paragraphs in documents
Techniques for writing precisely

Module 5 Professional Writing Skills [10L]
Technical Report Writing: Types and formats
Comprehension, Précis and Expansion Writing, Essay Writing, Writing SOPs and Project
Proposals.
Business Letters; Cover letter & CV
Office Correspondence:
• Notice
• Agenda
• Minutes
• Memo
• E-mail

Course Outcomes (COs)
CO1. Understanding the mechanism of interpretation through language learning by
practicing reading, writing and comprehension skills.
CO2. Understanding complex engineering problems by a sound grammatically correct
knowledge of the English Language & honing writing, and reading skills for
software research, solutions, marketing etc.
CO3. Equipping learners to solve various problems related to aptitude test through the
practice of various Verbal reasoning and grammar practice.
CO4. Development of analytical thinking through practice of analytical essays, business
 correspondence.
CO5. Learning effective communication strategies for handling criticism and adverse
remarks and also knowing strategies of effective intervention, kinesics and courtesies
and different components of soft skills.
CO6. Awareness about the society, public health and safety, growth and changes in
society, culture and environment through comprehension, technical report writing
practice.
Learning Resources
4. High School English Grammar by Wren and Martin
5. Common Errors in English by S.Prasad & K.P.Thakur, Bharti Bhawan Publishers
7. English Vocabulary in Use- McCarthy
Course Objectives

- To provide exposure to the students with hand on experience for data acquisition, precession, statistical data analysis, graph plotting calculation of fundamental quantities and error estimation of different fundamental physics experiments relevant to various engineering discipline.

All students have to perform total 9 experiments taking at least one from Optics, Electricity & Magnetism, Quantum Mechanics, Miscellaneous experiments and Innovative experiment sections. (One Innovative experiment is mandatory)

List of Experiments

Optics Experiments
1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton’s ring
3. Determination of wavelength of a monochromatic light by Fresnel’s bi-prism
4. Determination of wavelength of the given laser source by diffraction method
5. Determination of numerical aperture, angle of acceptance and bending energy losses of an optical fiber

Electricity & Magnetism Experiments
1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson’s method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
6. Determination of unknown resistance using Carey Foster’s bridge
7. Study of Transient Response in LR, RC and LCR circuits using Exp EYES
8. Generating sound from electrical energy using Exp EYES

Quantum Physics Experiments
1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous Experiments
1. Determination of Young’s modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille’s capillary flow method
7. Measurement of wavelength and velocity of Ultrasonic wave by using Ultrasonic Interferometer.

Innovative Experiments
1. Studies on Bandgap measurement of thin film using UV-VIS spectrophotometer.
2. Basic UV-VIS absorbance study of organic dyes.
3. Basic UV-VIS study of nano-particles (NPs) and quantum dots (Q Dots).
5. Basic photoluminescence study of nano-particles (NPs) and quantum dots (Q Dots).

Course Outcomes (COs)

CO1. Describe the various aspects, parameters, scales of experimental tools and design to conduct the experiments in the laboratory.

CO2. Analyze the methods of experiments and interpret the output results. Emphasis on the limitations of theoretical concepts, measuring instruments to perform the experiments and deviation of results from ideal one.

CO3. Describe the needs of publication of the outcome results and correlate the results with published papers in various journals and literature in the respective fields.

CO4. Describe how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals to execute the knowledge adopted from the course.

CO5. Define how the ideas can be share with the multi - disciplinary personals. Lighten on the latest and modern developments in the fields.

CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources
1. B.Sc. Practical Physics – C.L.Arora
2. B.Sc. Practical Physics – Harnam Singh and Dr. P.S.Hemne – S.Chand
Course Objective

- To be able to design, carry out, record and analyze the results of chemical experiments.
- To demonstrate creative and independent thinking in both learning and work environments.
- To be able to use modern instrumentation and classical techniques, to design experiments and to properly record the results of their experiments.

Name of the Experiments

1. Preparation of Phenyl and Hand Sanitizer owing to its disinfectant and germicidal values.
2. Determination of the partition coefficient of a substance between two immiscible liquids.
3. Complexometric titration for determination of calcium and magnesium hardness of water.
4. Conductometric and pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
5. Determination of dissolved oxygen present in a given water sample.
6. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
7. Determination of percentage composition of sugar solution by viscosity measurement method.
8. Saponification/acid value of oil.
9. Preparation of some useful organic compounds: Pthalimide, Aspirin
10. Study on Thin layer chromatography

Course Outcomes(COs)

CO1. To be able to design, carry out, record and analyze the results of chemical experiments. Students will demonstrate laboratory skills and show understanding in all major laboratory techniques and principles including instrumentation, synthesis, purification, analysis including green chemistry.

CO2. To be skilled in problem solving, critical thinking and analytical reasoning. To operate a range of chemical instrumentation with adequate hands-on experiences.

CO3. To be able to use modern instrumentation and classical techniques, to design experiments and to properly record the results of their experiments.

CO4. To be able to use appropriate literature research and go through journal articles for useful information. Students will show proficiency at scientific communication
including posters, presentations, laboratory reports and even journal articles.

**CO5.** To demonstrate creative and independent thinking in both learning and work environments. Work independently and collaborate effectively with other people in a team. Self-evaluate their own learning progress and develop motivation and learning skills for lifelong learning.

**CO6.** To learn the value of a professional work ethic including working as part of a diverse team. They will develop the ability to recognize ethical issues related to the impact of technological advances on society.

**Learning Resources**

Course Objectives

- To formulate and test simple algorithms for arithmetic and logical problems, execute the programs and correct syntax and logical errors for implementing conditional branching, iteration and recursion.

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given

**Tutorial 1:** Problem solving using computers:
Lab 1: Familiarization with programming environment

**Tutorial 2:** Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

**Tutorial 3:** Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

**Tutorial 4:** Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

**Tutorial 5:** 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

**Tutorial 6:** 2D arrays and Strings
Lab 6: Matrix problems, String operations

**Tutorial 7:** Functions, call by value:
Lab 7: Simple functions

**Tutorial 8 & 9:** Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

**Tutorial 10:** Recursion, structure of recursive calls

**Lab 10:** Recursive functions

**Tutorial 11:** Pointers, structures and dynamic memory allocation

**Lab 11:** Pointers and structures

**Tutorial 12:** File handling:

**Lab 12:** File operations

Course Outcomes (COs)

CO1. To formulate simple algorithms for arithmetic and logical problems.
   To translate the algorithms to programs (in C language).

CO2. To test and execute the programs and correct syntax and logical errors.
   To implement conditional branching, iteration and recursion.

CO3. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO4. To use arrays, pointers and structures to formulate algorithms and programs.

CO5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO6. To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.
Course Objectives

- To give the basic working knowledge required in various engineering based constructions, function, use and application of different working tools, equipment, and machines as well as the technique of manufacturing a product from its raw material.

[Before practice, background lectures will be delivered on the topics. Tool specifications and their materials will be described. Brief reports on the work done will be submitted by the students and evaluation will be made on the basis of examination of the report and viva, conducted by the teachers.]

**Theory**

1. **Carpentry (Wood Working)**
   Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications. Different Joints

2. **Metal Joining**
   Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment. AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

3. **Bench work and Fitting**
   Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

4. **Metal Cutting**
   Introduction to machining and common machining operations. Cutting tool materials, geometry of cutting tool, cutting fluid. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, facing and chamfering and parting. Difference between drilling and boring. Use of measuring instruments like micrometer / verniercaliper.

5. **Tin Smithy**
   Sheet metal introduction, tools and operations, Shearing and Bending of sheets, types of joints

**Jobs to be made in the Workshop**

**Group A** (6 P)

Carpentry Shop: T-Lap joints and Dovetail joint

**Group B** (6 P)

a. Gas Welding practice on mild steel flat/sheet (upto 3mm thick)
b. Lap joint by Gas Welding (upto 3mm thick)
c. Manual Metal Arc Welding practice (upto 5mm thick)
d. Square butt joint by MMA Welding
e. Lap joint by MMA Welding

**Group C**

Fittings work: Sawing and Finishing by Filing. (6 P )

**Group D**

a. Jobs on lathe with turning, facing, chamfering and parting operations  (6 P)
b. Job on shaper and milling machine for finishing two sides of a job (6 P)
c. Drilling of holes of size 5 and 12 mm diameters on the jobs / External threads making by dies, 
Tap size drill hole/ hand tapping operations

**Group E**
Smithy - making simple products on sheet metal (6 P)

**Course Outcomes (COs)**

CO1. Define, describe and determine the types and nature of the physical parameters like cutting speed, feed, depth of cut etc applied on mechanical manufacturing systems.

CO2. Classify and explain the effects of the above physical parameters as applied on mechanical manufacturing systems for proper comprehension.

CO3. Train the students in metal joining process like welding, soldering, etc

CO4. Impart skill in fabricating simple components using sheet metal

CO5. Cultivate safety aspects in handling of tools and equipment

CO6. Develop the collective skill and potentiality and leadership quality to work in a group or team.

**Learning Resources**


Paper Name: Engineering Drawing
Category: Engineering Science Course
Paper Code: ES-ME192
Semester: First
L-T-P: 1-0-3
Credit: 1.5

Periods: 42P

Course Objectives
- To teach students to communicate using graphic techniques.
- To accomplish the principles and standards of mechanical drawing and dimensioning.

[Sessional work should be completed in the class. Problems sheet will be provided. Students should attempt to solve the problems given in the Problem Sheet. Home assignments will be given. Evaluation will be made on the basis of seasonal work and viva-voce examination.]

Scales (3P)
Plain scales, Diagonal scales, Vernier scales

Geometrical Construction and Curves (3P)
Conic Section: Parabola, Hyparabola, Ellipse

Projection of Points, Lines, Surfaces (9P)
Orthographic Projection – First angle and third angle projection More no. of problems should be practiced in first angle projection. Projection of lines inclined to the planes Projection of surfaces Pentagon, Hexagon

Projection of Solids (12P)
Cube, Pyramid, Prism, Cylinder, Cone, Frustums

Isometric View And Isometric Projection (6 P)
(Prism, Pyramid, Cylinder, Cone and examples of simple solid objects / models).

Sectional Views of Solids, True Shape of a Section (6 P)

Development of Surfaces (3 P)
(Cube, Prism, Cylinder, Truncated Cone)

Course Outcomes (COs)
CO1. To represent pictorially different elements and components using basic engineering drawing guidelines.

CO2. To gain significance of scaling pertinent to engineering drawing problems. The incumbents should also have knowledge about analytical curves and their relevance to understand different higher level mechanical engineering problems.

CO3. To understand the concept of projections for 1D, 2D and 3D object representation.

CO4. To develop an idea and ability to view complex interior sections of a solid object, and they will also be able to analyze and explain how different surfaces are generated when a solid object is cut along a plane and its surfaces are stretched out.

CO5. To draw isometric to orthographic views and vice versa.

CO6. To apply the comprehensive knowledge by using a suitable computer aided drafting package.
Learning Resources

6. Corresponding set of CAD Software Theory and User Manuals

<table>
<thead>
<tr>
<th>Paper Name: Language Laboratory</th>
<th>Category: Humanities and Social Sciences including Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Code: HM-HU 191</td>
<td>Semester: First</td>
</tr>
<tr>
<td>L-T-P: 0-0-2</td>
<td>Credit: 1</td>
</tr>
</tbody>
</table>

Periods: 22P

Course Objectives

- To provide advanced skills of Technical Communication in English through various activities performed in the Language Lab Practice Sessions to 1st Semester U.G. students of Engineering and Technology.
- To instil confidence in them so that they can competently communicate in English language in all spheres.
- To make them efficient enough to communicate about day-to-day events and experiences of life, comprehend lectures delivered in English, read and understand relevant materials written in English and also to write grammatically correct English.
- To make them capable of shedding their fear of communication and public speaking.

