# DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

## Course Structure and Syllabus Applicable From 2021-22 Admitted Batch NR21

your roots to success...

## NARSIMHA REDDY ENGINEERING COLLEGE

# UGC AUTONOMOUS

**ACCREDITED BY NBA AND NAAC WITH A GRADE**

**NARSIMHA REDDY ENGINEERING COLLEGE (AUTONOMOUS)**

**B.Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE & SYLLABUS (NR21)**

**Applicable From 2021-22 Admitted Batch**

**I YEAR I SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | MA1101BS | Linear Algebra & Calculus | 3 | 1 | 0 | 4 |
| 2 | CH1102BS | Chemistry | 3 | 1 | 0 | 4 |
| 3 | ME1103ES | Engineering Graphics | 1 | 0 | 4 | 3 |
| 4 | EE1104ES | Basic Electrical Engineering | 3 | 0 | 0 | 3 |
| 5 | CH1105BS | Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 6 | ME1106ES | Engineering Workshop | 1 | 0 | 3 | 2.5 |
| 7 | EE1107ES | Basic Electrical Engineering Lab | 0 | 0 | 2 | 1 |
| | | Induction Programme | | | | |
| | | **Total Credits** | **11** | **2** | **12** | **19** |

**I YEAR II SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | MA1201BS | Advanced Calculus | 3 | 1 | 0 | 4 |
| 2 | AP1202BS | Applied Physics | 3 | 1 | 0 | 4 |
| 3 | CS1203ES | Programming For Problem Solving | 3 | 1 | 0 | 4 |
| 4 | EN1204HS | English | 2 | 0 | 0 | 2 |
| 5 | AP1205BS | Applied Physics Lab | 0 | 0 | 3 | 1.5 |
| 6 | CS1206ES | Programming For Problem Solving Lab | 0 | 0 | 3 | 1.5 |
| 7 | EN1207HS | English Language And Communication Lab | 0 | 0 | 2 | 1 |
| 8 | MC1001ES* | Environmental Science | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **14** | **3** | **8** | **18** |

***Mandatory Non Credit Course

**II YEAR I SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | EC2101PC | Electronic Devices and Circuits | 3 | 1 | 0 | 4 |
| 2 | EC2102PC | Network Analysis and Transmission Lines | 3 | 0 | 0 | 3 |
| 3 | EC2103PC | Digital Logic Design | 3 | 1 | 0 | 4 |
| 4 | EC2104PC | Signals and Systems | 3 | 1 | 0 | 4 |
| 5 | EC2105ES | Probability Theory and Stochastic Processes | 3 | 0 | 0 | 3 |
| 6 | EC2106PC | Electronic Devices and Circuits Lab | 0 | 0 | 2 | 1 |
| 7 | EC2107PC | Digital Logic Design Lab | 0 | 0 | 2 | 1 |
| 8 | EC2108ES | Basic Simulation Lab | 0 | 0 | 2 | 1 |
| 9 | MC2001* | Constitution of India | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **18** | **3** | **6** | **21** |

**II YEAR II SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | EC2201PC | Electromagnetic Fields and Waves | 3 | 0 | 0 | 3 |
| 2 | MA2202BS | Laplace Transforms, Numerical Methods & Complex Variables | 3 | 1 | 0 | 4 |
| 3 | EC2203PC | Analog and Digital Communications | 3 | 1 | 0 | 4 |
| 4 | EC2204PC | Linear IC Applications | 3 | 0 | 0 | 3 |
| 5 | EC2205PC | Electronic Circuit Analysis | 3 | 0 | 0 | 3 |
| 6 | EC2206PC | Analog and Digital Communications Lab | 0 | 0 | 3 | 1.5 |
| 7 | EC2207PC | IC Applications Lab | 0 | 0 | 3 | 1.5 |
| 8 | EC2208ES | Electronic Circuit Analysis Lab | 0 | 0 | 2 | 1 |
| 9 | MC2002* | Gender Sensitization Lab | 0 | 0 | 2 | 0 |
| | | **Total Credits** | **15** | **2** | **10** | **21** |

*MC Mandatory Non Credit Course

**III YEAR I SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | EC3101PC | Microprocessors & Microcontrollers | 3 | 1 | 0 | 4 |
| 2 | EC3102PC | Data Communications and Networks | 3 | 1 | 0 | 4 |
| 3 | EC3103PC | Control Systems | 3 | 1 | 0 | 4 |
| 4 | SM3104MS | Business Economics & Financial Analysis | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective - I | 3 | 0 | 0 | 3 |
| 6 | EC3105PC | Microprocessors & Microcontrollers Lab | 0 | 0 | 3 | 1.5 |
| 7 | EC3106PC | Data Communications and Networks Lab | 0 | 0 | 3 | 1.5 |
| 8 | EN3107HS | Advanced Communication Skills Lab | 0 | 0 | 2 | 1 |
| 9 | MC3001* | Cyber Security | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **18** | **3** | **8** | **22** |

**III YEAR II SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | EC3201PC | Antennas and Propagation | 3 | 1 | 0 | 4 |
| 2 | EC3202PC | Digital Signal Processing | 3 | 1 | 0 | 4 |
| 3 | EC3203PC | VLSI Design | 3 | 1 | 0 | 4 |
| 4 | | Professional Elective - II | 3 | 0 | 0 | 3 |
| 5 | | Open Elective - I | 3 | 0 | 0 | 3 |
| 6 | EC3204PC | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 |
| 7 | EC3205PC | e – CAD Lab | 0 | 0 | 3 | 1.5 |
| 8 | EC3206PC | Scripting Languages Lab | 0 | 0 | 2 | 1 |
| 9 | MC3002* | Artificial Intelligence | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **18** | **3** | **8** | **22** |

*MC Mandatory Non Credit Course

**Professional Elective – I**

| | |
|---|---|
| EC3111PE | Computer Organization & Operating Systems |
| EC3112PE | Electronic Measurements and Instrumentation |
| EC3113PE | Digital System Design Using FPGA |

**Professional Elective – II**

| | |
|---|---|
| EC3221PE | Digital Image Processing |
| EC3222PE | Embedded System Design |
| EC3223PE | Web Technology |

**IV YEAR I SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | EC4101PC | Microwave and Optical Communications | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective – III | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective – IV | 3 | 0 | 0 | 3 |
| 4 | | Open Elective - II | 3 | 0 | 0 | 3 |
| 5 | SM4102MS | Professional Practice, Law & Ethics | 2 | 0 | 0 | 2 |
| 6 | EC4103PC | Microwave and Optical Communications Lab | 0 | 0 | 2 | 1 |
| 7 | EC4104PC** | Industrial Oriented Mini Project/ Summer Internship | 0 | 0 | 0 | 2 |
| 8 | EC4105PC | Seminar | 0 | 0 | 2 | 1 |
| 9 | EC4106PC | Project Stage - I | 0 | 0 | 6 | 3 |
| 10 | MC4001* | Intellectual Property Rights | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **17** | **0** | **10** | **21** |

**IV YEAR II SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Professional Elective – V | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective – VI | 3 | 0 | 0 | 3 |
| 3 | | Open Elective - III | 3 | 0 | 0 | 3 |
| 4 | EC4201PC | Project Stage - II | 0 | 0 | 14 | 7 |
| | | **Total Credits** | **9** | **0** | **14** | **16** |

*MC Mandatory Non Credit Course
**Mandatory Credit Course

**Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 3-2 and 4-1 semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

**Professional Elective – III**

| | |
|---|---|
| EC4131PE | Scripting Languages |
| EC4132PE | Mobile Communications and Networks |
| EC4133PE | Internet of Things |

**Professional Elective – IV**

| | |
|---|---|
| EC4141PE | Biomedical Instrumentation |
| EC4142PE | Network Security and Cryptography |
| EC4143PE | Design of Fault Tolerant Systems |

**Professional Elective – V**

| | |
|---|---|
| EC4251PE | Satellite Communications |
| EC4252PE | Radar Systems |
| EC4253PE | Wireless Sensor Networks |

**Professional Elective – VI**

| | |
|---|---|
| EC4261PE | Information Theory and Coding |
| EC4262PE | Artificial Neural Networks |
| EC4263PE | Data Analytics |

**List of Open Electives offered by various departments**

| Sr. No. | Branch | Open Elective Offered (OE – I) | Open Elective Offered (OE – II) | Open Elective Offered (OE –III) |
|---|---|---|---|---|
| 1 | Civil Engineering | CE3211OE: Basics of Civil Engineering | CE4121OE: Environmental Impact Assessment | CE4231OE: Remote Sensing and GIS |
| 2 | | CE3212OE: Building Materials and Construction | CE4122OE: Industrial Waste Water Treatment | CE4232OE: Disaster Management |
| 3 | Computer Science Engineering | CS3211OE: Introduction to Data Science | CS4121OE: Python Programming | CS4231OE: Machine Learning |
| 4 | | CS3212OE: Data mining | CS4122OE: R Programming | CS4232OE: Cloud Computing |
| 5 | | CS3213OE: Computer Forensics | CS4123OE: JAVA Programming | CS4233OE: Natural Language Processing |
| 6 | Electrical And Electronics Engineering | EE3211OE: Electrical Installation and costing | EE4121OE: Renewable Energy sources | EE4231OE: Instrumentation and Control |
| 7 | | EE3212OE: Electrical Engineering Material | EE4122OE: Reliability Engineering | EE4232OE: Energy Storage Systems |
| 8 | Mechanical Engineering | ME3211OE: Operation Research | ME4121OE: Fabrication Processes | ME4231OE: Reliability Engineering |
| 9 | | ME3212OE: Fundamentals of Mechanical Engineering | ME4122OE: Total Quality Management | ME4232OE: Industrial Management |
| 10 | | ME3213OE: Metallurgy of Non-Metallurgists | ME4123OE: Energy Management and Conservation | ME4233OE: Renewable Energy Sources |
| 11 | Electronics And Communication Engineering | EC3211OE: Fundamentals of Internet of Things | EC4121OE: Principles of Computer Communications and Networks | EC4231OE: Electronic Measuring Instruments |

**MA1101BS: LINEAR ALGEBRA & CALCULUS**

**B.Tech. I Year I Sem.** **LTPC 3104**

**Course Objectives:** To learn

Types of matrices and their properties.
Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
Concept of Fourier Series.
Concept of nature of the series.
Geometrical approach to the mean value theorems and their application to the mathematical problems
Evaluation of surface areas and volumes of revolutions of curves.
Evaluation of improper integrals using Beta and Gamma functions.
Partial differentiation, concept of total derivative
Finding maxima and minima of function of two and three variables.

**Course Outcomes:** After learning the contents of this paper the student must be able to

Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
Find the Eigen values and Eigen vectors
Reduce the quadratic form to canonical form using orthogonal transformations.
Analyse the nature of sequence and series.
Solve the applications on the mean value theorems.
Evaluate the improper integrals using Beta and Gamma functions
Find the extreme values of functions of two variables with/ without constraints.

**UNIT-1: Matrices**

Matrices: Introduction. Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations. Gauss elimination method; Gauss Seidel Iteration method, **LU Decomposition Method.**

**UNIT-2: Eigen values and Eigen vectors**

Vectors Linear Transformation and Orthogonal Transformation: Eigen values and Eigen vectors and their properties. Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding the inverse an d power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of Quadratic forms; Reduction of Quadratic form to Canonical form by Orthogonal Transformation.

**UNIT-3: Fourier series**

Definition of periodic function, Fourier expansion of periodic function in $(0,2\ )$ $(-\ ,\ )$. Determination of Fourier coefficients – Fourier series of even and odd functions – Half – Range Fourier Sine and Cosine expansions.

**UNIT-IV: Calculus**

Mean value theorems : Rolle's theorem , Lagrange's Mean value theorem with their Geometrical Interpretation and applications , Cauchy's Mean value theorem. Definition of Improper Integral : Beta and Gamma functions and their applications.

**UNIT-V: Multivariable calculus (Partial Differentiation and applications)**

Definitions of limit and continuity. Partial Differentiation ; Euler's Theorem ; Total derivative; Jacobian ; Functional dependence & independence , Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

**TEXTBOOKS:**

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.

**REFERENCES:**

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010

**CH1102BS: CHEMISTRY**

**B.Tech I YEAR I SEM** **LTPC**
**3104**

**Course objectives:**

To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
To develop specialized knowledge in the analysis of water and waste water which are essential for the engineers and in industry.
Learn about the fundamentals of electrode reactions and electrochemical cells
To provide an understanding of the corrosion principles and engineering methods used to minimize and prevent corrosion.
To familiarize students about the characteristics and applications of different polymers and engineering materials in every day life.
To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.

**Course outcomes:**

The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.
Apply knowledge and understanding of water treatment process to real world problems.
Interpret the knowledge of electrochemical phenomenon involved in developing batteries and understanding fuel cells fundamentals.
Ability to determine appropriate method of protection against corrosion for a metal based on its applications in different fields.
Classify and characterize different polymers engineering materials and apply its knowledge to select suitable materials for specific applications.
The required skills to get clear concepts on basic spectroscopy and applications to medical and other fields.

**UNIT - I:**

**Molecular structure and Theories of Bonding**:

Atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO), molecular orbitals of diatomic orbitals, molecular orbital energy level diagrams for $N_2$, $O_2$ and $F_2$ molecules.

Crystal field theory (CFT): Salient features of CFT- Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and Square planar geometries. Band structure of solids and effect of doping on conductance.

**UNIT-II**

**Water and its treatment**: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent -expression and units of hardness. Numerical problems. Disadvantages of hard water.