List of Experiments

1. Developing active ‘Listening Skill’ and its sub skills through Language Lab Audio device; (Listening to conversations, passages, stories, news bulletin, speeches by famous personalities – Listening for general and specific information etc.,) (3P)

2. Developing ‘Speaking Skill’ and its sub skills; (Interpersonal Communication, Oral Presentations — Debate –Extempore – Speech Presentation– Conversational Practice – Face to Face / Telephonic Conversation ) (5P )

3. Developing ‘Reading Skills’ and its sub skills through reading excerpts from plays, poetry, news and various technical/non technical passages using Visual / Graphics/Diagrams /Chart Display etc. and using Literary text(s):
   The Homecoming by Rabindranath Tagore
   We’re Not Afraid to Die... if We’re Together by Gordon Cook and Alan East(4P)
4. Developing ‘Writing Skill’ and its sub skills by using Language Lab Audio –Visual input; Practice Sessions (Analytical essay writing, dialogue writing, story writing, etc.) (3P)

5. Pronunciation: Basic Rules (with emphasis on Accent Neutralisation)
   Organs of Speech (2P)

6. Introducing ‘Group Discussion’ through audio –Visual input and acquainting them with key strategies for success; GD practice sessions (unstructured and structured) (4P)

7. SWOT analysis (1P)

**Learning Resources**
2. Dr. D. Sudharani: Manual for English Language Laboratory. Pearson Education (WB edition), 2010

**Course Outcome (COs)**
CO1. Improving comprehension ability in English & understanding the mechanism of interpretation through language learning.
CO2. Honing conversation skills by learning to substantiate conclusions in grammatically correct English
CO4. Learning effective, real life communication skills in English through several language lab activities pertaining to the four basic skills of LSRW
CO5. Learning basic soft skills and leadership qualities
CO6. Engaging the learner in a positive and imaginative environment to hone socio-cultural, ethical and moral skills.
Course Objectives

- To create awareness for women’s education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.

- To realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arises in their academic and daily life.

1. Creating Awareness in Social Issues
   Blood Donation Camp, Road Safety Awareness, Poster Competition (Saving of Girl child, saving of water and fuel for future, Pollution and control, Global warming, Equal education for girls), Thalassemia awareness Programme, Eye Check-Up Camp.

2. Participating in Mass-Education Programme
   a. Poster Presentation on Education for All
   b. Elocation competition, SA writing on education for all
   c. National Education Day celebration (11th Nov)

3. Proposal for Local Slum Area Development
   a. Road and Costal Side Cleaning Programme
   b. Local Hospital Area Cleaning Programme (with collaboration Haldia Minicipality)
   c. Campus Cleaning Programme

4. Environmental Awareness Programme
   a. Resource Conversation (By Poster Competition)
      i. Water
      ii. Energy
   b. Poster Competition on Global warming
   c. Plantation Programme (5th September)
   d. Fire Safety Awareness Programme (With Haldia Fire Station)

5. Relief and Rehabilitation work during Natural Calamities

Course Outcomes (COs)

CO1. To Create awareness for women’s education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.

CO2. To Realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arises in their academic and daily life.

CO3. To Define and correlate different kind of social, cultural and ethical issue in light of saving of girl child, women education, saving of fuel. Manifest an ethics and
service to the nation as a fundamental duty by organizing seminar symposia, workshop, essay writing, poster presentation etc.

CO4. To Apply problem solving skills by taking on volunteer and community service in their professional and social life and show interest to think about eco-friendly projects for the betterment of the society.

CO5. To Recognize the importance of civic engagement and community activism through volunteerism, community and campus service, team projects.

CO6. To Realizing his/her importance and duty, feel interest about ethical awareness and impact in the field of environmental, social and safety of the finished products.
Annexure-I

Mandatory Additional Requirement (MAR) for earning B. Tech Degree

The additional requirement of MAR points applies to - every student, who is admitted to the 4 years B.Tech program under Autonomy, as per following:

<table>
<thead>
<tr>
<th>Level of Entry in B.Tech Course</th>
<th>Total duration for earning Points</th>
<th>Minimum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Year from the academic year 2020-21 onwards</td>
<td>1st to 4th Year</td>
<td>100</td>
</tr>
<tr>
<td>2nd Year from the academic year 2020-21 onwards (Lateral Entry)</td>
<td>2nd to 4th Year</td>
<td>75</td>
</tr>
</tbody>
</table>

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table- I, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before her she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System of the Institute
- Every student has to earn at least 100 / 75 (for lateral) activity points. The points students has earned will be reflected in the student's mark sheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.
Table I provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Activity</th>
<th>Points</th>
<th>Maximum Points Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>2.</td>
<td>Tech Fest/Teachers Day/Freshers Welcome</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organizer</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>5.</td>
<td>Rural Reporting</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Tree Plantation (per tree)</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Participation in Relief Camps</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>8.</td>
<td>Participation in Debate/Group Discussion/ Tech quiz</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>9.</td>
<td>Publication of Wall magazine in institutional level (magazine/article/internet)</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>11.</td>
<td>Research Publication (per publication)</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>12.</td>
<td>Innovative Projects (other than course curriculum)</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>13.</td>
<td>Blood donation</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Blood donation camp Organization</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15.</td>
<td>Participation in Sports/Games</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>College level</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>University Level</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>District Level</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>State Level</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>National/International Level</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>21.</td>
<td>Cultural Programme (Dance, Drama, Elocution, Music etc.)</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>22.</td>
<td>Member of Professional Society</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>23.</td>
<td>Student Chapter</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>24.</td>
<td>Relevant Industry Visit &amp; Report</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>25.</td>
<td>Photography activities in different Club( Photography club, Cine Club, Gitisansad)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>26.</td>
<td>Participation in Yoga Camp (Certificate to be submitted)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>27.</td>
<td>Self-Entrepreneurship Programme</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>28.</td>
<td>Adventure Sports with Certification</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>29.</td>
<td>Training to under privileged/Physically challenged</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>30.</td>
<td>Community Service &amp; Allied Activities</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>
### MOOCs list for B.Tech (Hons) 1st Yr

(Credit based courses are only opt by students from this bucket, which may change time to time as on the basis of availability of online courses)

<table>
<thead>
<tr>
<th>Module</th>
<th>Course</th>
<th>Provider</th>
<th>Duration (Weeks)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethics</strong></td>
<td>Ethics in Engineering Practice</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ethics and Law in Data and Analytics</td>
<td>edX</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>A Life of Happiness and Fulfillment</td>
<td>Coursera</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Introduction to Philosophy</td>
<td>Coursera</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ethical Leadership Through Giving Voice</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Soft Skills</strong></td>
<td>Enhancing Soft Skills and Personality</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Soft Skill Development</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Psychology at Work</td>
<td>Coursera</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Communication in the 21st Century Workplace</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Successful Career Development</td>
<td>Coursera</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Working in Teams: A Practical Guide</td>
<td>edX</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Communication theory: bridging academia and practice</td>
<td>Coursera</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Write Professional Emails in English</td>
<td>Coursera</td>
<td>5</td>
<td>2</td>
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<tr>
<td></td>
<td>Effective Writing</td>
<td>NPTEL</td>
<td>4</td>
<td>1</td>
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<tr>
<td></td>
<td>Technical Writing</td>
<td>Coursera</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Interpersonal Communication for Engineering Leaders</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
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<tr>
<td></td>
<td>Enhancing Soft Skill and Personality</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Employment Communication A Lab based course</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Speaking Effectively</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>English Language for Competitive Exams</td>
<td>NPTEL</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td><strong>Programming Skills</strong></td>
<td>Introduction to Programming with MATLAB</td>
<td>Coursera</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Introduction to Computer Science and Programming Using Python</td>
<td>edX</td>
<td>9</td>
<td>3</td>
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<tr>
<td></td>
<td>Introduction to R for Data Science</td>
<td>edX</td>
<td>4</td>
<td>1</td>
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<td></td>
<td>Java Programming: Solving Problems with Software</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
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<td></td>
<td>Responsive Website Basics: Code with HTML, CSS, and JavaScript</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
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<tr>
<td></td>
<td>Joy of computing using Python</td>
<td>NPTEL</td>
<td>12</td>
<td>3</td>
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<td></td>
<td>Programming, Data Structures and Algorithm Using Python</td>
<td>Coursera</td>
<td>8</td>
<td>2</td>
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<td></td>
<td>Web Design for Everybody (Basics of Web Development and Coding) Specialization</td>
<td>Coursera</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>Inferential Statistics</td>
<td>Coursera</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Introduction to Data Analysis using Excel</td>
<td>edX</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Multivariable Calculus</td>
<td>NPTEL</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td><strong>Environmental Studies</strong></td>
<td>The Science of Well Being</td>
<td>Coursera</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ecology: Ecosystem Dynamics and Conservation</td>
<td>Coursera</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Effective Problem-solving Decision-Making</td>
<td>Coursera</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Moralties of Everyday Life</td>
<td>Coursera</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Introduction to Logic</td>
<td>Coursera</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Digital Security and Human Rights</td>
<td>edX</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Annexure-III
Guidelines regarding Mandatory Induction Program for the new students

Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns. The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the Institute to implement the three week long Induction Programme:

<table>
<thead>
<tr>
<th>Week 1</th>
<th>1st Half</th>
<th>Day 1</th>
<th>Overall introduction of the new students to the Institution, its different Departments &amp; Faculty Members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2nd Half</td>
<td>Day 1</td>
<td>(a) Assignment of faculty mentors to the new students</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(b) Assessment and allotment for mentoring by senior students preferably from the second year</td>
</tr>
<tr>
<td></td>
<td>2 hrs</td>
<td>Day 2, 3, 4, 5</td>
<td>Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(c) Innovation and entrepreneurship</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(d) Creative and performing arts (e) Social issues</td>
</tr>
<tr>
<td></td>
<td>2 hrs</td>
<td>Day 2, 3, 4, 5</td>
<td>Participation in Games, Yoga, Meditation etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Visit to the different Departments of the Institute</td>
</tr>
<tr>
<td>Week 2</td>
<td>2 hrs</td>
<td>Day 2, 3, 4, 5</td>
<td>Scheduled class lectures as per time table.</td>
</tr>
<tr>
<td>(AllDays)</td>
<td></td>
<td></td>
<td>Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills &amp; Computer knowledge of the students and to prepare a report on the same</td>
</tr>
<tr>
<td></td>
<td>2hrs</td>
<td>Participation in Games, Sports, Yoga, Creative arts etc.</td>
<td>Scheduled class lectures as per time table</td>
</tr>
<tr>
<td>----------</td>
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<td>------------------------------------------</td>
</tr>
<tr>
<td><strong>Week 3</strong></td>
<td><strong>2hrs</strong></td>
<td>Visits to neighbourhood locations</td>
<td>Visits to natural spots in adjoining areas to understand the effect of nature on society</td>
</tr>
<tr>
<td><strong>Day 1</strong></td>
<td></td>
<td>Visits to Science Museum / laboratories</td>
<td></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td></td>
<td>Visits to NGOs</td>
<td></td>
</tr>
</tbody>
</table>

| **Day 3** |              | Visits to NGOs                                         |                                          |
| **Day 4** |              | Visits to NGOs                                         |                                          |
| **Day 5** |              | Visits to NGOs                                         |                                          |
Semester-III

<table>
<thead>
<tr>
<th>EC301</th>
<th>Electronic Devices</th>
<th>3L:0T:0P</th>
<th>3 credits</th>
</tr>
</thead>
</table>

Module I 6L

**Energy bands & Current Carriers in Semiconductors:** Bonding Forces in Solids, Energy Bands theory in crystals (Qualitative Analysis), Metals, Semiconductors, & Insulators, Fermi-Level, Intrinsic and Extrinsic Semiconductors, Concept of Holes, Carrier Concentration, and Mobility, diffusion and drift of carriers, continuity equation, Injected minority carrier charge, Recombination and generation of charge carriers. Generation and recombination of carriers; Poisson and continuity equation.

Module II 10L

**P-N junction:** Physical Description of p-n junction, Basic device technologies for fabrication of a p-n junction, I-V characteristics, and small signal switching models; Avalanche breakdown, Zenerdiode, Schottky diode.

**Bipolar Junction Transistor:** Basic Construction, I-V characteristics, Ebers-Moll Model.

Module III 6L

**Field Effect Transistors:** JFET and its characteristics, Pinch off voltage and drain saturation current, MOSFET: enhancement, depletion mode.

MODULE IV 10L Opto–

**Electronics:** Optical absorption in semiconductors, photovoltaic effects, solar cells (p-n junction), Photoconductors, Photodiode, PIN photodiode, Avalanche photodiode, Phototransistor, LED, Semiconductor Laser (p-n junction)

**Integrated circuit:** fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Text/Reference Books:

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1. Study and analyze the behavior of semiconductor devices.

CO2. Analyze characteristics of Semiconductor diodes and solve problems.

CO3. Analyze characteristics of Bipolar Transistors and solve problems.

CO4. Analyze characteristics of MOS Transistors and solve problems.

CO5: Differentiate between different opto-electronic devices.
Module I

Review of Number System, Signed and Unsigned Number.

Logic Simplifications: Review of Boolean Algebra and De Morgan’s Theorem, SOP & POS forms, Canonical forms, Karnaugh’s map, Binary codes, Code Conversion.

Combinational Logic Design: Comparators, Multiplexers, Encoder, Decoder, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Fast adders, Barrel shifter and ALU.

Module II


Module III

Logic families: TTL, ECL, CMOS Logic circuits, Transfer characteristics, fan-in, fan-out, rise time and fall time analysis.

Semiconductor Memories: Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

Different types of A/D and D/A conversion techniques. Sample & Hold Circuit

Module IV

VLSI Design flow: Design entry Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

Course outcomes:
At the end of this course students will demonstrate the ability to:

CO1: Describe and compare digital representation of information with the analog representation. Explain the fundamental concept of the number systems (Decimal, Binary, Hexadecimal and Octal) and understand the conversion of one number system to another. Classifies the data representation in codes such as Excess-3, Alphanumeric, EBCDIC and Gray codes and interpret those codes.

CO2: Interpret the basic logic operations of NOT, AND, OR, NAND, NOR and XOR gates with logic functions, circuit and truth tables.

CO3: Identify and apply the laws of Boolean algebra to simplify the digital circuits by Boolean algebra expressions and Karnaugh maps.

CO4: Explain and design the specific model of digital combination circuit and sequential circuits.

CO5: Describe and design the analog to digital converter circuits and the digital to analog converter circuits.
Differentiate and draw the diagrams of the different families of digital integrated circuits and also relate them with physical applications.

CO6: Understand the concept of different modelling styles in VHDL, behavioural and structural modelling.
<table>
<thead>
<tr>
<th>EC303</th>
<th>Signals and System</th>
<th>3L:0T:0P</th>
<th>3 credits</th>
</tr>
</thead>
</table>

**Module I**

6L

Continuous Time and Discrete Time signals, Exponential and Sinusoidal Signals, Energy and Power signal, Unit Impulse and Unit Step Functions, Continuous and Discrete Time Systems, basic System Properties likes linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability.

**Module II**

**Linear Time Invariant Systems**: Discrete Time LTI Systems, Continuous Time LTI Systems, properties of LTI Systems, causal LTI Systems Described by Difference equations

6L

**Module III**

8L

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

**Module IV**

8L

Evolution of Transforms: Fourier Transform, Laplace Transform, Z-transform (single sided and Double sided)

The Laplace Transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, solution to differential equations and system behavior using Laplace Transformation

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

**Module V**

4L


**Text/Reference books:**


Course outcomes:
At the end of this course students will demonstrate the ability to

CO-1: Understand the basics of continuous time and discrete time signals and systems.

CO-2: Classify systems based on their properties and determine the response of LSI system using convolution

CO-3: Calculate Fourier series and Fourier transform of continuous and discrete time signals

CO-4: Apply the Laplace transform and Z-transform for analyze of continuous-time and discrete-time signals and systems

CO-5: Comprehend the effects of sampling on a continuous time signal.
Node Voltage Network Analysis: Kirchoff’s Current law, Formulation of Node equations and solutions, driving point admittance, transfer admittance, Star delta transformations, Solution of problems with DC and AC sources.

Mesh Current Network Analysis: Kirchoff’s Voltage law, Formulation of mesh equations, Solution of mesh equations by Cramer’s rule and matrix method, Driving point impedance, Transfer impedance, Solution of problems with DC and AC sources.

Network Theorems: Definition and Implication of Superposition Theorem, Thevenin’s theorem, Norton’s theorem, Reciprocity theorem, Compensation theorem, Maximum Power Transfer theorem, Millman’s theorem. Solutions and problems with DC and AC sources.

Module II 6L


Laplace Transform and properties: Transform of f(t) into F(s), transform of step, exponential, over damped surge, critically damped surge, damped and undamped sine functions, inverse Laplace Transform, Partial fraction, Analysis of RC, RL and RLC network with and without initial condition.

Module III 8L


Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.

Module IV 8L

Graph of Network: Concept of tree and branch, tree link, junction, Incident matrix, Cut set matrix. Determination of Loop current and node voltage.

Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.

Fourier series: Trigonometric and exponential, discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic input, power factor.

Introduction to low pass, high pass, band pass and band reject filters.

Text/Reference Books
1. P. Ramesh Babu- Electrical Circuit Analysis- Scitech
2. A. Sudhakar: “Circuits & Networks: Analysis & Synthesis” 2/e TMH
4. Sivandam- “Electric Circuits and Analysis”, Vikas

Course Outcomes:
At the end of this course students will demonstrate the ability to
CO1: Understand basic electrical circuits with nodal and mesh analysis.
CO2: Implement network theorems to solve any circuit.
CO3: Analyze resonance of a circuit with practical aspects.
C04: Apply Laplace Transform for steady state and transient analysis.
C05: Investigate different circuits with two port network model and graph.
C06: Appreciate the frequency domain techniques.
Module 1

**Introduction**: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

**Searching**: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2

**Stacks and Queues**: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue,

Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3

**Linked Lists**: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4

**Sorting and Hashing**: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

**Graph**: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

**Suggested books**:

**Suggested reference books**:
2. “How to Solve it by Computer”, 2nd Impression by R.G. Dromey, Pearson Education.

**Course outcomes**
- CO1: Analyze the algorithms to determine the time and computation complexity; hence justify the correctness.
- CO2: Implement search problems using linear and binary search techniques..
- CO3: Analyse time and computation complexity involving stacks, queues and linked lists.
- CO4: Comprehend and compare selection sort, bubble sort, insertion sort, quick sort, merge sort and heap sort algorithms on basis of their performance in term of space and time complexity.
- CO5: Implement graph search and traversal algorithms to determine the time and computation complexity.
Module I
Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution. Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev’s Inequality.

Module II:
Continuous Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module III:
Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes’ rule.

Module IV:
Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.

Module V:
Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module VI:
Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

Course Outcomes
The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

The students will be able to:
- Develop basic ideas of probability and random variables with various discrete and continuous probability distributions.
- Comprehend basic ideas of statistics including measures of central tendency,
correlation and regression.
Implement various statistical methods to study data samples.
Purpose: We as human beings are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times.

Idea of an activity based course on environment protection is to sensitise the students on the above issues through following two type of activities.

(a) Awareness Activities:
  i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
  ii) Slogan making event
  iii) Poster making event
  iv) Cycle rally
  v) Lectures from experts

(b) Actual Activities:
  i) Plantation
  ii) Gifting a tree to see its full growth
  iii) Cleanliness drive
  iv) Drive for segregation of waste
  v) To live some big environmentalist for a week or so to understand his work
  vi) To work in kitchen garden for mess
  vii) To know about the different varieties of plants
  viii) Shutting down the fans and ACs of the campus for an hour or so

Assessment:

1. Attendance: 15
2. Assignment: 15
3. Posters: 15
4. Participation in events: 25
5. Assessment by Teacher: 40

Grading: >90% : O

  80-90% : E

  70-80% : A

  60-70% : B

  40-60% : C

  Below 40% : D
1. Identifying and study of different components like resistor, capacitors, diodes, LED, Transistors, FET(JFET & MOSFET) etc
2. Study of different instruments used in the laboratories like, power supply, Oscilloscope, Multi-meter etc.
3. CHARACTERISTICS OF PN JUNCTION DIODE
   a) To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions.
   b) To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias & Reverse Bias
4. CHARACTERISTICS OF ZENER DIODE & LOAD REGULATION
   a) To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode.
   b) Find out the Zener Break down Voltage from the Characteristics.
   c) To Obtain the Load Regulation Characteristics.
5. COMMON BASE BIPOLAR TRANSISTOR CHARACTERISTICS
   a) To plot the Input and Output characteristics of a transistor connected in Common Base Configuration and to find the h – parameters from the characteristics.
6. COMMON_EMITTER BIPOLAR TRANSISTOR CHARACTERISTICS
   a) To plot the Input and Output characteristics of a transistor connected in Common Emitter Configuration and to find the h – parameters from the characteristics
7. DESIGN SELF BIAS BJT CIRCUIT
8. JFET DRAIN & TRANSFER CHARACTERISTICS (COMMON SOURCE)
   a) Drain characteristics
   b) Transfer Characteristics.
   c) To find rd, gm, and μ from the characteristics.
9. Study Characteristics of Photo transistor
10. Study Characteristics of LED & LDR

Course Outcome
a) An ability to verify the working of different diodes, transistors, CRO probes and measuring instruments. Identifying the procedure of doing the experiment.
b) Ability to understand the characteristics of BJT and FET and how to Determine different parameters for designing purpose..
c) Ability to understand properties of photoelectric devices
d) Ability to measure and record the experimental data, analyze the results, and prepare a formal laboratory report.
1. Introduction to Digital Electronics Lab- Nomenclature of Digital Ics, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
3. Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
5. Implementation of 4x1 Multiplexer using Logic Gates.
6. Implementation of 4-Bit Parallel Adder Using 7483 IC.
7. Design , and Verify the 4-Bit Synchronous Counter
8. Design, and Verify the 4-Bit Asynchronous Counter.
9. Simulation of MOS Inverter with different loads using PSPICE software
10. Simulation of CMOS Inverter for different parameters Kn, Kp as a design variable in suitable circuit simulator software.
11. Design of a 4-bit Multiplexer using VHDL\Verilog
12. Design of a decade counter using VHDL\Verilog.
13. Design of a 3-input NAND gate and its simulation using suitable logic simulator

**Book List**

**Course Outcomes:**

On completion of this lab course the students will be able to:
CO1: Realize the fundamentals of Digital Electronics along with logic gates and its simulation using simulator.
CO2: Construct arithmetic circuits-Adder, Subtractor using logic gates and 7483 ICs. Also implement different Boolean Functions using Logic Gates in Both SOP and POS Forms.
CO3: Implement simple Decoder, Encoder and Multiplexer circuits using logic gates and VHDL\Verilog
CO4: Realize of RS-JK, D and T flip-flops using Universal logic gates.
CO5: Realize different type of Shift Register and Counters VHDL\Verilog.
CO6: Realize the working of MOS and CMOS and their parameter analysis using PSPICE software.
List of Experiments:

1. Spectrum analysis of different signals.
2. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse and Ramp signals using MATLAB in both Discrete and Analog form.
3. Evaluation of Convolution integral, Discrete Fourier transform for Periodic & non-periodic signals and simulation of difference equations using MATLAB.
4. Determination of Laplace transform and inverse Laplace transformation using MATLAB.
5. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB.
8. Study the effect of inductance on step response of series RL circuit in MATLAB/Hardware.
9. Determination of Impedance (Z) and Admittance(Y) parameters of two port network.