Boiler troubles: Scales and Sludges, caustic embrittlement, boiler corrosion, Softening of water by internal treatment of Boiler feed water and ion- exchange processes. Desalination of water – Reverse osmosis. Sewage water treatment. Potable water treatment - Disinfection of potable water by chlorination and Ozonization.

**UNIT-III**

**Electrochemistry, Batteries and Corrosion:**

Electrochemistry: Electrochemical cells- Electrode, electrode potential, standard electrode potential, types of electrodes- Calomel and glass electrodes. Nernst equation, electrochemical series and its applications.

Batteries: Cell and battery - Primary (Lithium cell) and secondary batteries (Lead – acid storage battery, Lithium ion battery, advantages and applications of solid state battery)

Fuel cells: Hydrogen-oxygen, solid polymer electrolytic fuel cell, Bio chemical fuel cells------- Advantages and Applications.

Corrosion and its control –Concept of corrosion, Types of corrosion,

mechanism of Chemical & Electro chemical corrosion. Types of electro chemical corrosion (Galvanic corrosion, Pitting, Water line corrosion, stress corrosion). Factors affecting corrosion.

Corrosion control methods -Principle of cathodic protection- Sacrificial Anodic Protection (SAP), Impressed Current Cathodic Protection (ICCP) .

Protective coatings: Metallic coatings- Hot dipping, metal cladding, cementation, electroplating of copper, electro less plating of nickel**, paints.**

**UNIT-IV**

**Engineering materials:**

**Ceramics:** Properties & types of ceramics. Engineering applications of ceramics

**Polymers:** Defnition, classification, properties of polymers. Plastics-Compounding of plastics, Engineering applications of plastics (PVC, Teflon, Bakelite), Fibres - Applications of Nylon 6. FRP-Types, advantages and applications. Natural rubber and its vulcanization. Elastomers- Applications. Conducting polymers and its applications-Mechanism of conduction and doping in poly acetylene. Applications of bio degradable polymers.

**Composites:** Classification, Constituents, advantages, applications.

**Lubricants:** Classification, properties and mechanism of lubrication.

**UNIT-V**

**Spectroscopic techniques and applications:**

Principles of Spectroscopy, Selection rules and applications of electronic spectroscopy. Vibrational and rotational spectroscopy. Basic concepts of Nuclear Magnetic resonance spectroscopy, Chemical shift. Introduction to Magnetic Resonance Imaging.

**Suggested Text Books:**

Physical Chemistry, by P.W. Atkins

Engineering Chemistry by P.C.Jain & M.Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Fundamentals of Molecular Spectroscopy, by C.N. Banwell

University Chemistry, by B.M. Mahan, Pearson IV Edition.

Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan

R. V. E. Gadag & A. Nityananda Shetty, Engineering Chemistry, I K International Publishing House Private Limited, New Delhi, 2015 Edition

**ME1103ES: ENGINEERING GRAPHICS**

**B.Tech. I Year I Sem.** **LTPC 1043**

**Course objectives:**

To provide basic concepts in engineering drawing.
To impart knowledge about standard principles of orthographic projection of objects.
To draw sectional views and pictorial views of solids.

**Course Outcomes:** At the end of the course, the student will be able to:

Preparing working drawings to communicate the ideas and information.
Read, understand and interpret engineering drawings.

**UNIT – I**

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

**UNIT- II**

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes.

**UNIT – III**

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

**UNIT – IV**

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

**UNIT – V**

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions

**Introduction to CAD:** (For Internal Evaluation Weightage only):

Introduction to CAD Software Package Commands. - Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package

**TEXT BOOKS:**

Engineering Drawing N.D. Bhatt / Charotar
Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

**REFERENCE BOOKS:**

Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

**EE1104ES: BASIC ELECTRICAL ENGINEERING**

**B.Tech. I Year I Sem.** **LTPC**
**3003**

**Course Objectives:**

To introduce the concepts of electrical circuits and its components
To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
To study and understand the different types of DC/AC machines and Transformers.
To import the knowledge of various electrical installations.
To introduce the concept of power, power factor and its improvement.

**Course Outcomes:**

To analyze and solve electrical circuits using network laws and theorems.
To understand and analyze basic Electric and Magnetic circuits
To study the working principles of Electrical Machines
To introduce components of Low Voltage Electrical Installations

**UNIT-I:**

D.C. Circuits Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems and maximum power transfer thorem. Time-domain analysis of first-order RL and RC circuits.

**UNIT-II:**

A.C. Circuits Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT-III:**

Transformers Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT-IV:**

Electrical Machines Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction and working principle of Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

**UNIT-V:**

Electrical Installations Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Power factor measurement using 2 wattmeter method, Elementary calculations for energy consumption,

**TEXT BOOKS/ REFERENCE BOOKS:**

Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
L.S. Bobrow, Fundamentals of Electrical Engineering”, Oxford University Press, 2011
Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010
Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 198

## CH1105BS: CHEMISTRY LAB

**B.Tech. I Year I Sem** **LTPC**
**0 0 31.5**

**Course Objectives:** The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
To determine the rate constant of reactions from concentrations as an function of time.
The measurement of physical properties like adsorption and viscosity.
To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.

**Course Outcomes:** The experiments will make the student gain skills on:

Determination of parameters like hardness and chloride content in water.
Estimation of rate constant of a reaction from concentration – time relationships.
Determination of physical properties like adsorption and viscosity.
Calculation of Rf values of some organic molecules by TLC technique.

**List of Experiments:**

Determination of total hardness of water by complexometric method using EDTA
Determination of chloride content of water by Argentometry
Estimation of an HCl by Conductometric titrations
Estimation of Acetic acid by Conductometric titrations
Estimation of HCl by Potentiometric titrations
Estimation of $Fe^{2+}$ by Potentiometry using $KMnO_4$
Determination of rate constant of acid catalysed hydrolysis of methyl acetate
Synthesis of Aspirin and Paracetamol
Thin layer chromatography calculation of Rf values. eg ortho and para nitro phenols
Determination of acid value of coconut oil
Verification of freundlich adsorption isotherm-adsorption of acetic acid on charcoal
Determination of viscosity of castor oil and ground nut oil by using Ostwald's viscometer.
Determination of partition coefficient of acetic acid between n-butanol and water.
Determination of surface tension of a give liquid using stalagmometer.

**References**

Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi)
An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi)
Vogel's text book of practical organic chemistry 5th edition
Text book on Experiments and calculations in Engineering chemistry – S.S. Dara

**ME1106ES: ENGINEERING WORKSHOP**

**B. Tech. I Year I Sem.** **LTPC 1032.5**

**Course Objectives:**

To Study of different hand operated power tools, uses and their demonstration.
To gain a good basic working knowledge required for the production of various engineering products.
To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
To develop a right attitude, team working, precision and safety at work place.
It explains the construction, function, use and application of different working tools, equipment and machines.
To study commonly used carpentry joints.
To have practical exposure to various welding and joining processes.
Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

**Course Outcomes:** At the end of the course, the student will be able to:

Study and practice on machine tools and their operations
Practice on manufacturing of components using workshop trades including pluming, fitting,carpentry, foundry, house wiring and welding.
Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
Apply basic electrical engineering knowledge for house wiring practice.

**TRADES FOR EXERCISES:**

**At least two exercises from each trade:**

Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
Welding Practice – (Arc Welding & Gas Welding)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

**2. TRADES FOR DEMONSTRATION & EXPOSURE:**

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and WoodWorking

**TEXT BOOKS:**

Workshop Practice /B. L. Juneja / Cengage
Workshop Manual / K. Venugopal / Anuradha.

**REFERENCE BOOKS:**

Work shop Manual - P. Kannaiah/ K. L. Narayana/ SciTech
Workshop Manual / Venkat Reddy/ BSP

## EE1107ES: BASIC ELECTRICAL ENGINEERING LAB

**B. Tech. I Year I Sem.** **L T P C**
**0021**

**Course Objectives:**

To analyze a given network by applying various electrical laws and network theorems
To know the response of electrical circuits for different excitations
To calculate, measure and know the relation between basic electrical parameters.
To analyze the performance characteristics of DC and AC electrical machines

**Course Outcomes:**

Get an exposure to basic electrical laws.
Understand the response of different types of electrical circuits to different excitations.
Understand the measurement, calculation and relation between the basic electrical parameters
Understand the basic characteristics of transformers and electrical machines.

**List of experiments/demonstrations:**

Verification of Ohms Law
Verification of KVL and KCL
Transient Response of Series RL , RC and RLC circuits using DC excitation
Resonance in series RLC circuit
Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a SinglePhase Transformer
Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
Three Phase Transformer: Verification of Relationship between Voltages and Currents (StarDelta, Delta-Delta, Delta-star, Star-Star)
Measurement of Active and Reactive Power in a balanced Three-phase circuit
Open circuit Characteristics of a Separately/Self Excited DC Shunt/Compound Generator
Performance Characteristics of a Separately/Self Excited DC Shunt/Compound Motor
Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor
Performance Characteristics of a Three-phase Induction Motor
Torque-Speed Characteristics of a Three-phase Induction Motor
No-Load Characteristics of a Three-phase Alternator

## MA1201BS: ADVANCED CALCULUS

**B.Tech. I Year II Sem.** **LTPC**
**3104**

**Course Objectives:** To learn

Methods of solving the differential equations of first and higher order.
Evaluation of multiple integrals and their applications
The physical quantities involved in engineering field related to vector valued functions
The basic properties of vector valued functions and their applications to line, surface and volume integrals

**Course Outcomes:** After learning the contents of this paper the student must be able to

Identify whether the given differential equation of first order is exact or not
Solve higher differential equation and apply the concept of differential equation to real world problems
Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelopiped
Evaluate the line, surface and volume integrals and converting them from one to another

**UNIT-I: First Order Ordinary Differential Equations**

Exact, linear and Bernoulli's equations ; Applications : Newton's law of cooling , Law of natural growth and decay ; Equations not of first degree : equations solvable for p, Applications: LR circuit problems.

**UNIT-II: Ordinary Differential Equations of Higher Order**

Second order linear differential equations with constant coefficients : Non-Homogeneous terms of the type ,sin ax, cos ax, polynomials in x, V(x) and xV(x); method of variation of parameters, Applications: LCR circuit problems.

**UNIT-III: Multivariable Calculus (Integration)**

Evaluation of Double Integrals (Cartesian coordinates) ; change of order of Integration (only Cartesian form) ; Evaluation of triple Integrals : Change of variables (Cartesian to polar) for double and (Cartesian to Spherical And Cylindrical polar coordinates) for triple integrals.Applications: Areas (double integrals) and volumes (by double integrals and triple integrals).

**UNIT-IV: Vector Differentiation**

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vectors Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

**UNIT-V: Vector Integration**

Line, Surface and Volume Integrals. Theorems of Greens, Gauss and Stokes (without proofs) and their applications.

**TEXT BOOKS:**

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984

## AP1202BS: APPLIED PHYSICS

| B. Tech. I Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Course Objectives:**

Students will demonstrate skills in scientific inquiry, problem solving and laboratory techniques.

Students will be able to demonstrate competency and understanding of the concepts found in Quantum Mechanics, Fiber optics and lasers, Semiconductor physics and Electromagnetic theory and a broad base of knowledge in physics.

The graduates will be able to solve non-traditional problems that potentially draw on knowledge in multiple areas of physics.

To study applications in engineering like memory devices, transformer core and superconductors.

**Course Outcomes: Upon graduation:**

The student would be able to learn the fundamental concepts on Quantum behaviour of matter in its micro state.

The knowledge of fundamentals of Semiconductor physics, Optoelectronics, Lasers and fibre optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.

Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.

The course also helps the students to be exposed to the phenomena of superconductivity and also to have exposure on magnetic materials and dielectric materials**.**

**UNIT-I**

**Principles of Quantum Mechanics:** Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, G-P Thomson experiment, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

**UNIT-II**

**Semiconductor Physics:** Origin of Energy Band Formation in Solids, Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier transport: diffusion and drift, Hall effect, Formation of PN junction, Open circuit PN junction, Energy diagram of PN diode, I-V Characteristics of PN junction diode, Zener diode –breakdown mechanism and characteristics

**UNIT-III**

**Physics of Semiconductor Devices:**, Generation & recombination mechanisms in semiconductors, LED and semiconductor lasers: Device structure, Materials, Characteristics and figures of merit, Photo diode(PIN diode) & Solar cell - their structure, Materials, working principle and Characteristics.

**UNIT-IV**

**Lasers:** Introduction to interaction of radiation with matter, Coherence, Principle and working of Laser, Population inversion, Pumping, Types of Lasers: Ruby laser, He-Ne laser, Applications of laser-Scientific & Medical applications.

**Fibre Optics:** Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Absorption & Bending Losses associated with optical fibres, Applications of optical fibres-Sensor & Medical Field.

**UNIT-V**

**Dielectric Properties:** Polarisation, Permittivity and Dielectric constant, Types of Polarisation, Internal fields in a solid, Clausius-Mossotti equation, Ferroelectrics and Piezoelectrics.

**Magnetic Properties:** Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, Hard & Soft Magnetic materials, Applications of magnetic materials.

**TEXT BOOKS:**

Engineering Physics, B.K. Pandey, S. Chaturvedi - Cengage Learing.
Halliday and Resnick, Physics - Wiley.
A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand

**REFERENCES:**

Richard Robinett, Quantum Mechanics
J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Graw-Hill inc. (1995).
Online Course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Guptha on NPTEL

**CS1203ES: PROGRAMMING FOR PROBLEM SOLVING**

**B.Tech. I Year II Sem.** **L T P C**
**3104**

**Course Objectives:**

To learn the fundamentals of computers.
To understand the various steps in program development.
To learn the syntax and semantics of C programming language.
To learn the usage of structured programming approach in solving problems.