Note: College may opt for some othersoftware or hardware simulation wherever possible in place of MATLAB

Course Outcomes:

On completion of this lab course the students will be able to:

CO-1. Demonstrate knowledge on signals, transients, two port networks & filters and their experimental implementation.

CO-2. Analyse and relate the experimental observations & measurements for validation.

CO-3 Design a suitable experimental/simulation procedure for practical investigations on signals, systems and networks.

CO-4 Demonstrates skills in evaluating various parameters and interpret the observations to provide feasible solutions.

CO-5 Select appropriate technique for experimental investigations, analysis and interpretation of signals and networks.
Experiments should include but not limited to:

1. Implementation of array in List, Stack and Queue ADTs, Circular Queue, Multiple stacks & queues

2. Implementation of linked lists: inserting, deleting, and inverting a linked list

3. Linked list implementation of List, Stack and Queue ADTs

4. Applications of List, Stack and Queue ADTs (Polynomial addition, Polynomial multiplication, Evaluation of expressions operations)

5. Sparse Matrices: addition, Multiplication

6. Recursive and Nonrecursive traversal of Trees

7. Implementation of Binary Search Trees

8. Graph representation and Traversal algorithms (BFS, DFS)

9. Implementation of searching and sorting algorithms

10. Hash tables implementation: searching, inserting and deleting
<table>
<thead>
<tr>
<th>Module I</th>
<th>10 L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian distribution with numeral example.</td>
<td></td>
</tr>
<tr>
<td>2. Fourier Transform, properties, time shifting, frequency shifting, Frequency spectrum for sine or cosine wave.</td>
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<tr>
<td>3. Multiplexing, Time division multiplexing (TDM), Frequency division multiplexing (FDM), Code Division Multiplexing (CDM), Orthogonal frequency division multiplexing (OFDM).</td>
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<tr>
<th>Module II</th>
<th>10 L</th>
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<tr>
<th>Module III</th>
<th>8 L</th>
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</thead>
<tbody>
<tr>
<td>1. Time domain and Frequency domain representation of Angle modulation, block diagram representation of generation of Angle Modulated Waves (FM &amp; PM), Bessel’s Function.</td>
<td></td>
</tr>
<tr>
<td>3. Phase Modulation (PM), Calculation of Bandwidth for FM and PM with Narrow and Wide-band modulation. Comparison of Narrow band FM and AM.</td>
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</tbody>
</table>

2. Super heterodyne Receiver: principle, intermediate frequency, Local oscillator frequency, image frequency, RF section and characteristics – Frequency changing and tracking, AGC.

3. Stereo AM and FM: basic concepts with block diagram, AFC, Pre-emphasis and De-emphasis in FM.

Module V4 L

1. Signal to Noise Ratio (SNR), Figure of Merit, SNR calculation for DSB-TC/DSB-FC, DSB-SC, SSB-SC and FM. Noise threshold effect in AM and FM.

2. Noise Figure, Noise equivalent bandwidth, Effective noise temperature, Noise Figure in cascade connection of two-port networks.

Text Books:

References:
2. Singh & Sapre—Communication Systems: 2/e, TMH
3. P K Ghosh- Principles of Electrical Communications- University Press
5. Blake, Electronic Communication Systems- Cengage Learning

Course outcomes

CO1: Identify and understand the basic concepts of Analog communication systems and applications.

CO2: Describe and explain the need for modulation and the type of continuous-wave modulation methods (AM, FM & PM) suitable for various analog communication applications.

CO3: Evaluate and differentiate different modulation and demodulation methods to be adopted and solve the problems associated with the particular method(s).

CO4: Understand the working principle of the super-heterodyne radio receivers and determine the IF and image frequencies for given specifications.

CO5: Characterize and understand the influence of noise in the transmission channel as well as the effects of noise on communications system models in terms of SNR on different analog modulated signals.

CO6: Carry out, analyze and report simple hardware-based experiments as well as Simulate as per given specifications using Matlab/ Simulink in a knowledgeable and confident manner.
Module 10L

Diode Circuits: Rectifiers, Clipper, Clamper

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier.

Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Module 6L

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc.,

Module 6L

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), Multivibrators (Monostable, Astable and Bistable)

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.

Module 10L

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.

OP-AMP: Basic structure and characteristics, inverting and non-inverting amplifiers


Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text/Reference Books:

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
Module I 10L

Assembly language programming:
Addition, Multiplication, Block Transfer, Ascending order, Descending order, finding largest & smallest number, Look-up table etc.

Module II 6L
Memory interfacing with 8085 microprocessor, Serial and parallel data transfer – Basic concept of serial I/O, DMA. Support IC – 8255A PPI, 8237, 8253, 8259. ADC /DAC interfacing with 8085.

Module III 8L
Microprocessor 8086 - Architecture, Pin details, memory segmentation, addressing modes. Familiarization of basic Instructions, Interrupts.

Assembly language programming:
Addition, Multiplication, Block Transfer, Ascending order, Descending order, finding largest & smallest number etc.

Module IV 6L
Advanced microprocessor – 80286, 80386, Pentium processor; Architecture, register organization, multitasking.
Microcontroller 8051 – Pin configuration, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.
Assembly language Programming using 8051.
Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout etc.

TEXT BOOKS:
1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar (Penram International)
2. The 8051 microcontroller - K. Ayala (Thomson)
4. Advanced Microprocessors & Peripherals, Ray &Bhurchandi, TMH
5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
6. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

References:
2. 8086 Microprocessor –K Ayala (Cengage learning)

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Understand the architecture, instruction set, timing diagram of 8085, 8086 microprocessors.
2. Execute assembly language programming for microprocessors & microcontrollers.
3. Design interfacing of peripherals like I/O, A/D, D/A, timer etc.
4. Distinguish advanced microprocessors like 80286, 80386 etc.
5. Investigate systems using different microcontrollers like 8051, PIC microcontroller etc.
Objectives of the course
Analyze the asymptotic performance of algorithms. Write rigorous correctness proofs for algorithms. Demonstrate a familiarity with major algorithms and data structures. Apply important algorithmic design paradigms and methods of analysis. Synthesize efficient algorithms in common engineering design situations.

Detailed contents:
Module 1: 8L

Module 2: 8L
Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics - characteristics and their application domains.

Module 3: 6L
Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Module 4: 6L

Module 5: 4L
Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP - P SPACE

Suggested books:

Suggested reference books

Course Outcomes
1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
Module I

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Interpolation: Newton forward/backward interpolation, Lagrange’s and Newton’s divided difference Interpolation.
Numerical integration: Trapezoidal rule, Simpson’s 1/3 rule, Expression for corresponding error terms.

Module I

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Module III


Text Books:

References:
2. Baburam: Numerical Methods, Pearson Education.
4. SoumenGuha& Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.
COURSE OBJECTIVES:
- To provide solution to real life problems in electromagnetics.
- To understand the concept of vector calculus and solve field theory problems dealing with electric and magnetic fields.
- To learn about time varying fields and appreciate the concept of EM waves.

Module I
Vector Algebra and Calculus 6L

Module II
Electrostatic Fields 8L
Introduction to Coulomb’s law and electric field intensity, electric flux density. Electric potential. Gaussian law and its applications in determination of field for various charge distributions. Maxwell’s equation for static electric fields. Laplace’s and Poisson’s equations. Effect of dielectric on capacitance. Boundary conditions at electric interfaces. Energy storage for electrostatic field. Boundary conditions for electrostatic fields.

Module III
Magnetostatic Fields 5L

Module IV
Time Varying Fields and Maxwell's Equations 6L

COURSE OUTCOMES
On completion of the course, student will be able to
CO1- Appraise need analysis for different coordinate systems in electromagnetics and their interrelations.
CO2- Apply vector calculus to solve field theory problems.
CO3- Calculate electric and magnetic fields in different coordinates for various charge and current configurations.
CO4- Understand boundary conditions associated with interfaces.
CO5- Appreciate Maxwell’s equations for static and time varying fields.
CO6- Understand the concept of time varying fields and wave equations.
TEXT/REFERENCEBOOKS
1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index of an AM signal for both DSB- & SSB.
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal for both DSB-SC & SSB.
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design and set up a PLL using VCO & to measure the lock frequency.
6. Design and set up a FM demodulator using PLL.
9. One innovative experiment.

**COURSE OUTCOMES**
On completion of the course, student will be able to
CO1: Design & implement Standard AM modulator and demodulator to measure modulation index of an AM signal.
CO2: Examine AM signal with suppressed carrier (both DSB- & SSB) to understand principle of operations.
CO3: Experiment FM signal to understand modulator and demodulator operations.
CO4: Construct a PLL circuit using VCO to measure the lock and capture frequencies.
CO5: Simulate & analyze performance of FDM using standard simulators.
CO6: Identify various functional blocks of a super-heterodyne receiver.
1. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).

2. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency:
   (a). Full Wave Rectifier  (b). Bridge Rectifier

3. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.

4. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.

5. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.

6. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.

7. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation.
   R-C Phase shift Oscillator/Wien Bridge Oscillator

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.

9. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

Course Outcome:

Students will be able to:

CO1: Design and test rectifiers, clipping circuits, clamping circuits and voltage regulators.

CO2: Compute the parameters from the characteristics of JFET and MOSFET devices.

CO3: Design, test and evaluate BJT amplifiers in CE configuration. CO4: Design and test JFET/MOSFET amplifiers.

CO5: Design and test a power amplifier.

CO6: Design and test various types of oscillators.
1. Familiarization with 8085 & 8051 simulator on PC.

2. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the KIT. Assignments based on above

3. **Programming using kit and simulator for:**
   i) Table look up
   ii) Copying a block of memory
   iii) Shifting a block of memory
   iv) Packing and unpacking of BCD numbers
   v) Addition of BCD numbers
   vi) Binary to ASCII conversion
   vii) String Matching, Multiplication using shift and add method and Booth’s Algorithm

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.

5. Study of timing diagram of an instruction on oscilloscope.

6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255

7. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3.
   Write programs to interface of Keyboard, DAC and ADC using the kit.

8. Serial communication between two trainer kits

**Course Outcomes:**

CO 1: Remember the concept of various different number systems.

CO2: Understand the concept of developing assembly language program.

CO3: Apply the knowledge of Hex codes in entering simple ALP in the trainer kit/Simulator.

CO4: Develop complex ALP in 8085 and 8051 for execution on the trainer kit.

CO5: Understand various intra and inter devices communication systems in microprocessors and microcontrollers.
Assignments on Newton forward/backward, Lagrange’s interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson’s 1/3 rule, Weddle’s rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.

5. Assignments on ordinary differential equation: Euler’s and Runga-Kutta methods.

6. Introduction to Software Packages: Matlab/Scilab/Labview/Mathematica.
COURSE OBJECTIVES:
To Provide solution to real life plane wave problems for various boundary conditions.
To Understand the concept of transmission lines types, various line parameters, waveguide types and resonators.
To Characterize and analyze the transmission line parameters and Acquire knowledge about the waveguides and resonators.
To Learn about basic antenna parameters and radiation characteristics.

UNIT 1: ELECTROMAGNETIC FUNDAMENTALS  

UNIT 2: UNIFORM PLANE WAVES  
Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

UNIT 3: PLANE WAVES AT MEDIA INTERFACE  
Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

UNIT 4: TRANSMISSION LINES  
Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

UNIT 5: WAVEGUIDE  
Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide, Circular wave guides- TE and TM waves in circular wave guides - Attenuation factor and Q of wave guides-Microwave resonators introduction - rectangular cavity resonator - Q-factor of micro wave cavities.