**Course Outcomes:** The student will learn

To write algorithms and to draw flowcharts for solving problems.
To convert the algorithms/flowcharts to C programs.
To code and test a given logic in C programming language.
To decompose a problem into functions and to develop modular reusable code.
To use arrays, pointers, strings and structures to write C programs.
Searching and sorting problems.

**UNIT - I: Introduction to Programming**

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code , Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments

Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

**UNIT - II: Arrays, Strings, Structures and Pointers:**

Arrays: one- and two-dimensional arrays, creating, accessing and manipulating elements of arrays

Strings: Introduction to strings, handling strings as array of characters, basic string functions availablein C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self- referential structures, usage of self referential structures in linked list (no implementation) Enumeration data type

**UNIT - III: Preprocessor and File handling in C:**

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

**UNIT - IV: Function and Dynamic Memory Allocation:**

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

**UNIT - V: Introduction to Algorithms:**

Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number, etc.
Basic searching in an array of elements (linear and binary search techniques),
Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms),
Basic concept of order of complexity through the example programs

**TEXT BOOKS:**

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, ($3^{rd}$ Edition)

**REFERENCE BOOKS:**

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

R.G. Dromey, How to solve it by Computer, Pearson ($16^{th}$ Impression)

Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.

Herbert Schildt, C: The Complete Reference, Mc Graw Hill, $4^{th}$ Edition

**EN1204HS: ENGLISH**

**B.Tech. I Year II SEM** **LTPC 2002**

**INTRODUCTION** In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.*

**Learning Objectives:** The course will help to a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills. b. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus. c. Develop study skills and communication skills in formal and informal situations.

**Course Outcomes:** Students should be able to

Use English Language effectively in spoken and written forms.

Comprehend the given texts and respond appropriately.

Communicate confidently in various contexts and different cultures.

Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

**SYLLABUS**

**UNIT –I 'The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press. Vocabulary Building**: The Concept of Word Formation --The Use of Prefixes and Suffixes.
**Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions.
**Reading:** Reading and Its Importance- Techniques for Effective Reading.
**Basic Writing Skills:** Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

**UNIT –II 'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.**
**Vocabulary:** Synonyms and Antonyms.
**Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
**Reading:** Improving Comprehension Skills – Techniques for Good Comprehension **Writing:** Format of a Formal Letter-
**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.

**UNIT –III 'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.**
**Vocabulary**: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.
**Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
**Reading:** Sub-skills of Reading- Skimming and Scanning
**Writing**: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying**- Providing Examples or Evidence

**UNIT –IV ' KING LEAR ' a tragedy story by William Shakespeare, play synopsis of Act 1 & 2 published by Bloom, Harold. "King Lear." Shakespeare : The Invention of the Human. New**

**York: Riverhead, 1998.**
**Vocabulary:** Standard Abbreviations in English Grammar: Redundancies and Clichés in Oral and Written Communication.
**Reading: Comprehension-** Intensive Reading and Extensive Reading
**Writing: Writing Practices--**Writing Introduction and Conclusion - Essay Writing-Précis Writing.

**UNIT –V 'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.**
**Vocabulary**: Technical Vocabulary and their usage
**Grammar:** Common Errors in English
**Reading:** Reading Comprehension-Exercises for Practice
**Writing: Technical Reports**- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing aReport.

**Textbook:**

Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.
Nahum Tate's 1681 Adaption of King Lear

**References:**

Swan, M. (2016). Practical English Usage. Oxford University Press.
Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.
Wood, F.T. (2007).Remedial English Grammar. Macmillan.
Zinsser, William. (2001). On Writing Well. Harper Resource Book.
Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

**AP1205BS: APPLIED PHYSICS LAB**

**B.Tech. I Year II SEM** **LTPC**
**0 031.5**

**List of Experiments:**

Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
Solar Cell: To study the V-I Characteristics of solar cell.
Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.
Hall effect:To determine Hall co-efficient of a given semiconductor.
Photoelectric effect: To determine work function of a given material.
LASER: To study the characteristics of LASER sources.
Optical fibre: To determine the bending losses of Optical fibres.
LCR Circuit: To determine the Quality factor of LCR Circuit.
R-C Circuit: To determine the time constant of R-C circuit.

**Note: Any 8 experiments are to be performed**

**CS1206ES: PROGRAMMING FOR PROBLEM SOLVING LAB**

**B.Tech. I Year II SEM** **L T P C**
**0 031.5**

*[Note:The programs may be executed using any available Open Source/ Freely available IDE Some of the Tools available are:*
*CodeLite: https://codelite.org/*
*Code::Blocks: http://www.codeblocks.org/*
*DevCpp : http://www.bloodshed.net/devcpp.html*
*Eclipse: http://www.eclipse.org*
*This list is not exhaustive and is NOT in any order of preference]*

**Course Objectives:** The students will learn the following:

To work with an IDE to create, edit, compile, run and debug programs
To analyze the various steps in program development.
To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
To Write programs using the Dynamic Memory Allocation concept.
To create, read from and write to text and binary files

**Course Outcomes:** The candidate is expected to be able to:

formulate the algorithms for simple problems
translate given algorithms to a working and correct program
correct syntax errors as reported by the compilers
identify and correct logical errors encountered during execution
represent and manipulate data with arrays, strings and structures
use pointers of different types
create, read and write to and from simple text and binary files
modularize the code with functions so that they can be reused

**Practice sessions:**

Write a simple program that prints the results of all the operators available in C (including pre/ post increment , bitwise and/or/not , etc.). Read required operand values from standard input.
Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

**Simple numeric problems:**

Write a program for fiend the max and min from the three numbers.
Write the program for the simple, compound interest.
Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

5 x 1 = 5
5 x 2 = 10
5 x 3 = 15

h. Write a program that shows the binary equivalent of a given positive number between0 to 255.

**Expression Evaluation:**

A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Write a program that finds if a given number is a prime number

Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Write a C program to find the roots of a Quadratic equation.

Write a C program to calculate the following, where x is a fractional value. i.

1-x/2 +x^2/4-x^3/6

j. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+ ..... +x^n. For example: if n is 3 and x is

5, then the program computes 1+5+25+125.

**Arrays and Pointers and Functions:**

Write a C program to find the minimum, maximum and average in an array of integers.

Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.

Write a C program that uses functions to perform the following:

Addition of Two Matrices

ii. Multiplication of Two Matrices

iii. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be same.

Write C programs that use both recursive and non-recursive functions

To find the factorial of a given integer.

ii. To find the GCD (greatest common divisor) of two given integers.

iii. To find x^n

Write a program for reading elements using pointer into array and display the values using array.

Write a program for display values reverse order from array using pointer.

Write a program through pointer variable to sum of n elements from array.

**Files:**

Write a C program to display the contents of a file to standard output device.

Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

Write a C program to count the number of times a character occurs in a text file. Thefile name and the character are supplied as command line arguments.

Write a C program that does the following:

It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function)
The program should then read all 10 values and print them back.

Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file).

**Strings:**

Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.

Write a C program that converts a number ranging from 1 to 50 to Roman equivalent

Write a C program that uses functions to perform the following operations:

To insert a sub-string in to a given main string from a given position.

ii. To delete n Characters from a given position in a given string.

Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

Write a C program that displays the position of a character ch in the string S or – 1 if S doesn‘t contain ch.

Write a C program to count the lines, words and characters in a given text.

**Miscellaneous:**

Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

Write a C program to construct a pyramid of numbers as follows:

```
1          *          1          1          *
1 2        * *        2 3        2 2        * *
1 2 3      * * *      4 5 6      3 3 3      * * *
                                 4444       * *
                                            *
```

**Sorting and Searching:**

Write a C program that uses non recursive function to search for a Key value in a given

list of integers using linear search method.

Write a C program that uses non recursive function to search for a Key value in a given

sorted list of integers using binary search method.

Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.

Write a C program that sorts the given array of integers using selection sort in descending order

Write a C program that sorts the given array of integers using insertion sort in ascending order

Write a C program that sorts a given array of names

**Suggested Reference Books for solving the problems:**

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)

Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.

Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

## EN1207HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

**B. Tech. I Year II SEM** **LTPC**
**0021**

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

**Course Objectives:**

To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
To improve the fluency of students in spoken English and neutralize their mother tongue influence
To train students to use language appropriately for public speaking and interviews

**Learning Outcomes:** Students will be able to attain

- Better understanding of nuances of English language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking skills with clarity and confidence which in turn enhances their employability skills

**Syllabus**

**English Language and Communication Skills Lab (ELCS) shall have two parts:**

**a. Computer Assisted Language Learning (CALL) Lab**

**b. Interactive Communication Skills (ICS) Lab**

**Listening Skills**

Objectives

To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation

To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

*Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.*

Listening for general content
Listening to fill up information
Intensive listening
Listening for specific information

**Speaking Skills**

Objectives

To involve students in speaking activities in various contexts

To enable students express themselves fluently and appropriately in social and professional contexts

Oral practice: Just A Minute (JAM) Sessions
Describing objects/situations/people
Role play – Individual/Group activities

**The following course content is prescribed for the English Language and Communication Skills Lab based on Unit-6 of AICTE Model Curriculum 2018 for B.Tech First English. As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the Lab)**

**Exercise – I**

**CALL Lab**: *Understand:* Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

**ICS Lab**: *Understand:* Communication at Work Place- Spoken vs. Written language. *Practice:* Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

**Exercise – II**

**CALL Lab**: *Understand:* Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context. *Practice:* Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

**ICS Lab**: *Understand:* Features of Good Conversation – Non-verbal Communication. *Practice:* Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

**Exercise - III**

**CALL Lab:** *Understand:* Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI). *Practice:* Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

**ICS Lab**: *Understand:* How to make Formal Presentations. *Practice:* Formal Presentations.

**Exercise – IV**

**CALL Lab**: *Understand:* Listening for General Details. *Practice:* Listening Comprehension Tests.

**ICS Lab**: *Understand:* Public Speaking – Exposure to Structured Talks. *Practice:* Making a Short Speech – Extempore.

**Exercise – V**

**CALL Lab:** *Understand:* Listening for Specific Details. *Practice:* Listening Comprehension Tests.

**ICS Lab**: *Understand:* Interview Skills. *Practice:* Mock Interviews.

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**Minimum Requirement of infrastructural facilities for ELCS Lab:**

**1. Computer Assisted Language Learning (CALL) Lab:**

**The Computer Assisted Language Learning Lab** has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

**System Requirement (Hardware component):** *Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:*

Computers with Suitable Configuration

High Fidelity Headphones

**2. Interactive Communication Skills (ICS) Lab:**

**The Interactive Communication Skills Lab:** A Spacious room with movable chairs and audio-visual aids with a Public-Address System, a LCD and a projector etc.

**MC1001ES*: ENVIRONMENTAL SCIENCE**
**(MANDITORY NON CREDIT COURSE)**

**B.Tech. I Year II Sem** **LTPC**
**3000**

**Course Objectives:**

Understanding the importance of ecological balance for sustainable development.
Understanding the impacts of developmental activities and mitigation measures.
Understanding the environmental policies and regulations

**Course Outcomes:**

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

**UNIT-I**

**Ecosystems:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnifications, ecosystem value, services and carrying capacity, Field visits.

**UNIT-II**

**Natural Resources: Classification of Resources:** Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

**UNIT-III**

**Biodiversity And Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT-IV**

**Environmental Pollution and Control Technologies: Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil.
**Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

**UNIT-V**

**Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

**TEXT BOOKS:**

Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
Environmental Studies by R. Rajagopalan, Oxford University Press.

Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

## EC2101PC: ELECTRONIC DEVICES AND CIRCUITS

| B. Tech. II Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Course Objectives:**

To introduce components such as diodes, BJTs and FETs.
To know the applications of components.
To know the switching characteristics of components
To give understanding of various types of amplifier circuits

**Course Outcomes:** Upon completion of the Course, the students will be able to:

Know the characteristics of various components.
Understand the utilization of components.
Understand the biasing techniques
Design and analyze small signal amplifier circuits.

**UNIT - I**

**Diode and Applications:** Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

**UNIT - II**

**Bipolar Junction Transistor (BJT):** Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

**UNIT - III**

**Junction Field Effect Transistor (FET):** Construction, Principle of Operation, Pinch-Off Voltage, Volt- Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor. **Special Purpose Devices:** Zener Diode **-** Characteristics, Voltage Regulator. Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode.

**UNIT – IV**

**Analysis and Design of Small Signal Low Frequency BJT Amplifiers:** Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

**UNIT – V**

**FET Amplifiers:** Small Signal Model**,** Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET Characteristics in Enhancement and Depletion mode, Basic Concepts of MOS Amplifiers.

**TEXT BOOKS:**

Electronic Devices and Circuits- Jacob Millman, McGraw Hill Education
Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson**.**

**REFERENCE BOOKS:**

The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press
Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2Ed., 2008, Mc Graw Hill.

**EC2102PC: NETWORK ANALYSIS AND TRANSMISSION LINES**

| B. Tech. II Year I Sem. | L | T | P | C | 0 |
|---|---|---|---|---|---|
| **Pre-Requisites: Nil** | **3** | **0** | **3** | | |

**Course Objectives:**

To understand the basic concepts on RLC circuits.
To know the behavior of the steady states and transients states in RLC circuits.
To understand the two port network parameters.
To study the propagation, reflection and transmission of plane waves in bounded and unbounded media.