UNIT 6: ANTENNA FUNDAMENTALS  
Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

COURSE OUTCOMES
On completion of the course, student will be able to
CO1 - Discuss the fundamental concepts of wave propagation.
CO2 - Calculate reflection and transmission of waves at media interface.
CO3 - Analyze the field equations for the wave propagation in lossy and lossless dielectric media.
CO4 - Understand characteristics and wave propagation on high frequency transmission lines.
CO5 - Analyze wave propagation on metallic waveguides in modal form.
CO6 - Understand principle of radiation and radiation characteristics of an antenna.

TEXT/REFERENCE BOOKS
Module I (3L)
Introduction to DSP: Typical Signal Processing Operations; Application Areas of DSP. Discrete-Time Signals and Systems: Representation of Discrete-time Signals; Elementary Discrete-time Signals; Basic Operations on Sequences; Classification of Discrete-time Signals; Classification of Discrete-time Systems; Representation of an Arbitrary Sequence.

Module II (5L)
Discrete Convolution: Impulse Response and Convolution Sum; Linear Convolution of Finite Sequences; Properties of the Convolution Sum; Deconvolution; Periodic or Circular Convolution; Linear Convolution from Periodic Convolution; Periodic Convolution from Linear Convolution, Sectioned Convolution.

Module III (6L)
Z-Transforms: Z-Transform and ROC of Finite Duration Sequences; Properties of ROC; Properties of Z-transform; Inverse Z-transform; Impulse Response and Transfer Function; Stability and Causality; Solution of Difference Equations Using Z-transforms; Deconvolution Using Z-transform.

Module IV (6L)
Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Transform (DFT) of Discrete Time Signal; Inverse DFT (IDFT); Properties of DFT; Relation Between DFT and Z-Transform; Analysis of LTI Discrete Time Systems using DFT; Fast Fourier Transform (FFT); Computation of inverse DFT Using FFT; Linear Convolution Using DFT; Circular Convolution Using DFT and IDFT.

Module V (5L)

Module VI (5L)
Finite Impulse Response (FIR) Filters: LTI system as Frequency Selective Filters; Ideal Frequency Response of Linear Phase FIR Filters; Characteristics of FIR Filters with Linear Phase; Frequency Response of Linear Phase FIR filter; Design Techniques for Linear Phase FIR Filters; Fourier Series Method of FIR Filter Design; FIR Filter Design Using Windows; Design of FIR Filters by Frequency Sampling Technique.

Module VII (3L)

Module VIII (3L)
Effect of finite register length in FIR filter design, Introduction to multirate signal processing, Application of DSP.

Total Lectures: 36L (36Hrs)
Text/Reference Books:
4. Digital Signal Processing, A. Anand Kumar, PHI.
7. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH.
8. Digital Signal Processing, A. Nagoor Kani, TMH.

Course Outcomes:
At the end of this course students will demonstrate the ability to
CO1: Understand signals mathematically in continuous and discrete time and frequency domain and the response of an LTI system.
CO2: Illustrate the concepts of arithmetic operations on discrete-time sequences.
CO3: Differentiate different convolution methods (i.e., linear, circular etc.) and explain z-transform on discrete-time sequences with examples and exercises.
CO4: Evaluate DFT/IDFT and FFT/IFFT using different algorithms/methods.
CO5: Examine and differentiate IIR and FIR digital filters using different techniques.
CO6: Design of different types of digital filters for various applications.
**Module I:** Introduction to Digital Communication, advantages of digital communication over Analog Communication  

**Module II:** Review of Random Process: Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, basic definition of Stationarity, Ergodicity, autocorrelation, cross correlation, power spectral density, Response of Linear systems to Random inputs, Gaussian process, Narrow band noise, Rayleigh pdf.

Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error , error function, complementary error function, Type-I and Type-II errors

**Module III:** Digital Data Transmission (Waveform Coding) : Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and μ -law companding, differential PCM, delta modulation and adaptive delta modulation.

**Module IV:** Baseband Transmission: Digital transmission components, source, multiplexer, line code, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction.

**Module V:** Pass band Transmission: Basic digital carrier modulation techniques: ASK, FSK and PSK, (coherent and non-coherent). Binary Phase Shift Keying (BPSK), Differential phase shift keying (DPSK), Quadrature Phase Shift Keying (QPSK), Offset Quadrature Phase shift Queuing (OQPSK), Concept of M-ary phase shift keying (MPSK), geometrical representation of BPSK wave; probability of error for BPSK (Considering With channel noise and without channel noise),generation and detection of BPSK Signal, power spectrum of BPSK. The average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals. Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, GMSK, basic concept of OFDM, constellation diagram.

**Text Books:**

1) Digital Communications, S. Haykin, Wiley India.
3) Wireless Communication and Networks : 3G and Beyond, I. SahaMisra, TMH Education.
References:
2) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.

Course Outcome:
At the end of this course students will demonstrate the ability to
CO1- Understand the basic building blocks of digital communication system, random theory and stochastic process.
CO2- Understand Sampling Theorem to explain PAM, PWM, PPM, PAM-TDM and process of quantization to explain PCM, LDM, ADM.
CO3- Understand line coding techniques along with PSDs and describe Inter Symbol Interference (ISI) equalization techniques.
CO4- Analyze different Passband Digital Modulation Techniques viz. ASK, PSK, FSK, MSK.
CO5- Understand detection theory, optimum correlation receiver and identification of BER.
Module I
Basic Structure of Computers, Computer organization and architecture, Harvard & Von Neumann architecture, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines. 5L

Module II
Processor organization, Information representation, number formats. 3L

Module III
Multiplication & division, ALU design (combinational ALU & sequential ALU), Floating Point arithmetic, IEEE 754 floating point formats.
Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit 4L

Module IV
Memory organization, device characteristics, RAM, ROM, Memory mapping and management techniques, Concept of Cache & associative memories, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties, Virtual memory, memory replacement policies. 5L

Module V
CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces 4L

Module VI
Concept of parallel processing, Details of Pipelining, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Pipeline optimization techniques. Flynn’s classification –SISD, SIMD, MISD, MIMD architectures, Forms of parallel processing, interconnect network, Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors. 6L

Module VII
Introduction to Multi-core Processor, Roadmap to modern multi-core processors, architecture and working principle [brief study] , Various proposed and implemented methods of load balancing in multi-core processors: their challenges and future directions. 5L
Text/Reference Books:

Course Outcomes

At the end of this course students will demonstrate the ability to

CO1: Study and analyze the types of instructions, Instruction sets and Instruction formats and numbering formats.

CO2: Analyze the ALU, Floating Point arithmetic.

CO3: Classify the various memory organization systems, memory mapping and techniques.

CO4: Classify various methods of parallel processing and identify Instruction-level parallelism.

CO5: Differentiate the working principle of modern multi-core processor architecture and their load balancing techniques.

| EC591 | EM Wave & Transmission Lines Laboratory | 0L:0T:2P | 1 credits |

Name of the Experiment:-

(1) Study of Radiation pattern and measurement of beam width of a Simple Dipole antenna.
(2) Study of Radiation pattern and measurement of beam width of a Folded Dipole antenna.
(3) Study of Radiation pattern and measurement of beam width of a Yagi-Uda antenna.
(4) Study of Radiation pattern and measurement of beam width of Parabolic Reflector antenna.
(5) Study of Radiation Pattern and measurement of Gain & Beam width of a Horn Antenna using Rectangular Wave Guide.
(6) Measurement of input & load impedance of a terminated waveguide using Shift in minima technique.
(7) Study of Smith Chart.
(8) Study the characteristics of Transmission Line for different loading conditions.
Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands verification of the properties of convolution.
3. Z-transform of various sequences - verification of the properties of Z-transform.
4. Twiddle factors - verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap - add and Overlap - save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Course Outcomes:
CO1: Examine different discrete time signals and compute arithmetic operations of discrete time sequences using standard simulators.
CO2: Evaluate and Differentiate different convolution methods (Linear and Circular) and it's properties using standard simulators.
CO4: Simulate 8-point DFT of a discrete time sequence in direct method using standard simulators.
CO5: Determine Z-transform of discrete-time sequences and it's properties using standard simulators.
CO6: Design IIR and FIR digital filters using standard simulators.

EC593 | Digital Communication Laboratory | 0L:0T:2P | 1 credits
--- | --- | --- | ---
1. Design, implementation and study of all the properties of 7-length and 15-length sequences using shift register.
2. Study of PAM and demodulation.
3. Study of PCM and demodulation.
4. Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
5. Study of delta modulator and demodulator.
6. Study of adaptive delta modulator and demodulator.
7. Study of BPSK modulator and demodulator.
8. Study of BFSK modulator and demodulator.
9. Study of ASK modulator and demodulator.
10. Study of QPSK modulator and demodulator.
11. Simulation study of probability of symbol error for BPSK modulation.
12. Simulation study of probability of symbol error for BFSK modulation.
Course Outcomes:
CO1- Understand the basic building of pseudo sequence, PAM, PCM modulation demodulation.
CO2- Understand line coding polar/unipolar/bipolar NRZ, RZ and Manchester.
CO3- Understand delta modulation, adaptive delta modulation and demodulation techniques.
CO4- Understand different Passband Digital Modulation Techniques viz. ASK, BPSK, BFSK, QPSK.
CO5- Simulation study of probability of symbol error for BPSK and BFSK modulation.

| MC-581          | Essence of Indian Tradition & Culture | 0L:0T:2P | 2 credits |
Course Outcomes:
At the end of the course, students will demonstrate the ability to:
   1. Understand the concept of information and entropy
   2. Understand Shannon’s theorem for coding
   3. Calculation of channel capacity
   4. Apply coding techniques

Module-I: Basics of Information Theory (7L)
Amount & unit of information, Measure of entropy for discrete ensembles, Information rate, Discrete, Markov sources and their entropy expressions, Encoding of discrete sources.

Module-II: Discrete Channels and Channel Capacity (8L)
Discrete channel and discrete memoryless channel model, Mutual information, Different types of entropy and their interrelationship, Channel capacity of various discrete channels, Shannon’s noiseless and noisy coding theorems, Shannon’s channel capacity theorem for AWGN channel, Shannon’s limit.

Module-III: Source Coding Techniques (8L)

Module-IV: Channel Codes (15L)
Linear Block Code: Matrix representation of block code, G and H matrix, Encoding, Syndrome computation, Minimum distance, error detection and correction capabilities, Standard Array and decoding, Different types of block code.
Cyclic Code: Polynomial representation, Generator and parity polynomial, Encoding and decoding circuits.

Total Lectures: 38 Hours

Text/ Reference Books

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the concept of information, entropy and information sources.
2. Understand Shannon’s theorem and application of it in different channels.
3. Explanation and derivation of different source coding techniques.
4. Understanding the basics of Channels codes.
5. Design encoder and decoder circuit of linear block codes and cyclic codes
Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

**Text/Reference Books:**


**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals.
Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT - Treatment should consist of structure, characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based). Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current - Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers - TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.


Text/Reference Books:
1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.
UNIT I - SELF ANALYSIS 2 hours
SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

UNIT II - CREATIVITY 3 hours
Out of box thinking, Lateral Thinking.

UNIT III - ATTITUDE 3 hours
Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette.

UNIT IV - MOTIVATION 2 hours
Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

UNIT V - GOAL SETTING 4 hours
Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time management
Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

UNIT VII - INTERPERSONAL SKILLS 6 hours
Gratitude
Understanding the relationship between Leadership Networking & Team work. Assessing Interpersonal Skills Situation description of Interpersonal Skill.

Team Work: Necessity of Team Work Personally, Socially and Educationally

UNIT VIII - LEADERSHIP 2 hours
Skills for a good Leader, Assessment of Leadership Skills

UNIT IX - STRESS MANAGEMENT 4 hours
Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters.

Emotional Intelligence
What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT X - CONFLICT RESOLUTION 2 hours
Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - DECISION MAKING 4 hours
Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives
Cyber World:
An Overview, The internet and online resources, Security of information, Digital signature

An Overview Cyber Law:
Introduction about the cyber space, Regulation of cyber space – introducing cyber law Scope of Cyber laws – ecommerce; online contracts; IPRs (copyright, trademarks and software patenting); e-taxation; e-governance and cyber crimes, Cyber law in India with special reference to Information Technology (Amendment) Act, 2008

IPR:

Intellectual Property: Issues and Challenges:
Geographical Indications, Layout designs of Integrated Circuits and Protection of Plant Varieties and Farmers’ Rights. Copyright protection with reference to performers rights and Artist rights, Global governance towards Patents, Trade Marks: Legal recognition, Comparative analysis in India, EU and USA, Trade secrets: Legal recognition, Comparative analysis in India, EU and USA

Intellectual Property: Contemporary Trends
Benefit sharing and contractual agreements – International Treaty on Plant Genetic Resources for Food and Agriculture – issues on patent policy and farmers’ rights- CBD, Nagoya Protocol and Indian law, UNESCO – protection of folklore/cultural expressions Developments in WIPO on traditional knowledge and traditional cultural expressions

Text Book
1. Duggal Pavan, Cyber Law - An exhaustive section wise Commentary on The Information Technology Act along with Rules, Regulations, Policies, Notifications etc. UNIVERSAL LAW PUBLISHING CO. PVT. LTD. C-FF-1A, Dilkush Industrial Estate, (Near Azad Pur Metro Station) G. T. Karnal Road, Delhi - 110033, INDIA 2014

Reference Book
1. Intellectual Property Rights in India: General Issues and Implications Prankrishna Pal

Course Outcome: At the end of the course, the students will be able to:
1. understand the role of intellectual property rights
2. identify the main types of intellectual property rights
3. understand the steps for successful registration and protection of intellectual property rights
national, regional and international levels
4. search patent and trademark databases
5. understand the legal aspects for intellectual property protection

| OE-EC506C | Human Resource Management | 3L:0T:0P 3 credits |

**UNIT-1-Human Resource Management :**
Meaning & Definition, Functions, Scope & Objectives, Qualities of a HR Manager

**UNIT-2-Human Resource Planning :**
Training & Performance Appraisal- Definition & Objective, Areas of Training, Meaning & Definition of Performance Appraisal, process, Effective principles of performance Appraisal.

**UNIT-3- Industrial Relations :**
Concept & Meaning, Objective & Importance, Reasons of poor Industrial Relation. Industrial Disputes- Meaning & Definition, Causes of Industrial Dispute, Prevention of Industrial Dispute, Conditions for good Industrial Relation.

**UNIT-4- Workers Participation in Management :**
Meaning & Need, Forms of Participation, Scheme of participation, Merits & Demerits.

**Text Book**

**Reference Book**

**Course Outcome :** At the end of the course the students will be able to:
1. know the professional and personal qualities of a HR manager.
2. learn different methods of selecting human resources through recruitment, training and performance appraisal system.
3. know how to develop a favourable working environment in an organisation through participation in management and maintain a good industrial relation for benefit of the society.
4. know about consequence of industrial dispute and employee indiscipline of an organization.
Module – I:

a) INTRODUCTION
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems. [4L]

b) TRANSFER FUNCTION REPRESENTATION
Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason’s gain formula. [5L]

Module – II:

a) TIME RESPONSE ANALYSIS

b) STABILITY ANALYSIS IN S-DOMAIN
The concept of stability – Routh’s stability criterion – limitations of Routh’s stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci. [4L]

Module – III:

a) FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. [5L]

b) STABILITY ANALYSIS IN FREQUENCY DOMAIN
Polar Plots, Nyquist Plots Stability Analysis. [4L]

Module - IV:

a) CLASSICAL CONTROL DESIGN TECHNIQUES
Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [4L]

b) STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it’s Properties – Concepts of Controllability and Observability. [5L]

Module - V:

INTRODUCTION TO PLC BASIC
Architecture and function, Input-output modules and interfacing, CPU and memory, Relays, Timers, Counters and their uses, PLC programming and applications, Introduction to DCS. [4L]
TEXT BOOKS:

REFERENCE BOOKS:

Course Outcomes (CO):
After completion of the course, the student will be able to:

1. Explain the concept of open loop and close loop control system transfer function and determine overall transfer function using block diagram reduction technique and Mason’s gain formula.
2. Demonstrate the transient response of first order and second order control system and solve the mathematical equation, variation between input and output, realization for instability, marginal stability and stability of a system using Routh Hurwitz Criterion, Nyquist polar plot.
3. Compute frequency response, frequency domain specification and transfer function using Bode plot, Root –Locus and determine gain margin, phase margin and stability analysis.
4. Differentiate compensation technique- lag, lead, lead-lag and design PI, PD &PID controller and implement them using various passive components.
5. Explain the concept of state, state variable, state model, derivation of state model from block diagram, solving the time invariant state equation, controllability and observability Verification.
6. Demonstrate Input-output modules, interfacing, Relays, Timers, Counters and PLC programming and applications.
Module I
Overview of Data Communication and Networking: [4L]
Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.
Physical Level: [6L]
Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II
Data link Layer: [5L]
Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;
Medium Access sub layer: [5L]
Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);

Module III
Network layer: [8L]
Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing, Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6;
Transport layer: [4L]
Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets;
Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV
Application Layer [5L]
Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.
Modern topics: [5L]
ISDN services & ATM, DSL technology, Cable Modem:
Architecture & Operation in brief Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books:
1. B. A. Forouzan - “Data Communications and Networking (3rd Ed.)” - TMH
3. W. Stallings - “Data and Computer Communications (5th Ed.)” - PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:
1. Kurose and Rose - “Computer Networking - A top down approach featuring the internet” - Pearson Education
2. Leon, Garica, Widjaja - “Communication Networks” - TMH
3. Walrand - “Communication Networks” - TMH.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Study and analyze the network components, modes of communication, network protocols and standards, network reference models.
CO2: Analyze the specifications of physical layer and related protocols.
CO3: Classify the working principle of various layer 3 protocols, routing protocols and techniques.
CO4: Differentiate the classes of IP addresses and implementation of subnetting.
CO5: Classify the working mechanism of various transport layer protocols, connection oriented and connection-less services, identify QoS policies and improvement.
CO6: Differentiate the working principle of different application layer protocols.
Module-I

Module-II

Module-III
5. Inflation And Price Change - Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.

Module-IV

Readings
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
1. Familiarization with MATLAB control system toolbox and representation of pole zero and transfer function of control system.

2. Determination of transfer function of a given system from its state model and its vice-versa.

3. Determination of impulse & step response for 2nd order under damped system on CRO & calculation of control system specifications for variation of system design.

4. Determination of root Locus from transfer function and evaluation of system parameters like marginal value of gain, frequency etc. of a given control system.

5. Drawing of Nyquist plot and Bode plot from transfer function of a control system and estimation of relative system parameters like gain margin, phase margin etc.

6. Design PI, PD and PID controller for specified system requirements.

7. Study of static (accuracy, precision, repeatability, linearity) and dynamic (fidelity, speed of response) characteristics of a measuring instrument.

8. Design and study of Instrumentation Amplifier.

Course Outcomes (COs):
On completion of this lab course the students will be able to:
CO1: Examine different discrete time signals, compute arithmetic operations using MATLAB and also Realize Block Diagram Reduction and verify properties using MATLAB.
CO2: Simulate transient response of first order and second order control system using MATLAB and Realization of variation of output with the variation of input and condition for being in the steady state using MATLAB commands.
CO3: Evaluate Poles and zeros and locate their position in s-plane using MATLAB and Realization of step response of a closed loop control system and obtain the time domain response using MATLAB.
CO4: Determine the input vs. output graph, and conditions for stability, marginal stability and unstability of a system using Nyquist polar plot in MATLAB.
CO5: Simulate frequency response, frequency domain specification and transfer function using Bode plot and obtain gain margin, phase margin and explain stability analysis using MATLAB.
CO6: Simulate frequency response, frequency domain specification and transfer function using root-locus in MATLAB.
- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with
  - Networking cables (CAT5, UTP)
  - Connectors (RJ45, T-connector)
  - Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of
  - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
  - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
  - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation/report writing.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.
1. Study and implementation of basic concept of OOP (Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing etc.)

2. Study and implementation of abstract class, run time and compile time polymorphism, access specifies: private, public, package, Files and Streams in java, array of objects etc.

3. Write a program to build a simple Menu-Driven Program for Bank Management System using OOP which can perform following operations:
   a) Open account
   b) Deposit Money
   c) Withdraw Money
   d) Display Account

4. Write a program to build a simple Menu Library Management System using OOP which can perform following operations:
   a) Insert new Book
   b) Search for book(s).
   c) Update book details
   d) Issue a book to any student.
   e) Take return of books from student and
   f) Collect fine if any

5. Write a program to build a simple Menu-Driven Program for Student Record System using OOP which can perform following operations:
   a) Insert new Students
   b) Search any student
   c) Update academic records
   d) Modify Student Record
   e) Generate Mark sheet
   f) Delete Student Record

6. Write a program to build a simple Menu-Driven Program for Bus Reservation System using OOP which can perform following operations:
   a) Insert the bus record
   b) Show all buses available
   c) Show the seat availability of any particular bus
   d) Reservation of seat

7. Write a program to build a simple Menu-Driven Program for supermarket billing system using OOP which can perform following operations:
   a) Insert Items
   b) Buy items
   c) Show items in the bucket
   d) Discount if amount is more than a specific amount
   e) Generate bill
8. Write a java applet program that computes the payment of loan based on the amount of loan, interest rate/year and the time either in months or year.

Text Book

Reference Book
2. Head First Java, By Kathy Sierra, Bert Bates, O'Reilly, 2nd Edition

Course Outcome:
At the end of the course, the students will be able to:
1. Differentiate between structures oriented programming and object oriented programming.
2. Use object oriented programming language like C++ or JAVA and associated libraries to develop object oriented programs.
3. Understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using OOP language.
4. Apply concepts of overloading, abstract class, overriding, constructors and destructors, exception handling, packaging system.
COURSE OBJECTIVES:

- Build confidence in listening, speaking, reading and writing English professionally.
- Enable the students to think and speak effectively on everyday topics, including topics related to technical concepts.
- Equip students with the basics of Academic writing.
- Developing industry-ready attitude towards professional communication.
- Prepare for competitive exams like TOEFL, IELTS.

The classes need to be taken in ICT enabled classrooms, as well as in the Language lab.

Module-I:
Conversational Skills (6 hours)

1. General Conversation
   - **Warm-up sessions**
     - Basics of Communication, verbal and non-verbal communication how to be a good speaker, effective body language.
     - Practice sessions on:
       - Introducing oneself
       - Debates on topics like Is India really developing, Indian culture VS western culture, whether robots will overtake humans one day.
       - Just a Minute Sessions (JAMs)
       - Situational Dialogues and Role play: where students can enact everyday situations in their personal and professional lives.

Module-II: (6 hours)
Intensive Practice Sessions

2.1 **Group Discussion** on topics like dangers of social media, is internet killing the print media, *Artificial Intelligence, IOT, Cloud Computing, Cyber security*.

Module-III:

**Organisational Writing** (4 hours)
- Job application letter and CV writing
- E-Mail writing

**Academic Writing** (8 hours)
- *Techniques for good Technical Writing: Academic Writing and Thesis writing*
- Avoiding plagiarism
- Project Proposal
- Statement of Purpose
- Journal Articles
Module-IV: (6 hours)

4.1 Principles and practices of Personal Interview: (Practice sessions)

- Do’s and Don’ts of facing an interview.
- SWOC Analysis
- Rigorous practices of mock-interviews

Module-V: Presentations (4 hours)

- Fundamentals of presentation skills
- Presentation sessions on Technical topics

Module-VI: (6 hours)

Preparation for T.O.E.F.L. and IELTS (Guidance and Practice sessions)

References:

COURSE OBJECTIVES:
To Analyze microwave frequencies and microwave components.
To Analyze microwave systems and assess the impact of microwave component performances on overall system performance.
To Describe the operation and analyze the performance of basic microwave sources and solid state semiconductor devices.
To Understand the techniques of measuring different parameters at microwave frequency.