**Course Outcomes:** Upon successful completion of the course, students will be able to:

Gain the knowledge on basic RLC circuits behavior.
Analyze the Steady state and transient analysis of RLC Circuits.
Know the characteristics of two port network parameters.
Analyze the transmission line parameters and configurations.

**UNIT - I**

Network Topology, Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

**UNIT - II**

Transient and Steady state analysis of RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. $2^{nd}$ order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

**UNIT - III**

Two port network parameters, Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, , L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

**UNIT – IV**

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless / Low Loss Characterization, Types of Distortion, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.

**UNIT – V**

Transmission Lines – II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. λ/4, λ/2, λ/8 Lines – Impedance Transformations, Smith Chart – Configuration and Applications, Single Stub Matching.

**TEXT BOOKS:**

Network Analysis – Van Valkenburg, $3^{rd}$ Ed., Pearson, 2016.
Networks, Lines and Fields - JD Ryder, PHI, $2^{nd}$ Edition, 1999.

**REFERENCE BOOKS:**

Electric Circuits – J. Edminister and M. Nahvi – Schaum's Outlines, Mc Graw Hills Education, 1999.
Engineering Circuit Analysis – William Hayt and Jack E Kemmerly, MGH, $8^{th}$ Edition, 1993.
Electromagnetics with Applications – JD. Kraus, $5^{th}$ Ed., TMH
Transmission Lines and Networks – Umesh Sinha, Satya Prakashan, 2001, (Tech. India Publications), New Delhi.

**EC2103PC: DIGITAL LOGIC DESIGN**

| **B. Tech. II Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Pre-Requisites: Nil** | **3** | **1** | **0** | **4** |

**Course Objectives:**

To understand common forms of number representation in logic circuits
To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
To understand the concepts of combinational logic circuits and sequential circuits.
To understand the Realization of Logic Gates Using Diodes & Transistors.

**Course Outcomes:** Upon completing this course, the student will be able to

Understand the numerical information in different forms and Boolean Algebra theorems
Postulates of Boolean algebra and to minimize combinational functions
Design and analyze combinational and sequential circuits
Known about the logic families and realization of logic gates.

**UNIT - I:**

**Number Systems: N**umber systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.
**Boolean Algebra:** Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

**UNIT - II:**

**Minimization of Boolean functions:** Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method,
**Combinational Logic Circuits:** Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

**UNIT - III**

**Sequential Circuits Fundamentals:** Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.
**Registers and Counters:** Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

**UNIT - IV**

**Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters. Finite state machine-capabilities and limitations, Mealy and Moore models.

**UNIT - V**

**Realization of Logic Gates Using Diodes & Transistors:** AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri - state outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

**TEXT BOOKS:**

Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.

Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill

Digital Design- Morris Mano, PHI, 4th Edition,2006

Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

**EC2104PC: SIGNALS AND SYSTEMS**

| B. Tech. II Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Nil** | **3** | **1** | **0** | **4** |

**Course Objectives:**

This gives the basics of Signals and Systems required for all Electrical Engineering related courses.
To understand the behavior of signal in time and frequency domain
To understand the characteristics of LTI systems
This gives concepts of Signals and Systems and its analysis using different transform techniques.

**Course Outcomes:** Upon completing this course, the student will be able to

Differentiate various signal functions.
Represent any arbitrary signal in time and frequency domain.
Understand the characteristics of linear time invariant systems.
Analyze the signals with different transform technique

**UNIT - I**

**Signal Analysis:** Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

**UNIT – II**

**Fourier series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

**UNIT - III**

**Signal Transmission through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

**UNIT – IV**

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Z–Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

**UNIT - V**

**Sampling theorem**: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

**Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution

and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of

Signal from Noise by Filtering.

**TEXT BOOKS:**

Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.

**REFERENCE BOOKS:**

Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
Signals and Systems – A. Rama Krishna Rao, 2008, TMH
Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, 3 Ed., 2004, PE.
Signals and Systems – K. Deergha Rao, Birkhauser, 2018.

**EC2105ES: PROBABILITY THEORY AND STOCHASTIC PROCESSES**

| B. Tech. II Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Nil** | **3** | **0** | **0** | **3** |

**Course Objectives:**

This gives basic understanding of random signals and processes sing
Utilization of Random signals and systems in Communications and Signal Processing areas.
To know the Spectral and temporal characteristics of Random Process.
To Learn the Basic concepts of Noise sources

**Course Outcomes:** Upon completing this course, the student will be able to

Understand the concepts of Random Process and its Characteristics.
Understand the response of linear time Invariant system for a Random Processes.
Determine the Spectral and temporal characteristics of Random Signals.
Understand the concepts of Noise in Communication systems.

**UNIT - I**

**Probability & Random Variable**: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events, *Random Variable*- Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

**UNIT - II**

**Operations on Single & Multiple Random Variables – Expectations**: Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic and Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence.

Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions. Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

**UNIT - III**

**Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

**UNIT - IV**

**Random Processes – Spectral Characteristics:** The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral

Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

**UNIT - V**

**Noise Sources & Information Theory:** Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off between bandwidth and SNR.

**TEXT BOOKS:**

Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
Principles of Communication systems by Taub and Schilling (TMH),2008

**REFERENCE BOOKS:**

Random Processes for Engineers-Bruce Hajck, Cambridge unipress,2015
Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
Probability, Statistics & Random Processes-K. Murugesan, P. Guruswamy, Anuradha Agencies, 3rd Edition, 2003.
Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.
Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications, 2003

**EC2106PC: ELECTRONIC DEVICES AND CIRCUITS**

| B. Tech. | LAB II Year I Sem. | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**List of Experiments (Twelve experiments to be done):**

Verify any twelve experiments in H/W Laboratory

- PN Junction diode characteristics A) Forward bias B) Reverse bias.
- Zener diode characteristics and Zener as voltage Regulator
- Full Wave Rectifier with & without filters
- Input and output characteristics of BJT in CE Configuration
- Input and output characteristics of FE in CS Configuration
- Common Emitter Amplifier Characteristics
- Common Base Amplifier Characteristics
- Common Source amplifier Characteristics
- Measurement of h-parameters of transistor in CB, CE, CC configurations
- Switching characteristics of a transistor
- SCR Characteristics.
- Types of Clippers at different reference voltages
- Types of Clampers at different reference voltages
- The steady state output waveform of clampers for a square wave input

**Major Equipment required for Laboratories:**

- Regulated Power Suppliers, 0-30V
- 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
- Functions Generators-Sine and Square wave signals
- Multimeters
- Electronic Components

**EC2107PC: DIGITAL LOGIC DESIGN**

| **B. Tech.** | **LAB II Year I Sem.** | **L** | **T** | **P** | **C** | **2** |
|---|---|---|---|---|---|---|
| | | **0** | **0** | **1** | | |

**Note: Implement using digital ICs, all experiments to be carried out. List of Experiments**

Realization of Boolean Expressions using Gates
Design and realization logic gates using universal gates
Generation of clock using NAND / NOR gates
Design a 4 – bit Adder / Subtractor
Design and realization of a 4 – bit gray to Binary and Binary to Gray Converter
Design and realization of an 8 bit parallel load and serial out shift register using flip-flops.
Design and realization of a Synchronous and Asynchronous counter using flip-flops
Design and realization of Asynchronous counters using flip-flops
Design and realization of 8x1 MUX using 2x1 MUX
Design and realization of 4 bit comparator
Design and Realization of a sequence detector-a finite state machine

**Major Equipments required for Laboratories:**

5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply.
20 MHz Oscilloscope with Dual Channel.
Bread board and components/ Trainer Kit.
Multimeter.

## EC2108ES: BASIC SIMULATION LAB

| B. Tech. II Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Note:**

All the experiments are to be simulated using MATLAB or equivalent software
Minimum of 15 experiment are to be completed

**List of Experiments:**

Basic Operations on Matrices.
Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
Convolution for Signals and sequences.
Auto Correlation and Cross Correlation for Signals and Sequences.
Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
Gibbs Phenomenon Simulation.
Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
Waveform Synthesis using Laplace Transform.
Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
Generation of Gaussian noise ( Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
Verification of Sampling Theorem.
Removal of noise by Autocorrelation / Cross correlation.
Extraction of Periodic Signal masked by noise using Correlation.
Verification of Weiner-Khinchine Relations.
Checking a Random Process for Stationarity in Wide sense.

**Major Equipments required for Laboratories:**

Computer System with latest specifications connected
Window Xp or equivalent
Simulation software-MAT Lab or any equivalent simulation software

**MC2001: CONSTITUTION OF INDIA**

| **B. Tech. II Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Pre-requisites: Nil** | **3** | **0** | **0** | **0** |

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

**Course content**

Meaning of the constitution law and constitutionalism
Historical perspective of the Constitution of India
Salient features and characteristics of the Constitution of India
Scheme of the fundamental rights
The scheme of the Fundamental Duties and its legal status
The Directive Principles of State Policy – Its importance and implementation
Federal structure and distribution of legislative and financial powers between the Union and the States
Parliamentary Form of Government in India – The constitution powers and status of the President of India
Amendment of the Constitutional Powers and Procedure
The historical perspectives of the constitutional amendments in India
Emergency Provisions: National Emergency, President Rule, Financial Emergency
Local Self Government – Constitutional Scheme in India
Scheme of the Fundamental Right to Equality
Scheme of the Fundamental Right to certain Freedom under Article 19

**EC2201PC: ELECTROMAGNETIC FIELDS AND WAVES**

| B. Tech. II Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Applied Physics** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magnetostatic Fields, and apply them to solve physics and engineering problems.
To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
To conceptually understand the waveguides and to determine the characteristics of rectangular waveguides, microstrip lines.

**Course Outcomes**: Upon completing this course, the student will be able to

Get the knowledge of Basic Laws, Concepts and proofs related to Electrostatic Fields and Magnetostatic Fields.
Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions.
Analyze the Wave Equations for good conductors, good dielectrics and evaluate the UPW Characteristics for several practical media of interest.
To analyze completely the rectangular waveguides, their mode characteristics, and design waveguides for solving practical problems.

**UNIT – I**

**Electrostatics:** Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors.

**UNIT – II**

**Magnetostatics:** Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

**UNIT – III**

**Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

**UNIT – IV**

**EM Wave Characteristics:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization.
Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

**UNIT – V**

**Waveguides:** Electromagnetic Spectrum and Bands. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, Circular waveguides, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations,

Equation of Power Transmission, Impossibility of TEM Mode. Microstrip Lines – $Z_0$ Relations, Effective Dielectric Constant.

**TEXT BOOKS:**

Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill,2014
Principles of Electromagnetics – Matthew N.O. sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition, 2015.

**REFERENCE BOOKS:**

□ Ā □ Ā □ Ā □ Ā □ lectromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2nd Ed., 2000, PHI.
□ Ā □ Ā □ Ā □ Ā □ ngineering Electromagnetics – Nathan Ida, 2nd Ed., 2005, Springer (India) Pvt. Ltd., New Delhi.

**MA2202BS: LAPLACE TRANSFORMS, NUMERICAL METHODS AND COMPLEX VARIABLES**

| **B. Tech. II Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Pre-requisites: Mathematical Knowledge at pre-university level** | **3** | **1** | **0** | **4** |

**Course Objectives:** To learn

Concept, properties of Laplace transforms
Solving ordinary differential equations using Laplace transforms techniques.
Various methods to the find roots of an equation.
Concept of finite differences and to estimate the value for the given data using interpolation.
Evaluation of integrals using numerical techniques
Solving ordinary differential equations using numerical techniques.
Differentiation and integration of complex valued functions.
Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
Expansion of complex functions using Taylor's and Laurent's series.

**Course outcomes:** After learning the contents of this paper the student must be able to

Use the Laplace transforms techniques for solving ODE's
Find the root of a given equation.
Estimate the value for the given data using interpolation
Find the numerical solutions for a given ODE's
Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems
Taylor's and Laurent's series expansions of complex function

**UNIT - I**

**Laplace Transforms**

Laplace Transforms; Laplace Transform of Standard functions; first shifting theorem; Laplace Transform of functions when they are multiplied and divided by t; Laplace Transforms of Derivatives and Integrals of function; Evaluation of Integrals by Laplace Transforms; Laplace Transforms of special functions; Inverse Laplace Transform by different methods; Convolution Theorem (without Proof) Solving ODE s by Laplace Transform method.

**UNIT - II**

**Numerical Methods I**

Solution of Polynomial and Transcendental equations - Newton Raphson Method and Regula False Method. Finite differences – forward difference – Back ward difference – Central differences – Symbolic Relations and separation of Symbolic Interpolation using Newton's forward and backward difference formulae, Lagrange's method of Interpolation.

**UNIT - III**

**Numerical Methods II**

Numerical Integration: Trapezoidal rule and Simpson s 1/3 and 3/8 rules. Ordinary differential equations Taylor's series, Picard's method, Euler and Modified Eulers methods and Runge – Kutta method of fourth order, Predictor – Corrector Methods.

**UNIT - IV**

**Complex Variables (Differentiation)**

Limits, Continuity and Differentiation of Complex functions, Cauchy – Riemann equations (without proof). Milne Thomson methods, Analytic functions, Harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**UNIT - V**

**Complex Variables (Integration)**

Line integrals, Cauchy's theorem, Cauchy's integral formula, Liouvilles theorem, Maximum-Modulus theorem (All theorems without proof); zeros of analytic functions, singularities, Taylors series, Laurent's series; Residues, Cauchy's Residue theorem ( without proof).