UNIT 1: INTRODUCTION TO MICROWAVES
1L
History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

UNIT 2: MICROWAVE TRANSMISSION LINES 5L
Concept of Mode Features of TEM, TE and TMModes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of - Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Microstrip line.

UNIT 3: MICROWAVE NETWORK ANALYSIS 2L
Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

UNIT 4: MICROWAVE PASSIVE COMPONENTS 8L
N-port networks- Properties of S matrix, Transmission matrix & their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magic tee, hybrid ring, Circulators, Isolators.

UNIT 5: MICROWAVE TUBES 6L
Design considerations for microwave tubes, current status of microwave tubes, principle of operation of multicycavity and reflex klystron, magnetron and traveling wavetube.

UNIT 6: MICROWAVE SEMICONDUCTOR DEVICES 6L
Operation and circuit applications of Gunn diode, IMPATT diode, PIN Diode, and Schottky barrier diode; Microwave BJT, MESFET, HEMT and their applications.

UNIT 7: MICROWAVE DESIGN PRINCIPLES 6L
Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

UNIT 8: MICROWAVE MEASUREMENTS 4L
Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal. Measurement of Microwave antenna parameters.

Max: 38L

COURSE OUTCOMES
On completion of the course, students will be able to
CO1 - Analyze different parameters of various microwave transmission lines.
CO2 - Realize microwave passive components using network parameters.
CO3 - Outline the characteristics and applications of resonant and non-resonant microwave tubes.
CO4 - Explain the mechanism of microwave generation and application of semiconductor microwave devices.
CO5 - Describe about the design of different microwave systems.
CO6 - Understand the techniques of measurement at microwave frequency.

TEXT/REFERENCE BOOKS
COURSE OUTCOME:
At the end of this course students will be able to:

I. Familiar with importance of error correction methods in data communication and storage.
II. Explain the relations between minimum distance, error detecting capability and error correcting, code rate; and calculate or estimate these quantities for simple block codes
III. Understand the properties of cyclic codes and explain the encoding and decoding techniques.
IV. Define and analyze the properties of BCH and Convolution Codes. Explain their principles of encoding and decoding techniques.
V. Implement encoder and decoder for Turbo, LDPC and Polar codes using iterative decoding
VI. Analyzing and evaluating the practice of different error correcting coded in digital communication system and Memory system.

Module 01:
LINEAR BLOCK CODES  
(07 Hours)
Introduction To Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance of Block Codes, Soft - Decision Decoding, Automatic Repeat Request Schemes. Error Syndromes, Error Detection and Correction, Shortened and Extended Linear Codes.

Module 02:
CYCLIC CODES  
(07 Hours)
Definition of Cyclic Codes, Factors of $X^N +1$, Parity-Check Polynomials, Generator and Parity-Check Matrices of Cyclic Codes, Encoding Cyclic Codes, Decoding Cyclic Codes, Cyclic Hamming Codes, Dual Cyclic Codes,

Module 03:
BCH CODES  
(07 Hours)
Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes in Finite Fields, Decoding SEC and DEC, Reed- Solomon Codes.

Module 04:
CONVOLUTION CODES  
(06 Hours)
Encoding of Convolutional Codes, Generator Matrices for Convolutional Codes, Generator Polynomials for Convolutional Codes, Graphical Representation of Convolutional Codes, Viterbi Decoder.

Module 05:
TURBO CODES  
(04 Hours)
Introduction to Turbo Coding, Distance properties of Turbo Codes, Performance analysis of Turbo codes, Design of Turbo Codes,

Module 06:
LDPC CODES & POLAR CODES  
(04 Hours)
Introduction of LDPC Codes, A Geometric construction of LDPC codes, Tanner Graph Introduction of Polar Codes.
Module 07: BURST ERROR CORRECTING CODES (03 Hours)
Introduction of BEC, Encoding and Decoding of Single & Double Burst Error Correcting Codes.
Total Lectures: 38 Hours

BOOKS RECOMMENDED
Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating Point Arithmetic, Cancellation


Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Nonlinear equations: Fixed Point Iteration, Newton’s Method, Inverse Interpolation Method

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation,


Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers and Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Text/Reference Books:
Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
UNIT I:
Block Schematics of Measuring Systems:
Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of
Errors, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag;
Measuring Instruments: DC Voltmeters, D’Arsonval Movement, DC Current Meters,
AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of
Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT II:
Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave
Analyzers, Spectrum Analyzers, Capacitance-Voltage Meters, Signal Generators: AF, RF
Signal Generators,
Sweep Frequency Generators, Pulse and Square wave Generators, Function
Generators, Arbitrary waveform Generator.

UNIT III:
Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures,
CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency.
Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT IV:
Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement
Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT,
Thermocouples, Synchros, Special Resistance Thermometers, Piezoelectric
Transducers, Magnetostrictive Transducers.

UNIT V:
Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.
Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level
Measurement, Measurement of Humidity and Moisture, Velocity, Pressure
- High Pressure,
- Vacuum level, Temperature
- Measurements, Data Acquisition Systems.

TEXTBOOKS:
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D.

REFERENCES:
OUTCOMES
Upon a successful completion of this course, the student will be able to:

1. Describe the fundamental concepts and principles of instrumentation
2. Explain the operation of various instruments required in measurements
3. Apply the measurement techniques for different types of tests
4. To select specific instruments for specific measurement function.
5. Understand principle of operation and working of different electronic instruments

Students will understand functioning, specification and application of signal analyzing instruments
Object oriented design [4 L]
Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

Object oriented concepts [4 L]
Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

Class & Object properties [6L]
Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length(), substring(), toCharArray(), toLowerCase(), toUpperCase(), trim(), valueOf() methods) & StringBuffer classes append(), capacity(), delete(), deleteCharAt(), ensureCapacity(), getChars(), insert(), setCharAt(), setLength() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

Reusability properties[6L] – Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading [6L] – Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, interthread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) [4L] – Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener. I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Course Outcome: At the end of the course, the students will be able to:
1. Understanding the concept of Object Oriented Programming. Able to prepare object-oriented design for small/medium scale problems
2. Able to explain class structures as fundamental, modular building blocks and can identify the class, object, methods, different access specifiers, constructors, polymorphism by overloading and overriding, string class, string buffer class etc and their usage.
3. Define various classes with constructors, methods and create objects and use them in solving small/medium scale problems. Able to demonstrate the differences between traditional imperative design and object-oriented design.
4. Learn JAVA basics and syntax and use it for implementing OOP to solve problems. Design and implement non-trivial object-oriented program using appropriate object-oriented design. Use the concept of packages and different access specifiers.
5. Implement the concept of OOP for solving various large programmes into a modular approach using abstract classes, interfaces-multiple inheritance, extending interfaces etc. (i.e., reusability of code) and realize the benefit of OOP approach. Able to use classes written by other programmers when constructing their systems. Understand the concept of
multithreaded programming for solving various large programmes into a sub programme.

6. Try to solve different real life problem using exception handling in an Object Oriented way where ever changing future can adopt easily with less coding and less changes is required. Like they should able to understand and to use stacks, queues etc. Develop different real life application using applet programming.
Semester-VII

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>HS-HU701</td>
<td>Principles of Management</td>
<td>2L:0T:0P 2</td>
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</table>

**Module-I**

1. Basic concepts of management: Definition - Essence, Functions, Roles, Level.

**Module-II**

5. Managerial Competencies - Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

**Module-III**


**Module-IV**


**References:**

COURSE OBJECTIVES:

To learn the basic antenna parameters.

To understand the radiation mechanism of dipole antennas.

To explore the various antenna arrays and calculate the maxima, minima and half power directions.

To discuss characteristics of travelling wave radiators and high frequency antennas.

To study antenna measurements techniques.

UNIT 1: ANTENNA FUNDAMENTALS AND WIRE ANTENNAS  

UNIT 2: ANTENNA ARRAYS  
Types of arrays-Broadside, End fire, Collinear, Parasitic arrays. -Arrays of two-point sources. N element of uniform linear arrays- Array of N elements with equal spacing and currents equal in magnitude (broadside array)-Array of N elements with equal spacing and currents equal in magnitude but with progressive phase shift(end fire array)-Hansen-woodyard array-Pattern Multiplication-Binomial arrays.

UNIT 3: TRAVELLING WAVE AND BROAD BAND ANTENNAS  

UNIT 4: WAVE PROPAGATION  
Factors involved in the propagation of Radio Waves-Ground wave propagation, Structure of Ionosphere and its effects on radio waves-Refraction and Reflection of skywave by the ionosphere, Ray paths-Measures of Ionosphere propagation: critical frequency, skip distance, virtual height, Maximum usable frequency,OWF. Ionospheric abnormalities. Fading of signals and Diversity reception. Space wave propagation-Considerations in space wave propagation, LOS, Atmospheric effects in space wave propagation. Super Refraction-Duct Wave Propagation. Tropospheric scatter( brief idea only).

UNIT 5: ANTENNA DESIGN & MEASUREMENTS  
Introduction to basic concepts in antenna measurements with error sources-Anechoic Chamber. Radiation Pattern Measurement-Gain measurement-Beamwidth and Directivity

Max. 38L

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Define the antenna basic parameters.

CO2 – Explain the radiation mechanism from different antennas.

CO3 – Classify antenna arrays and infer their significance.

CO4 – Analyze the characteristics of low and high frequency antennas.

CO5 – Compare the properties and measures of radiowave propagation.

CO6 – Design practical antennas & perform antenna measurements.

TEXT/REFERENCE BOOKS


Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.


WDM and DWDM systems. Principles of WDM networks.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

**Text/Reference Books**

**Course Outcomes:**
At the end of the course, students will demonstrate the ability to:
1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors
4. Analyze system performance of optical communication systems
5. Design optical networks and understand non-linear effects in optical fibers
Introduction and Historical Background, Scaling Effects.

Micro/Nano Sensors, Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction;


Text/Reference Book:

Course Outcomes:
At the end of the course the students will be able to
1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.
Brief introduction to human physiology.

Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.


Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

**Text/Reference Books:**

**Course Outcomes:**
At the end of the course, students will demonstrate the ability to:
1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/ Reference Books:
1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems
Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Satellite link budget

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text / Reference Books:

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
### Course Details

**Course Code:** PE-EC702C  
**Course Name:** Adaptive Signal Processing  
**Credits:** 3L:0T:0P  
**3 credits**

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudoinverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

### Text/Reference Books:


### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
2. Mathematically represent the ‘adaptability requirement’.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Single-node architecture, Hardware components & design constraints,

Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Course Outcomes:
At the end of the course the students will be able to
1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN
Introduction:
- Origin of wavelets and its history
- Different communities of wavelet
- Classification: continuous and discrete wavelet transforms
- Developments in wavelet theory applications

Continuous Wavelet Transform:
- Introduction
- Continuous time wavelets
  - Definition of CWT
- Constant Q factor filtering interpretation and Time Frequency Resolution
- CWT as an operator
- Inverse CWT

Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition:
- Approximations of vectors in nested linear vector subspaces
- Multi-resolution Analysis of $L^2(R)$
  - Haar Scaling function
  - Haar wavelet
  - Haar wavelet decomposition.
  - Haar wavelet packets and application.

MRA Ortho-normal wavelets and their relationships to filter banks:
- Construction of an ortho-normal MRA
- Wavelet basis for the MRA
- Digital filtering interpretation
- Examples of orthogonal basis generating wavelets
- Interpreting ortho-normal MRA for discrete time signals
- Generating scaling functions and wavelets from filter coefficients.