**TEXT BOOKS:**

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

**REFERENCE BOOKS:**

M. K. Jain, SRK Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations , New Age International publishers.
Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

**EC2203PC: ANALOG AND DIGITAL COMMUNICATIONS**

| **B. Tech. II Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Prerequisite: Probability theory and Stochastic Processes** | **3** | **1** | **0** | **4** |

**Course Objectives:**

To develop ability to analyze system requirements of analog and digital communication systems.
To understand the generation, detection of various analog and digital modulation techniques.
To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
To understand the concepts of baseband transmissions.

Analyze and design of various continuous wave and angle modulation and demodulation techniques
Understand the effect of noise present in continuous wave and angle modulation techniques.
Attain the knowledge about AM , FM Transmitters and Receivers
Analyze and design the various Pulse Modulation Techniques.
Understand the concepts of Digital Modulation Techniques and Baseband transmission**.**

**UNIT - I**

**Amplitude Modulation:** Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

**UNIT - II**

**Angle Modulation:** Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal-Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

**UNIT - III**

**Transmitters:** Classification of Transmitters, AM Transmitters, FM Transmitters

**Receivers:** Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

**UNIT - IV**

**Pulse Modulation:** Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM.

**Pulse Code Modulation:** PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

**UNIT - V**

**Digital Modulation Techniques:** ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non-Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM.

**Baseband Transmission and Optimal Reception of Digital Signal:** A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

**TEXT BOOKS:**

Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.

**REFERENCE BOOKS:**

Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.
Electronic Communications – Dennis Roddy and John Coolean , 4th Edition , PEA, 2004
Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004
Analog and Digital Communication – K. Sam Shanmugam, Willey ,2005

**EC2204PC: LINEAR IC APPLICATIONS**

| B. Tech. II Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Electronic Devices & Circuits** | **3** | **0** | **0** | **3** |

**Course Objectives:** The main objectives of the course are:

To introduce the basic building blocks of linear integrated circuits.
To introduce the theory and applications of analog multipliers and PLL.
To introduce the concepts of waveform generation and introduce some special function ICs.

**Course Outcomes:** Upon completing this course, the student will be able to

A thorough understanding of operational amplifiers with linear integrated circuits.
Attain the knowledge of functional diagrams and applications of IC 555 and IC 565
Acquire the knowledge about the Data converters.

**UNIT - I**

**Integrated Circuits:** Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

**UNIT - II**

**Op-amp and Applications:** Basic information of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Sample & hold circuits, multipliers and dividers, differentiators and integrators, comparators, Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723

**UNIT - III**

**Active Filters & Oscillators:** Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien and quadrature type, waveform generators - triangular, sawtooth, square wave and VCO.

**UNIT - IV**

**Timers & Phase Locked Loops:** Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.

**UNIT - V**

**D-A and A-D Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC dual slope integration type ADC, DAC and ADC specifications.

**TEXT BOOKS:**

Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

**REFERENCES BOOKS:**

Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI.
Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.
Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGraw Hill.
Digital Fundamentals - Floyd and Jain, Pearson Education.

**EC2205PC: ELECTRONIC CIRCUIT ANALYSIS**

| **B. Tech. II Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Pre-requisite: Electronic Devices and Circuits** | **3** | **0** | **0** | **3** |

**Course Objectives:**

Learn the concepts of high frequency analysis of transistors.
To give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback
To construct various multivibrators using transistors and sweep circuits.

**Course Outcomes:** Upon completing this course, the student will be able to

Design the multistage amplifiers and understand the concepts of High Frequency Analysis of Transistors.
Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations
Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
Design Multivibrators and sweep circuits for various applications.

**UNIT I**

**Multistage Amplifiers:** Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Casca RC Coupled amplifiers, Cascode amplifier, Darlington pair.

**Transistor at High Frequency:** Hybrid -ᴨmodel of Common Emitter transistor model, $f_\alpha$, $f_\beta$ and unity gain bandwidth, Gain-bandwidth product.

**UNIT II**

**Feedback Amplifiers:** Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

**UNIT -III**

**Oscillators:** Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

**UNIT -IV**

**Large Signal Amplifiers:** Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C Amplifiers.

**Tuned Amplifiers:** Introduction, single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning.

**UNIT –V**

**Multivibrators**: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

**Time Base Generators:** General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

**TEXT BOOKS:**

Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education.
Electronic Devices Conventional and current version -Thomas L. Floyd 2015, Pearson.

**REFERENCE BOOKS:**

Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson

## EC2206PC: ANALOG AND DIGITAL COMMUNICATIONS LAB

| B. Tech. II Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Note:**

Minimum 12 experiments should be conducted:
All these experiments are to be simulated first either using MATLAB, COMSIM or any other simulation package and then to be realized in hardware

**List of Experiments:**

1. (i) Amplitude modulation and demodulation (ii) Spectrum analysis of AM
2. (i) Frequency modulation and demodulation (ii) Spectrum analysis of FM

DSB-SC Modulator & Detector
SSB-SC Modulator & Detector (Phase Shift Method)
Frequency Division Multiplexing & De multiplexing
Pulse Amplitude Modulation & Demodulation
Pulse Width Modulation & Demodulation
Pulse Position Modulation & Demodulation
PCM Generation and Detection
Delta Modulation
Frequency Shift Keying: Generation and Detection
Binary Phase Shift Keying: Generation and Detection
Generation and Detection (i) DPSK (ii) QPSK

**Major Equipments required for Laboratories:**

CROs: 20MHz
Function Generators: 2MHz
Spectrum Analyzer
Regulated Power Supplies: 0-30V
MAT Lab/Equivalent Simulation Package with Communication tool box
Analog and Digital Modulation and Demodulation Trainer Kits.

## EC2207PC: IC APPLICATIONS LAB

| B. Tech. II Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Note:** Verify the functionality of the IC in the given application

**Design and Implementation of:**

Inverting and Non-Inverting Amplifiers using Op Amps
Adder and Subtractor using Op Amp.
Comparators using Op Amp.
Integrator Circuit using IC 741.
Differentiator Circuit using Op Amp.
Active filter Applications-LPF, HPF (First Order)
IC 741 waveform Generators-Sine, Square wave and Triangular Waves.
Mono-Stable Multivibrator using IC 555.
Astable multivibrator using IC 555.
Schmitt Trigger Circuits using IC 741.
IC 565-PLL Applications.
Voltage Regulator using IC 723
Three terminal voltage regulators-7805, 7809, 7912

**Major Equipments required for Laboratories:**

5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply.
20 MHz Oscilloscope with Dual Channel.
Bread board and components/ Trainer Kit.
Multimeter.

## EC2208ES: ELECTRONIC CIRCUIT ANALYSIS LAB

| B. Tech. I Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Note**:

Experiments marked with ***** has to be designed, simulated and verified in hardware.
Minimum of 9 experiments to be done in hardware.

**Hardware Testing in Laboratory:**

Common Emitter Amplifier **(*)**
Two Stage RC Coupled Amplifier
Cascode amplifier Circuit **(*)**
Darlington Pair Circuit
Current Shunt Feedback amplifier Circuit
Voltage Series Feedback amplifier Circuit **(*)**
RC Phase shift Oscillator Circuit **(*)**
Hartley and Colpitt's Oscillators Circuit
Class A power amplifier
Class B Complementary symmetry amplifier **(*)**
Design a Monostable Multivibrator
The output voltage waveform of Miller Sweep Circuit

**Major Equipments required for Laboratories:**

Computer System with latest specifications connected
Window XP or equivalent
Simulation software-Multisim or any equivalent simulation software
Regulated Power Suppliers, 0-30V
20 MHz, Dual Channel Cathode Ray Oscilloscopes.
Functions Generators-Sine and Square wave signals
Multimeters
Electronic Components

**MC2002*: GENDER SENSITIZATION LAB**
**(An Activity-based Course)**

| B. Tech. II Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Nil** | **0** | **0** | **2** | **0** |

**Course Description:**
This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

**Course Objectives:**

To develop students' sensibility with regard to issues of gender in contemporary India.
To provide a critical perspective on the socialization of men and women.
To introduce students to information about some key biological aspects of genders.
To expose the students to debates on the politics and economics of work.
To help students reflect critically on gender violence.
To expose students to more egalitarian interactions between men and women.

**Course Outcomes:** Upon completing this course, the student will be able to

Students will have developed a better understanding of important issues related to gender in contemporary India.
Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
Students will acquire insight into the gendered division of labour and its relation to politics and economics.
Men and women students and professionals will be better equipped to work and live together as equals.
Students will develop a sense of appreciation of women in all walks of life.
Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

**UNIT I**
**UNDERSTANDING GENDER:** Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

**UNIT II**
**GENDER ROLES AND RELATIONS:** Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary.

**UNIT -III**
**GENDER AND LABOUR:** Division and Valuation of Labour-Housework: The Invisible Labor- "My

Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

**UNIT -IV**

**GENDER - BASED VIOLENCE:** The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".
Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life….".

**UNIT –V**

**GENDER AND CULTURE:** Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

***Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".***

**TEXT BOOKS:**

"Towards a World of Equals: A Bilingual Textbook on Gender" written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

**ASSESSMENT AND GRADING:**

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

## EC3101PC: MICROPROCESSORS AND MICROCONTROLLERS

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Nil** | **3** | **1** | **0** | **4** |

**Course Objectives:**

To familiarize the architecture of microprocessors and micro controllers
To provide the knowledge about interfacing techniques of bus & memory.
To understand the concepts of ARM architecture
To study the basic concepts of Advanced ARM processors

Understands the internal architecture, organization and assembly language programming of 8086 processors.
Understands the internal architecture, organization and assembly language programming of 8051/controllers
Understands the interfacing techniques to 8086 and 8051 based systems.
Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

**UNIT -I:**

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

**Instruction Set and Assembly Language Programming of 8086**: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

**UNIT -II:**

**Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

**8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

**UNIT –III:**

**I/O And Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

**UNIT –IV:**

**ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

**UNIT – V:**

**Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

**TEXT BOOKS:**

Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

**REFERENCE BOOKS:**

The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

**EC3102PC: DATA COMMUNICATIONS AND NETWORKS**

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Digital Communications** | **3** | **1** | **0** | **4** |

**Course Objectives:**

To introduce the Fundamentals of data communication networks
To demonstrate the Functions of various protocols of Data link layer.
To demonstrate Functioning of various Routing protocols.
To introduce the Functions of various Transport layer protocols.
To understand the significance of application layer protocols

**Course Outcomes:** Upon completing this course, the student will be able to

Know the Categories and functions of various Data communication Networks
Design and analyze various error detection techniques.
Demonstrate the mechanism of routing the data in network layer
Know the significance of various Flow control and Congestion control Mechanisms
Know the Functioning of various Application layer Protocols.

**UNIT - I:**

**Introduction to Data Communications:** Components, Data Representation, Data Flow, Networks-Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards

Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture,

**UNIT - II:**

**Data Link Layer**: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame

**UNIT - III:**

**The Network Layer:** Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router**-**Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

**UNIT - IV:**

**Transport Layer:** Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

**UNIT - V:**

**Application Layer:**

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,-FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

**TEXTBOOKS:**

Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6th Edition, Pearson.
Data Communications and Networking Behrouz A. Forouzan 4th Edition McGraw-Hill Education

**REFERENCES:**

Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education
Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

## EC3103PC: CONTROL SYSTEMS

**B. Tech. III Year I Sem.** **L T P C**

**Prerequisite:** Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables **3 1 0 4**

**Course objectives:**

To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
To assess the system performance using time domain analysis and methods for improving it
To assess the system performance using frequency domain analysis and techniques for improving the performance
To design various controllers and compensators to improve system performance

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

Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
Understand the concept of stability and its assessment for linear-time invariant systems.
Design simple feedback controllers.

**UNT-I**

**Introduction to Control Problem:** Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra. Representation by Signal flow graph - Reduction using mason's gain formula

**UNT - II**

**Time Response Analysis of Standard Test Signals:** Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

**UNT - III**

**Frequency-Response Analysis:** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

**UNT - IV**

**Introduction to Controller Design:** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

**UNT-V**

**State Variable Analysis and Concepts of State Variables:** State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

**TEXT BOOKS:**

M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

**REFERENCE BOOKS:**

K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

## EC3104MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objective:** To learn the basic business types, impact of the economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

**Course Outcome:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

**UNIT – I: Introduction to Business and Economics**

**Business**: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

**Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

**UNIT - II: Demand and Supply Analysis**

**Elasticity of Demand:** Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

**Supply Analysis:** Determinants of Supply, Supply Function and Law of Supply.

**UNIT- III: Production, Cost, Market Structures & Pricing**

**Production Analysis:** Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

**Cost analysis**: Types of Costs, Short run and Long run Cost Functions.

**Market Structures**: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

**Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

**UNIT - IV: Financial Accounting:** Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

**UNIT - V: Financial Analysis through Ratios:** Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

**TEXT BOOKS:**

D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.

Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.

Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

**REFERENCE BOOKS:**

Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.

S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

**EC3111PE: COMPUTER ORGANIZATION & OPERATING SYSTEMS (Professional Elective – I)**

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To understand the structure of a computer and its operations.
To understand the RTL and Micro-level operations and control in a computer.
Understanding the concepts of I/O and memory organization and operating systems.

**Course Outcomes:**

Able to visualize the organization of different blocks in a computer.
Able to use micro-level operations to control different units in a computer.
Able to use Operating systems in a computer.

**UNIT - I**:

**Basic Structure of Computers:** Computer Types, Functional Unit, Basic OPERATIONAL Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating – Point Representation.

**Register Transfer Language and Micro Operations:** Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions – Instruction Cycle, Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

**UNIT - II:**

**Micro Programmed Control:** Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control

**The Memory System:** Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories Secondary Storage, Introduction to RAID.

**UNIT - III:**

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE 1394.

**UNIT - IV:**

**Operating Systems Overview:** Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating Systems Generation

**Memory Management:** Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows

**Principles of Deadlock:** System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

**UNIT - V:**

**File System Interface:** The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.

**File System Implementation:** File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

**TEXT BOOKS:**

Computer Organization – Carl Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw Hill.
Computer Systems Architecture – M. Moris Mano, IIIrd Edition, Pearson

Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

**REFERENCE BOOKS:**

Computer Organization and Architecture – William Stallings Sixth Edition, Pearson
Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI
Fundamentals of Computer Organization and Design - Sivaraama Dandamudi Springer Int. Edition.
Operating Systems – Internals and Design Principles, Stallings, sixth Edition–2009, Pearson Education.
Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI.
Principles of Operating Systems, B.L. Stuart, Cengage Learning, India Edition.

## EC3112PE: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PE – I)

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Basic Electrical and Electronics Engineering** | **3** | **0** | **0** | **3** |

It provides an understanding of various measuring system functioning and metrics for performance analysis.
Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
Understanding the concepts of various measuring bridges and their balancing conditions.
Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

**Course Outcomes:** Upon completing this course, the student will be able to

Measure electrical parameters with different meters and understand the basic definition of measuring parameters.
Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
Operate an Oscilloscope to measure various signals.
Measure various physical parameters by appropriately selecting the transducers.

**UNIT - I:**

**Block Schematics of Measuring Systems:** Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, 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, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

**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 Specifications.

**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, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

**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, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

**TEXT BOOKS:**

Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.

Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

**REFERENCE BOOKS:**

Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
Industrial Instrumentation: T.R. Padmanabham Springer 2009.
Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

**EC3113PE: DIGITAL SYSTEM DESIGN USING FPGA (Professional Elective – I)**

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Switching Theory and Logic Design** | **3** | **0** | **0** | **3** |

To acquire the knowledge in measurement of information and errors.
To study the generation of various code methods used in communications.
To study the various application of codes.

**Course Outcomes:** After completion of the course the student will be:
Able to transmit and store reliable data and detect errors in data through coding.
Able to understand the designing of various codes like block codes, cyclic codes, convolution codes, turbo codes and space codes.

**UNIT – I:**
Integrated Design Process and Methodology, Hardware Descriptive language and digital circuit primitives- Flip flop, latch, Three state Buffer, combinational gates, HDL Synthesis Rules, pads. HDL Simulation Environment, Synthesis Environment, synthesis Technology library, HDL Design process for a Block.

**UNIT - II:**
**Design of Basic Combinational circuits through VHDL/Verilog HDL**
Selectors, Encoder, Code Converter, Equality Checker, Comparators, Half adder, Full adder, Carry ripple adder, carry look ahead adder, Count one circuit, leading zero Circuit, Barrel Shifter.

**UNIT – III:**
**Design of Basic Sequential Circuit Through VHDL/Verilog HDL**
Signal manipulator, counter, Shift Register, Parallel to serial Converter, Serial to parallel convertor, General framework to design registers- Interrupt Registers, DMA and control Register, configuration registers, Register Block portioning and synthesis.

**UNIT – IV:**
**Clock and Reset Circuits**
Clock Buffer and Clock Tree, Clock Tree generation, Reset Circuitry, Clock Skew and Fixes, Synchronization between clock domains, clock Divider, Gated clock.

**UNIT - V:**
**Design Case Study**
Design Description, Design partition, Design verification, Design Synthesis, Worst-case Timing analysis, Best-case Timing Analysis, Net list Generation, Post layout Verification, Design Management.

**TEXT BOOKS:**
Digital Systems Design with VHDL and Synthesis – K. C. Chang, Wiley-India Edition
Digital System Design with FPGA: Implementation Using Verilog and VHDL - Cem Ünsalan, Bora Tar, McGraw-Hill Education 2017

**REFERENCE BOOKS:**
Digital Systems Design Using VHDL, 3E - Charles H. Roth, Jr./Lizy Kurian John, Cengage Publications

## EC3105PC: MICROPROCESSORS AND MICROCONTROLLERS LAB

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Cycle 1: Using 8086 Processor Kits and/or Assembler (5 Weeks)**

Assembly Language Programs to 8086 to Perform
Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

**Cycle 2: Using 8051 Microcontroller Kit (6 weeks)**

Introduction to IDE
Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
Time delay Generation Using Timers of 8051.
Serial Communication from / to 8051 to / from I/O devices.
Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

**Cycle 3: Interfacing I/O Devices to 8051(5 Weeks)**

7 Segment Display to 8051.
Matrix Keypad to 8051.
Sequence Generator Using Serial Interface in 8051.
8 bit ADC Interface to 8051.
Triangular Wave Generator through DAC interfaces to 8051.

**TEXT BOOKS:**

Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006
The 8051 *Microcontrollers*: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

## EC3106PC: DATA COMMUNICATIONS AND NETWORKS LAB

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Note:**

Minimum of 12 Experiments have to be conducted
All the Experiments may be Conducted using Network Simulation software like NS-2, NSG-2.1 and Wire SHARK/equivalent software.

**Note**: For Experiments 2 to 10 Performance may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, Delay etc.

Writing a TCL Script to create two nodes and links between nodes
Writing a TCL Script to transmit data between nodes
Evaluate the performance of various LAN Topologies
Evaluate the performance of Drop Tail and RED queue management schemes
Evaluate the performance of CBQ and FQ Scheduling Mechanisms
Evaluate the performance of TCP and UDP Protocols
Evaluate the performance of TCP, New Reno and Vegas
Evaluate the performance of AODV and DSR routing protocols
Evaluate the performance of AODV and DSDV routing protocols
Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
Evaluate the performance of IEEE 802.11 and SMAC
Capturing and Analysis of TCP and IP Packets
Simulation and Analysis of ICMP and IGMP Packets
Analyze the Protocols SCTP, ARP, NetBIOS, IPX VINES
Analysis of HTTP, DNS and DHCP Protocols

Major Equipment Required:
Required software (Open Source) like NS-2, NSG-2.1 and Wire SHARK

## EN3107HS: ADVANCED COMMUNICATION SKILLS LAB

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**INTRODUCTION:**

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

Gathering ideas and information to organize ideas relevantly and coherently.
Engaging in debates.
Participating in group discussions.
Facing interviews.
Writing project/research reports/technical reports.
Making oral presentations.
Writing formal letters.
Transferring information from non-verbal to verbal texts and vice-versa.
Taking part in social and professional communication.

**OBJECTIVES:**

This Lab focuses on using multi-media instruction for language development to meet the following targets:

To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
Further, they would be required to communicate their ideas relevantly and coherently in writing.
To prepare all the students for their placements.

**SYLLABUS**:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

**Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language

Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

**Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

**Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.

**Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions / seminars/**PPTs** and written presentations through posters / projects / reports/ e-mails / assignments etc.

**Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

**MINIMUM REQUIREMENT:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

Spacious room with appropriate acoustics.
Round Tables with movable chairs

Audio-visual aids
LCD Projector
Public Address system
P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
T. V, a digital stereo & Camcorder
Headphones of High quality

**SUGGESTED SOFTWARE:**

The software consisting of the prescribed topics elaborated above should be procured and used.

Oxford Advanced Learner's Compass, 7th Edition
DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
Lingua TOEFL CBT Insider, by Dream tech
TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

**TEXT BOOKS:**

Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

**REFERENCES:**

Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
English Vocabulary in Use series, Cambridge University Press 2008.
Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
Job Hunting by Colm Downes, Cambridge University Press 2008.
English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

**MC3001*: CYBER SECURITY**

| B. Tech. III Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Nil** | **3** | **0** | **0** | **0** |

**Course Objectives:** The course objectives are:

To familiarize various types of cyber-attacks and cyber-crimes
To give an overview of the cyber laws
To study the defensive techniques against these attacks

**Course Outcomes:** Upon completing this course, the student will be able to explain The students will be able to understand cyber-attacks, types of cybercrimes, cyberlaws and also how to protect them self and ultimately the entire Internet community from such attacks.

**UNIT - I**

**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy

**UNIT - II**

**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

**UNIT - III:**

**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT - IV**

**Cyber Security:** Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT - V:**

**Privacy Issues:** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**Cybercrime: Examples and Mini-Cases:** Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

**Mini-Cases**: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TEXT BOOKS:**

Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

**REFERENCE BOOKS:**

Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

## EC3201PC: ANTENNAS AND PROPAGATION

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite: Electromagnetic Theory and Transmission Lines** | **3** | **1** | **0** | **4** |

**Course Objectives:** The course objectives are:

To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.

To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.

To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.

To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.

To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

**Course Outcomes:** Upon completing this course, the student will be able to explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.

Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, UHF and Microwave antennas and also antenna arrays.

Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.

Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

**UNIT - I**

**Antenna Basics:** Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height.

Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem

**Thin Linear Wire Antennas** – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

**UNIT - II**

**Antenna Arrays:** Point Sources – Definition, Patterns**,** arrays of 2 Isotropic Sources **-** Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

**Antenna Measurements:** Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

**UNIT - III:**

**VHF, UHF and Microwave Antennas - I**: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

**UNIT - IV**

**VHF, UHF and Microwave Antennas - II**: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip

Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

**UNIT - V:**

**Wave Propagation -** Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

**Ground Wave Propagation** –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

**Space Wave Propagation –**Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

**Sky Wave Propagation** –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

**TEXT BOOKS:**

Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.

Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

**REFERENCE BOOKS:**

Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.

Radio Engineering Handbook- Keith henney, 3rd edition TMH.

Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007

**EC3202PC: DIGITAL SIGNAL PROCESSING**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Signals and Systems** | **3** | **1** | **0** | **4** |

**Course Objectives:**

To provide background and fundamental material for the analysis and processing of digital signals.
To understand the fast computation of DFT and appreciate the FFT processing.
To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
To acquaint in Multi-rate signal processing techniques and finite word length effects**.**

**Course Outcomes:** Upon completing this course, the student will be able to

Understand the LTI system characteristics and Multirate signal processing.
Understand the inter-relationship between DFT and various transforms.
Design a digital filter for a given specification.
Understand the significance of various filter structures and effects of round off errors.

**UNIT - I:**

**Introduction:** Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency**,** Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation**,** Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems
**Multirate Digital Signal Processing:** Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

**UNIT - II:**

**Discrete Fourier series:** Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation**,** DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.
**Fast Fourier Transforms:** Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

**UNIT - III**

**IIR Digital Filters:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

**UNIT - IV**

**FIR Digital Filters:** Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

**UNIT - V**

**Realization of Digital Filters:** Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.
**Finite Word Length Effects:** Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

**TEXT BOOKS:**

Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

**REFERENCE BOOKS:**

Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH, 2009
Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd Edition, Pearson Education, 2009

## EC3203PC: VLSI DESIGN

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Electronic Circuit Analysis; Switching Theory and Logic Design** | **3** | **1** | **0** | **4** |

**Course Objectives:** The objectives of the course are to:

Give exposure to different steps involved in the fabrication of ICs.
Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads.
Give exposure to the design rules to be followed to draw the layout of any logic circuit.
Provide design concepts to design building blocks of data path of any system using gates.
Understand basic programmable logic devices and testing of CMOS circuits.

**Course Outcomes:** Upon completing this course, the student will be able to

Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

**UNIT – I**

**Introduction:** Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

**Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits: $I_{ds}$-$V_{ds}$ relationships, MOS transistor threshold Voltage, $g_m$, $g_{ds}$, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**UNIT - II**

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

**UNIT – III**

**Gate Level Design:** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

**UNIT - IV**

**Data Path Subsystems:** Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

**Array Subsystems:** SRAM, DRAM, ROM, Serial Access Memories.

**UNIT - V**

**Programmable Logic Devices:** Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

**CMOS Testing:** CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

**TEXT BOOKS:**

Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

**REFERENCE BOOKS:**

Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.

**EC3221PE: DIGITAL IMAGE PROCESSING (Professional Elective III)**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Digital Signal Processing** | **3** | **0** | **0** | **3** |

To provide a approach towards image processing and introduction about 2D transforms
To expertise about enhancement methods in time and frequency domain
To expertise about segmentation and compression techniques
To understand the Morphological operations on an image

**Course Outcomes:** Upon completing this course, the student will be able to
Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
Understand the enhancement, segmentation and restoration processes on an image.
Implement the various Morphological operations on an image
Understand the need of compression and evaluation of basic compression algorithms.

**UNIT-I:**
**Digital Image Fundamentals & Image Transforms:** Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.
**Image Transforms:** 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

**UNIT-II:**
**Image Enhancement (Spatial Domain):** Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.
**Image Enhancement (Frequency Domain):** Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

**UNIT -III:**
**Image Restoration:** Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

**UNIT -IV:**
**Image Segmentation:** Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.
**Morphological Image Processing:** Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

**UNIT -V:**
**Image Compression:** Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

**TEXT BOOKS:**

Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010.

**REFERENCE BOOKS:**

Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, 2nd Edition, TMH, 2010.
Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2nd Edition, BS Publication, 2008.

**EC3222PE: EMBEDDED SYSTEM DESIGN (Professional Elective II)**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Microprocessors and Microcontrollers; Computer Organization and Operating Systems** | **0** | **0** | **3** | **3** |

**Course Objectives:**

To provide an overview of Design Principles of Embedded System.
To provide clear understanding about the role of firmware.
To understand the necessity of operating systems in correlation with hardware systems.
To learn the methods of interfacing and synchronization for tasking.