Bi-orthogonal Wavelets:
- Bi-orthogonal Wavelet bases
- Filtering relationship for Bi-orthogonal filters
- Bi-orthogonal scaling functions and wavelets
- Two dimensional wavelets
- Non separable Multi-dimensional wavelet
- Wavelet Packets.

Wavelength Transform and applications:
- Transform coding
- DTWT for image compression, audio compression
Wavelet based audio coding, video coding and multi resolution Techniques  
Wavelet de-noising, Speckle removal, Edge detection and  
object isolation  
Image fusion, Object detection, discrete wavelet multi-tone  
modulation. Beyond

Wavelet:

Ridge lets and curve lets:Ridge let transform and Digital Curve let  
transform  
Curve let construction  
Properties and applications.

Reference Books:
1. RaguveerM.Rao and Ajit S.Bopardikar-Wavelet Transforms –  
Introduction and applications- Pearson Education, 2008  
2. K.P Soman, K.I.Ramachandran – Insight into Wavelets from Theory to practice, PHI2006

Course Outcome:
After successfully completion of this course, students should able to –
1. Classify various wavelet transform and explain importance of it.  
2. Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT).  
3. Explain the properties and application of wavelet transform.  
4. Develop and realize computationally efficient wavelet based algorithms for signal and image  
processing.  
5. Explain brief features and strength of transform beyond wavelet.
COURSE OBJECTIVES:
To understand the fundamentals of Millimeter wave devices and circuits.
To understand the various components of Millimeter wave Communications system.
To know the antenna design at Millimeter wave frequencies

UNIT 1: INTRODUCTION 6L
Millimeter wave characteristics- implementation challenges, Radio wave propagation for mm wave: Large scale propagation channel effects, small scale channel effects, Outdoor and Indoor channel models, Emerging applications of millimeter wave communications.

UNIT 2: MILLIMETER WAVE DEVICES AND CIRCUITS 8L
Millimeter wave generation and amplification: Peniotrons, Ubitrons, Gyrotrons and Free electron lasers . HEMT, models for mm wave Transistors, transistor configurations, Analog mm wave components: Amplifiers, Mixers, VCO, PLL. Metrics for analog mm wave devices, Consumption factor theory, Trends and architectures for mm wave wireless, ADC’s and DAC’s only.

UNIT 3: MILLIMETER WAVE COMMUNICATION SYSTEMS 8L
Modulations for millimeter wave communications: OOK, PSK, FSK, QAM, OFDM, Millimeter wave link budget, Transceiver architecture, Transceiver without mixer, Receiver without Oscillator, Overview of Millimeter wave calibration, production and manufacture, Millimeter wave design considerations.

UNIT 4: MILLIMETER WAVE MIMO SYSTEMS 8L
Massive MIMO Communications, Spatial diversity of Antenna Arrays, Multiple Antennas, Multiple Transceivers, Noise coupling in MIMO system, Potential benefits for mm wave systems. Spatial, Temporal and Frequency diversity, Dynamic spatial, frequency and modulation allocation-Brief idea only.

UNIT 5: ANTENNAS FOR MILLIMETER WAVE SYSTEMS 8L
Antenna beamwidth, polarization, advanced beam steering and beam forming, mm wave design consideration, On-chip and In package mm wave antennas, Techniques to improve gain of on-chip antennas, Implementation for mm wave in adaptive antenna arrays, Device to Device communications over 5G systems , Design techniques of 5G mobile.

Max: 38L

COURSE OUTCOMES
On completion of the course, students will be able to
CO1 - Understand the fundamentals of Millimeter wave technology.
CO2 –Acquire knowledge about working of Millimeter wave devices and circuits.
CO3- Explain the mechanism of millimeter wave generation and amplification.
CO4 -Outline the characteristics of various components of Millimeter wave Communications system.
CO5 - Design antenna for Millimeter wave frequencies.
CO6 –Apply knowledge of Millimeter wave technology in emerging applications.

TEXT/REFERENCE BOOKS
UNIT-I :
New Industrial Policy of 1991, Meaning and Definition of Entrepreneurship, Incentives and benefits available to SSI Units and New Entrepreneurs. Dearth of entrepreneurial talent in India, Growth of SSI in India. Procedures to start SSIs.

UNIT-II :
Market survey and research pricing and techniques, Distribution Channel, Sales promotion activities. Raising Finance and enterprise launching.

UNIT-III :

UNIT-IV :

Text Book

Reference Book

Course outcome : At the end of the course the students will be able to :
1. know the contribution of an entrepreneur and role of SSI units in growth and development of socioeconomic condition of our country.
2. learn market survey, sales promotions and management of working capital through costing and book keeping.
3. know different decision making technique and benefit of personal management system as well as motivational methods of an enterprise.
4. learn how to prepare a project report and knowledge about different tax system of an enterprise.
The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.
Semester-VIII

| PE-EC801A | Mobile Communication and Networks | 3L:0T:0P | 3 credits |

Cellular concepts-Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance.
Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels - neighborhood, adjacency, connectivity, distance measures.

Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters - linear and order-statistics, pixel-domain sharpening filters - first and second derivative, two-dimensional DFT and its inverse, frequency domain filters - low-pass and high-pass.

Color Image Processing-Color models-RGB, YUV, HSI; Color transformations- formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding - global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

Image Compression-Redundancy-inter-pixel and psycho-visual; Lossless compression - predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards-JPEG and JPEG-2000.

Fundamentals of Video Coding-Inter-frame redundancy, motion estimation techniques - full-search, fast search strategies, forward and backward motion prediction, frame classification - I, P and B; Video sequence hierarchy-Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards - MPEG and H.26X.

Video Segmentation-Temporal segmentation-shot boundary detection, hard-cuts and soft-cuts; spatial segmentation-motion-based; Video object detection and tracking.

**Text/Reference Books:**
**Course Outcomes:**
At the end of the course, students will demonstrate the ability to:
1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding
VLSI Methodologies: Introduction to VLSI design, Moore’s Law, VLSI Design flow, Design hierarchy, VLSI Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmable devices, design quality. MOSFET: Electrical characteristics of MOSFET, Threshold voltage, Body effect, current expression (gradual channel approximation method), Channel length modulation, MOSFET scaling: constant field and constant voltage scaling, Short-channel effects.

Unit process in VLSI and IC fabrication: Unit process in VLSI: Wafer preparation, Oxidation, Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. nMOS fabrication, n-well and p-well process.

CMOS Logic Circuits: General CMOS logic structure, VTC of inverter, noise margin, Different types of inverter (resistive load, enhancement and depletion nMOS load and CMOS), Switching characteristic (propagation delay and parasitic capacitance estimation), NAND, NOR and other complex CMOS logic circuits, Sizing of CMOS logic circuits, CMOS Power: static and dynamic power dissipation, latch-up, sizing for large capacitive load. Dynamic CMOS logic circuits, charge leakage and charge sharing problem, dynamic gate cascading problem, Domino and NORA logic, Introduction of sequential CMOS logic circuits, Stick diagram. Layout and Layout design rules.

Physical Design Automation: Objectives and goals of partitioning, floor planning and placement, Global routing.

Text Book

Reference Book
2. VLSI Design and EDA Tools – Angsuman Sarkar, Swapnadip De & Chandan Kumar Sarkar, Scitech Publication(India) PVT, LTD

Embedded Hardware:


Interrupt Service Mechanism: Concept of ISR, different interrupt sources, Interrupt handling Mechanism, Multiple Interrupts, Interrupt Latency and deadline.

Embedded Software Development-
Software Development: Programming concept in ALP (assembly language programming) and High level language-C, Processor directives, functions and macros and other programming elements, Embedded C++ concept only.

RTOS(Real time operating System)- OS overview, Process, Interrupt and memory management, RTOS overview, Basic Design rule using RTOS, Task scheduling using Priority based scheduling, cyclic scheduling and round robin scheduling.

Embedded system Design using PIC microcontroller: Introduction to Microchip PIC16 family, PIC16F873
processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM, Asynchronous serial port, SPI mode, I2C mode, Interfacing with LCD, ADC, sensors, stepper motor, key board, DAC.

**Case study of different types of Embedded System:** Design of Automated Chocolate Vending Machine, Digital Camera.

**Text Book**

**Reference Book**
Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques - parametric, waveform and hybrid; Requirements of speech codecs - quality, coding delays, robustness.

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of nonstationary signals - prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization-uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization - distortion measures, codebook design, codebook types.

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency - LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Code Excited Linear Prediction- CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search - state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards- An overview of ITU-T G.726, G.728 and G.729 standards

Text/Reference Books:
Introduction:
The Internet of Things: an Overview:
The flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices:
Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for Connected Devices, Affordances.

Internet Principles:

Prototyping:
Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community.

Prototyping Embedded Devices:

Prototyping the Physical Design:
Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling.

Prototyping Online Components:
Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols.

Techniques for Writing Embedded Code:
Memory Management, Performance and Battery Life, Libraries, Debugging.

Prototype to Reality:

Moving to Manufacture:
What Are You Producing?, Designing Kits, Designing Printed Circuit Boards, Manufacturing Printed Circuit Boards, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software,

Ethics:
Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Text Book

Course Outcome: At the end of the course, the students will be able to:
1. understand the application areas of IOT.
2. realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. understand building blocks of Internet of Things and characteristics.
Introduction:

Cyber security objectives and guidance

Cyber governance issues

Cyber infrastructure issues
Cyber Infrastructure Issue – economics ,finance and banking – Health care – Industrial Control systems. Cyber insurance, cyber security in international relations.

Text Book

Reference Book

Course Outcome : At the end of the course, the students will be able to :
1. understand the concept of cyber security
Introduction:
Overview; Foundation; History; The State of Art.

Intelligent Agents:
Agents and environment; Rationality; The nature of environment; The structure of agents.

Solving Problems by Searching:
Problem-solving agents; Well defined problems & solutions; Formulating problems; Searching for solution; Uninformed search strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search) Informed Search and Exploration:
Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

Constraint Satisfaction Problems:
Constraint satisfaction problems; Backtracking search for CSPs; Local search for CSPs.

Adversial search:
Games; Optimal decisions in games; Alpha-Beta pruning.

Logical Agents:
Knowledge-based agents; The wumpus world as an example world; Logic: Propositional logic Reasoning patterns in propositional logic.

First-order Logic:
Syntax and semantics of first-order logic; Use of first-order logic.

Text Book

Reference Book
   Hill, 2008.

Course Outcome: At the end of the course, the students will be able to:
1. understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
2. demonstrate awareness of the major challenges facing AI and the complex of typical problems within the field.
3. exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.
4. assess critically the techniques presented and to apply them to real world problems.
UNIT-1-Introduction to Organization and Organizational Behaviour:
Meaning and definition of organization, features and principles of organization, Organizational structures and nature of organizational behavior.

UNIT-2-Personality:
Meaning of Personality, Personality Development, Determinants of personality, Application of personality in the organizational level. Motivation-concept of motivation, motivation and behavior, Theories of motivation, Need theory, Hygiene theory, Theory X and Theory Y, Elements of sound motivational system, Motivation in Indian organization.

UNIT-3-Leadership:

UNIT-4- Organizational Change:
Meaning and Nature of organizational change, Factors of organizational change, Resistance to change, Factors in resistance, Overcoming resistance to change, Organizational Development-Concept, Objectives and process of organization development.

Text Book

Reference Book
1. Organizational Behaviour Dr S.S.Khanka, S.Chand, 2014.

Course Outcome: At the end of the course the students will be able to:
1. know about organisational structure, organisational behaviour and personality development.
2. learn about motivational techniques and skill required to work in a group and the process of group decision making.
3. know various leadership styles and the role of leader in achievement of organisational objective.
4. learn about the reasons organizational change and its development.
The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.