**Course Outcomes:** Upon completing this course, the student will be able to

To understand the selection procedure of Processors in the embedded domain.
Design Procedure for Embedded Firmware.
To visualize the role of Real time Operating Systems in Embedded Systems.
To evaluate the Correlation between task synchronization and latency issues

**UNIT - I:**

**Introduction to Embedded Systems:** Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**UNIT - II:**

**Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**UNIT - III:**

**Embedded Firmware:** Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**UNIT - IV:**

**RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**UNIT - V:**

**Task Communication**: Shared Memory, Message Passing, Remote Procedure Call and Sockets,
**Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

**TEXT BOOK:**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

**REFERENCE BOOKS:**

Embedded Systems - Raj Kamal, TMH.
Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
Embedded Systems – Lyla, Pearson, 2013
An Embedded Software Primer - David E. Simon, Pearson Education.

**EC3223PE: WEB TECHNOLOGIES (Professional Elective II)**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 4 | 0 | 0 | 4 |

**Course Objectives:**

To introduce PHP language for server side scripting
To introduce XML and processing of XML Data with Java
To introduce Server side programming with Java Servlets and JSP
To introduce Client side scripting with Javascript and AJAX.

**Course Outcomes:**

Gain knowledge of client side scripting, validation of forms and AJAX programming
Have understanding of server side scripting with PHP language
Have understanding of what is XML and how to parse and use XML Data with Java
To introduce Server side programming with Java Servlets and JSP

**UNIT - I**

**Introduction to PHP**: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads, Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies

**File Handling in PHP**: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories

**UNIT - II**

**XML**: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemas, Document Object Model, XHTML

**Parsing XML Data** - DOM and SAX Parsers in java.

**UNIT - III**

**Introduction to Servlets**: Common Gateway Interface (CGI), Lifecycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

**UNIT - IV**

**Introduction to JSP**: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

**UNIT- V**

**Client side Scripting**: Introduction to Javascript: Javascript language - declaring variables, scope of variables, functions, event handlers (onclick, onsubmit etc.), Document Object Model, Form validation. Simple AJAX application.

**TEXT BOOKS**:

Web Technologies, Uttam K Roy, Oxford University Press
The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill

**REFERENCE BOOKS**:

Web Programming, building internet applications, Chris Bates 2nd edition, Wile y Dreamtech
Java Server Pages –Hans Bergsten, SPD O'Reilly
Java Script, D. Flanagan, O'Reilly,SPD.
Beginning Web Programming-Jon Duckett WROX.
Programming World Wide Web, R. W. Sebesta, Fourth Edition, Pearson.
Internet and World Wide Web – How to program, Dietel and Nieto, Pearson

## EC3204PC: DIGITAL SIGNAL PROCESSING LAB

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Note:**
The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

**Note: -** Minimum of 12 experiments has to be conducted.

**List of Experiments:**

Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
Histogram of White Gaussian Noise and Uniformly Distributed Noise.
To find DFT / IDFT of given DT Signal
To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
Implementation of FFT of given Sequence
Determination of Power Spectrum of a given Signal(s).
Implementation of LP FIR Filter for a given Sequence/Signal.
Implementation of HP IIR Filter for a given Sequence/Signal
Generation of Narrow Band Signal through Filtering
Generation of DTMF Signals
Implementation of Decimation Process
Implementation of Interpolation Process
Implementation of I/D Sampling Rate Converters
Impulse Response of First order and Second Order Systems.

**EC3205PC: e - CAD LAB**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 3 | 1.5 |

**Note:** Any **SIX of** the following experiments from each part are to be conducted (Total 12)

**Part - I**

**All the following experiments have to be implemented using HDL**

Realize all the logic gates
Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
Design of 4 bit binary to gray code converter
Design of 4 bit comparator
Design of Full adder using 3 modeling styles
Design of flip flops: SR, D, JK, T
Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
Finite State Machine Design

**Part-II**

**Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:**

Basic logic gates
CMOS inverter
CMOS NOR/ NAND gates
CMOS XOR and MUX gates
Static / Dynamic logic circuit (register cell)
Latch
Pass transistor
Layout of any combinational circuit (complex CMOS logic gate).

**EC3206PC: SCRIPTING LANGUAGES LAB**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisites: Any High-level programming language (C, C++)** | **0** | **0** | **2** | **1** |

**Course Objectives:**

To Understand the concepts of scripting languages for developing web-based projects
To understand the applications the of Ruby, TCL, Perl scripting languages

**Course Outcomes:**

Ability to understand the differences between Scripting languages and programming languages
Able to gain some fluency programming in Ruby, Perl, TCL

**Note**: Each Practical session will have theory session for introduction of topic and fundamental of scripting language.

**List of Experiments**

Write a Ruby script to create a new string which is n copies of a given string where n is a nonnegative integer
Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
Write a Ruby script which accept the user's first and last name and print them in reverse order with a space between them
Write a Ruby script to accept a filename from the user print the extension of that
Write a Ruby script to find the greatest of three numbers
Write a Ruby script to print odd numbers from 10 to 1
Write a Ruby scirpt to check two integers and return true if one of them is 20 otherwise return their sum
Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100
Write a Ruby script to print the elements of a given array
Write a Ruby program to retrieve the total marks where subject name and marks of a student stored in a hash
Write a TCL script to find the factorial of a number
Write a TCL script that multiplies the numbers from 1 to 10
Write a TCL script for Sorting a list using a comparison function
Write a TCL script to (i)create a list (ii )append elements to the list (iii)Traverse the list (iv)Concatenate the list
Write a TCL script to comparing the file modified times.
Write a TCL script to Copy a file and translate to native format.
a) Write a Perl script to find the largest number among three numbers. b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
Write a Perl program to implement the following list of manipulating functions a)Shift b)Unshift c) Push
a) Write a Perl script to substitute a word, with another word in a string. b) Write a Perl script to validate IP address and email address.
Write a Perl script to print the file in reverse order using command line arguments

## MC3003*: ARTIFICIAL INTELLIGENCE

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisites: Nil** | **3** | **0** | **0** | **0** |

**Course Objectives:** To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

**Course Outcomes:**

Able to use search algorithms in AI
Able to apply learning and reasoning to AI systems

**UNIT - I**

**Introduction:** AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents
**Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

**UNIT - II**

**Advanced Search**: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning
**Basic Knowledge Representation and Reasoning**: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

**UNIT - III**

**Advanced Knowledge Representation and Reasoning**: Knowledge Representation Issues, Non-monotonic Reasoning, Other Knowledge Representation Schemes
**Reasoning Under Uncertainty**: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

**UNIT - IV**

**Learning:** What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

**UNIT - V**

**Expert Systems:** Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

**TEXT BOOK:**

Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

**REFERENCE BOOKS:**

Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

## EC4101PC: MICROWAVE AND OPTICAL COMMUNICATIONS (PC)

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Antennas and Propagation** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S-Matrix for various types of microwave junctions.
Understand the utility of Optical Fibres in Communications.

Upon completing this course, the student will be able to
Known power generation at microwave frequencies and derive the performance characteristics.
realize the need for solid state microwave sources and understand the principles of solid state devices.
distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications
understand the utility of S-parameters in microwave component design and learn the measurement procedure of various microwave parameters.
Understand the mechanism of light propagation through Optical Fibres.

**UNIT - I**

**Microwave Tubes:** Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.
**Helix TWTs:** Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

**UNIT - II**

**M-Type Tubes:**
Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave-Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI- Mode, o/p characteristics,
**Microwave Solid State Devices:** Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

**UNIT - III**

**Waveguide Components:** Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator,

**UNIT - IV**

**Scattering matrix**: Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator.

**Microwave Measurements:** Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

**UNIT - V**

**Optical Fiber Transmission Media:** Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget.

**TEXT BOOKS:**

Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.

Electronic Communications Systems- Wayne Tomasi, Pearson, 5th Edition

**REFERENCE BOOKS:**

Optical Fiber Communication – Gerd Keiser, TMH, 4th Ed., 2008.

Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint.

Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.

Electronic Communication System – George Kennedy, 6th Ed., McGrawHill.

**EC4131PE: SCRIPTING LANGUAGES (Professional Elective III)**

| **B. Tech. VI Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Prerequisites: Computer Programming and Data Structures** | **3** | **0** | **0** | **3** |

**Course Objectives:**

Able to differentiate scripting and non- scripting languages.
To learn Scripting languages such as PERL, TCL/TK, python and BASH.
Expertise to program in the Linux environment.
Usage of scripting languages in IC design flow.

**Course Outcomes:** Upon completing this course, the student will be able to

Known about basics of Linux and Linux Networking
Use Linux environment and write programs for automation
Understand the concepts of Scripting languages
Create and run scripts using PERL/TCl/Python.

**UNIT – I: Linux Basics**

Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

**UNIT – II: Linux Networking**

Introduction to Networking in Linux, Network basics & Tools, File Transfer Protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

**UNIT – III: Perl Scripting**.

Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

**UNIT – IV: Tcl / Tk Scripting**

Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures, Control Flow Commands, Procedures and Scope, Evel, Working with Unix, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and List box Widgets Focus, Grabs and Dialogs.

**UNIT – V: Python Scripting**.

Introduction to Python, using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

**TEXT BOOKS**:

Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk 4.0.
Red Hat Enterprise Linux 4 : System Administration Guide Copyright, Red Hat Inc, 2005.

**REFERENCE BOOKS**:

Learning Python – Mark Lutz and David Ascher, 2nd Ed. , O'Reilly, 2003.
Learning Perl – 4th Ed. Randal Schwartz, Tom Phoenix and Brain d foy. 2005.
Python Essentials – Samuele Pedroni and Noel Pappin. O'Reilly, 2002.
Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN 0596000278)

**EC4132PE: MOBILE COMMUNICATIONS AND NETWORKS (Professional Elective II)**

| B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisites: Analog and Digital Communications** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To provide the student with an understanding of the cellular concept, frequency reuse, hand-off strategies.
To provide the student with an understanding of Co-channel and Non-Co-Channel interferences.
To give the student an understanding of cell coverage for signal and traffic, diversity techniques and channel assignment
To give the student an understanding types of handoff.
To understand challenges and application of Adhoc wireless Networks.

**Course Outcomes:** Upon completing this course, the student will be able to:

Known the evolution of cellular and mobile communication system.
The student will be able to understand Co-Channel and Non-Co-Channel interferences.
Understand impairments due to multipath fading channel and how to overcome the different fading effects.
Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoff.
Know the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

**UNIT - I**

**Introduction to Cellular Mobile Radio Systems:** Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

**Fundamentals of Cellular Radio System Design:** Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems-Cell Splitting, Sectoring, Microcell Zone Concept.

**UNIT – II**

**Co-Channel Interference:** Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

**Non Co-Channel Interference:** Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

**UNIT – III**

**Cell Coverage for Signal and Traffic:** Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point to point prediction model in different conditions, merits of lee model.

**Frequency Management and Channel Assignment:** Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

**UNIT - IV**

**Handoffs and Dropped Calls:** Handoff Initiation, types of Handoff, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

**UNIT - V**

**Ad Hoc Wireless Networks:** Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

**TEXT BOOKS:**

Mobile Cellular Telecommunications-W.C.Y. Lee, Mc Graw Hill, 2nd Edn., 1989.
Wireless Communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

**REFERENCE BOOKS:**

Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.
Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005.

**EC4133PE: INTERNET OF THINGS (Professional Elective - III)**

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To introduce the terminology, technology and its applications
To introduce the concept of M2M (machine to machine) with necessary protocols
To introduce the Python Scripting Language which is used in many IoT devices
To introduce the Raspberry PI platform, that is widely used in IoT applications
To introduce the implementation of web based services on IoT devices

**Course Outcomes:**

Interpret the impact and challenges posed by IoT networks leading to new architectural models.
Compare and contrast the deployment of smart objects and the technologies to connect them to network.
Appraise the role of IoT protocols for efficient network communication.
Elaborate the need for Data Analytics and Security in IoT.
Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**UNIT - I**

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

**UNIT - II**

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

**UNIT - III**

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

**UNIT - IV**

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

**UNIT - V**

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

**TEXT BOOKS:**

Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
Getting Started with Raspberry Pi, Matt Richardson & Shawn W allace, O'Reilly (SPD), 2014, ISBN: 9789350239759

## EC4141PE: BIOMEDICAL INSTRUMENTATION (PE – IV)

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives**

**Identify** significant biological variables at cellular level and ways to acquire different bio-signals.
**Elucidate** the methods to monitor the activity of the heart,brain, eyes and muscles.
**Introduce** therapeutic equipment for intensive and critical care.
**Outline** medical imaging techniques and equipment for certain diagnosis and therapies.

**Course Outcomes:** After completion of the course the student is able to:

**Understand** biosystems and medical systems from an engineering perspective.
**Identify** the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
**Understand** the working of various medical instruments and critical care equipment.
**Know** the imaging techniques including CT,PET, SPECT and MRI used in diagnosis of various medical conditions.

**UNIT - I:**

**Bio-Potential Signals and Electrodes:** Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems. Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

**UNIT - II:**

**Cardiovascular Instrumentation:** Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

**UNIT - III:**

**Neurological Instrumentation:** Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

**UNIT - IV:**

**Equipment for Critical Care:** Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

**UNIT - V:**

**Principles of Medical Imaging:** Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

**TEXT BOOKS:**

Hand-book of Biomedical Instrumentation – by R.S. Khandpur, McGraw-Hill, 2003.
Medical Instrumentation, Application and Design – by John G. Webster, John Wiley.

**REFERENCE BOOKS:**

Biomedical Instrumentation and Measurements – by Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, PHI.
Principles of Applied Biomedical Instrumentation – by L.A. Geoddes and L.E. Baker, John Wiley and Sons.
Introduction to Biomedical equipment technology-by Joseph Carr and Brown.

**EC4142PE: NETWORK SECURITY AND CRYPTOGRAPHY (PE – IV)**

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Nil** | **3** | **0** | **0** | **3** |

**Course Objectives:**

Understand the basic concept of Cryptography and Network Security, their mathematical models
To understand the necessity of network security, threats/vulnerabilities to networks and countermeasures
To understand Authentication functions with Message Authentication Codes and Hash Functions.
To provide familiarity in Intrusion detection and Firewall Design Principles

Describe network security fundamental concepts and principles
Encrypt and decrypt messages using block ciphers and network security technology and protocols
Analyze key agreement algorithms to identify their weaknesses
Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities

**UNIT- I**

Security Services, Mechanisms and Attacks, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
**Modern Techniques:** Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

**UNIT- II**

**Encryption:** Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

**UNIT – III**

**Public Key Cryptography:** Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptograpy.
**Number Theory:** Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

**UNIT- IV**

**Message Authentication and Hash Functions:** Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
**Hash and Mac Algorithms:** MD-5, Message digest Algorithm, Secure Hash Algorithm.
Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
**Authentication Applications:** Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

**UNIT – V**

**IP Security:** Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.
**Intruders, Viruses and Worms:** Intruders, Viruses and Related threats.
**Fire Walls:** Fire wall Design Principles, Trusted systems.

**TEXT BOOKS:**

Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.

Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH,2004.

Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
Principles of Information Security, Whitman, Thomson.
Introduction to Cryptography, Buchmann, Springer.

**EC4143PE: DESIGN OF FAULT TOLERANT SYSTEMS (PE – IV)**

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Digital System Design Using FPGA** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To provide broad understanding of fault diagnosis and tolerant design approach.

To illustrate the framework of test pattern generation using semi and full automatic approach.

**Course Outcomes:** Upon completing this course, the student will be able to

To acquire the knowledge of fundamental concepts in fault tolerant design.

To acquire the knowledge of design requirements of self check-in circuits.

To acquire the knowledge of test pattern generation using LFSR.

To acquire the knowledge of design for testability rules and techniques for combinational circuits.

To acquire the knowledge of scan architectures.

To acquire the knowledge of design of built-in-self test.

**UNIT- I**

**Fault Tolerant Design:**

Basic concepts: Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, reliability of series, parallel and parallel-series combinational circuits. Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant system (TMR), 5MR reconfiguration techniques, Data redundancy, Time redundancy and software Redundancy concepts.

**UNIT- II**

**Self Checking circuits & Fail safe Design:**

Self Checking Circuits: Basic concepts of self checking circuits, Design of Totally self checking checker, Checkers using m out of n codes, Berger code, Low cost residue code. Fail Safe Design: Strongly fault secure circuits, fail safe design of sequential circuits using partition theory and Berger code, totally self checking PLA design.

**UNIT – III**

**Design for Testability:**

Design for testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs. Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

**UNIT- IV**

**Logic Built-in-self-test:**

BIST Basics-Memory-based BIST,BIST effectiveness, BIST types, Designing a BIST, Test Pattern Generation-Engaging TPGs, exhaustive counters, ring counters, twisted ring counter, Linear feedback shift register, Output Response Analysis-Engaging ORA's, One's counter, transition counter, parity checking, Serial LFSRs, Parallel Signature analysis, BIST architectures-BIST related terminologies, A centralized and separate Board-level BIST architecture, Built-in evaluation and self test(BEST), Random Test socket (RTS), LSSD On-chip self test, Self – testing using MISR and SRSG, Concurrent BIST, BILBO, Enhancing coverage, RT level BIST design- CUT design, simulation and synthesis, RTS BIST insertion, Configuring the RTS BIST, incorporating configurations in BIST, Design of STUMPS, RTS and STUMPS results.

**UNIT – V**

**Standard IEEE Test Access Methods:**

Boundary Scan Basics, Boundary scan architecture- Test access port, Boundary scan registers, TAP controller, the decoder unit, select and other units, Boundary scan Test Instructions-Mandatory instructions, Board level scan chain structure-One serial scan chain, multiple-scan chain with one control test port, multiple-scan chains with one TDI,TDO but multiple TMS, Multiple-scan chain, multiple access port, RT Level boundary scan-inserting boundary scan test hardware for CUT, Two module test case, virtual boundary scan tester, Boundary Scan Description language.

**TEXTBOOKS:**

Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design", 1984, PHI

Zainalabedin Navabi, "Digital System Test and Testable Design using HDL models and

Architectures", Springer International Edition.

**REFERENCES:**

Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, "Digital Systems Testing and Testable Design", Jaico Books
Bushnell & Vishwani D. Agarwal, "Essentials of Electronic Testing", Springer.
Alfred L. Crouch, "Design for Test for Digital IC's and Embedded Core Systems", 2008, Pearson Education.

## EC4102MS: PROFESSIONAL PRACTICE, LAW AND ETHICS (PC)

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Course Objectives:**

To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession

To develop some ideas of the legal and practical aspects of their profession.

**Course Outcome:** The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen

**UNIT - I**

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

**UNIT - II**

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

**UNIT - III**

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

**UNIT - IV**

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

**UNIT - V**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

**TEXT BOOKS:**

Professional Ethics: R. Subramanian, Oxford University Press, 2015.

Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

**REFERENCE BOOKS:**

RERA Act, 2017.

Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.

T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.

Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

**EC4103PC: MICROWAVE AND OPTICAL COMMUNICATIONS LAB**

**B. Tech. VI Year I Sem.** **L T P C 0021**

**Note:** Any **twelve** of the following experiments

**LIST OF EXPERIMENTS:**

Reflex Klystron Characteristics.
Gunn Diode Characteristics.
Attenuation measurement
Directional coupler Characteristics.
Scattering parameters of wave guide components
Frequency measurement.
Impedance measurement
VSWR measurement
Characterization of LED.
Characterization of Laser Diode.
Intensity modulation of Laser output through an optical fiber.
Measurement of Data rate for Digital Optical link.
Measurement of Numerical Aperture of fiber cable.
Measurement of losses for Optical link

## MC4001*: INTELLECTUAL PROPERTY RIGHTS

| B. Tech. VI Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives :**

Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
Understanding the Framework of Strategic Management of Intellectual Property (IP).
Appreciating and appraising different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs,
Explaining how to derive value from IP and leverage its value in new product and service development
Exposing to the Legal management of IP and understanding of real life practice of IPM..

**Course Outcomes:** Upon completing this course, the student will be able to

Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.
Be able to anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.
Be able to demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing;

**UNIT - I:**

**Introduction to Intellectual property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT - II:**

**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

**UNIT - III:**

**Law of copy rights:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**Law of patents:** Foundation of patent law, patent searching process, ownership rights and transfer.

**UNIT - IV:**

**Trade Secrets:** Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

**Unfair competition:** Misappropriation right of publicity, false advertising.

**UNIT - V:**

**New development of intellectual property:** new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

**TEXT BOOKS:**

Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

**EC4251PE: SATELLITE COMMUNICATIONS (PE –**

| **B. Tech. V) VI Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **0** | **0** | **3** |

**Course Objectives :**

To acquired foundation in orbital mechanics and launch vehicles for the satellites.
To provide basic knowledge of link design of satellite.
To understand multiple access systems and earth station technology
To understand the concepts of satellite navigation and GPS.

**Course Outcomes:** Upon completing this course, the student will be able to

Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
Envision the satellite sub systems and design satellite links for specified C/N.
Understand the various multiple access techniques for satellite communication systems and earth station technologies.
Known the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation

**UNIT - I:**

**Introduction:** Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

**Orbital Mechanics and Launchers:** Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance.

**UNIT - II:**

**Satellite Subsystems:** Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

**UNIT - III:**

**Satellite Link Design:** Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

**Multiple Access:** Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

**UNIT - IV:**

**Earth Station Technology:** Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

**UNIT - V:**

**Low Earth Orbit and Geo-Stationary Satellite Systems:** Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

**Satellite Navigation & Global Positioning System:** Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A Code Accuracy, Differential GPS.

**TEXT BOOKS:**

Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.

Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

**REFERENCE BOOKS:**

Satellite Communications : Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
Satellite Communications – Dennis Roddy, McGraw Hill, 4th Edition, 2009.

**EC4252PE: RADAR SYSTEMS (PE – V)**

| B. Tech. VI Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Analog and Digital Communications** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To explore the concepts of radar and its frequency bands.
To understand Doppler effect and get acquainted with the working principles of CW radar, FM-CW radar.
To impart the knowledge of functioning of MTI and Tracking Radars.
To explain the deigning of a Matched Filter in radar receivers.

**Course Outcomes:** Upon completing this course, the student will be able to

Derive the complete radar range equation.
Understand the need and functioning of CW, FM-CW and MTI radars
Known various Tracking methods.
Derive the matched filter response characteristics for radar receivers.

**UNIT - I**

**Basics of Radar**: Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.

**Radar Equation:** SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

**UNIT - II**

**CW and Frequency Modulated Radar:** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.

**FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter.

**UNIT - III**

**MTI and Pulse Doppler Radar:** Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

**UNIT - IV**

**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

**UNIT - V**

**Detection of Radar Signals in Noise** Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

**Radar Receivers** – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

**TEXT BOOKS:**

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

**REFERENCE BOOKS:**

Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.

Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.

Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee, 2013

Radar Handbook - Merrill I. Skolnik, 3rd Ed., McGraw Hill Education, 2008.

**EC4253PE: WIRELESS SENSOR NETWORKS (PE – V)**

| B. Tech. VI Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Analogue and Digital Communications** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To acquire the knowledge about various architectures and applications of Sensor Networks
To understand issues, challenges and emerging technologies for wireless sensor networks
To learn about various routing protocols and MAC Protocols
To understand various data gathering and data dissemination methods
To Study about design principals, node architectures, hardware and software required for implementation of wireless sensor networks.

**Course Outcomes:** Upon completion of the course, the student will be able to:

Analyze and compare various architectures of Wireless Sensor Networks
Understand Design issues and challenges in wireless sensor networks
Analyze and compare various data gathering and data dissemination methods.
Design, Simulate and Compare the performance of various routing and MAC protocol

**UNIT - I:**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

**UNIT - II:**

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

**UNIT - III:**

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

**UNIT - IV:**

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.

**UNIT - V:**

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 BOOKS:**

Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy,B. S. Manoj, Pearson
Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

**REFERENCE BOOKS:**

Wireless Digital Communications – Kamilo Feher, 1999, PHI.
Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
Wireless Communication and Networking – William Stallings, 2003, PHI.

## EC4261PE: INFORMATION THEORY AND CODING (PE – VI)

| B. Tech. VI Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Digital Communications** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To acquire the knowledge in measurement of information and errors.
Understand the importance of various codes for communication systems
To design encoder and decoder of various codes.
To known the applicability of source and channel codes

**Course Outcomes:** Upon completing this course, the student will be able to

Learn measurement of information and errors.
Obtain knowledge in designing various source codes and channel codes
Design encoders and decoders for block and cyclic codes
Understand the significance of codes in various applications

**UNIT - I**

**Coding for Reliable Digital Transmission and storage**

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. **Source Codes:** Shannon-fano coding, Huffman coding

**UNIT - II**

**Linear Block Codes:** Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

**UNIT - III**

**Cyclic Codes:** Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

**UNIT - IV**

**Convolutional Codes:** Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

**UNIT - V**

**BCH Codes:** Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

**TEXT BOOKS**

Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.

Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

**REFERENCE BOOKS**

1. Digital Communications- John G. Proakis, 5th ed., TMH 2008.

h

Introduction to Error Control Codes-Salvatore Gravano-oxford

Error Correction Coding- Mathematical Methods and Algorithms- Todd K. Moon, 2006, Wiley India.

Information Theory, Coding and Cryptography- Ranjan Bose, 2nd Edition, 2009, TMH.

**EC4262PE: ARTIFICIAL NEURAL NETWORKS (PE – VI)**

| B. Tech. VI Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Nil** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To understand the biological neural network and to model equivalent neuron models.
To understand the architecture, learning algorithms
To know the issues of various feed forward and feedback neural networks.
To explore the Neuro dynamic models for various problems.

**Course Outcomes:** Upon completing this course, the student will be able to

Understand the similarity of Biological networks and Neural networks
Perform the training of neural networks using various learning rules.
Understanding the concepts of forward and backward propagations.
Understand and Construct the Hopfield models.

**UNIT-I:**

**Introduction**: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

**Learning Process**: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

**UNIT-II:**

**Single Layer Perceptrons**: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

**Multilayer Perceptron**: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

**UNIT-III:**

**Back Propagation:** Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

**UNIT - IV:**

**Self-Organization Maps (SOM):** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

**UNIT-V:**

**Neuro Dynamics:** Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

**Hopfield Models** – Hopfield Models, restricted boltzmen machine.

**TEXT BOOKS:**

Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,.
Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

**REFERENCE BOOKS:**

Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005.

## EC4263PE: DATA ANALYTICS (PE – VI)

| B. Tech. VI Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite: Knowledge of probability and statistics** | **3** | **0** | **0** | **3** |

**Course Objectives:**

To explore the fundamental concepts of data analytics.
To learn the principles and methods of statistical analysis
Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
To understand the various search methods and visualization techniques.

**Course Outcomes:** Upon completion of the course, the student will be able to:

Understand the impact of data analytics for business decisions and strategy
Carry out data analysis/statistical analysis
To carry out standard data visualization and formal inference procedures
Design Data Architecture
Understand various Data Sources

**UNIT - I:**

**Data Management**: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality(noise, outliers, missing values, duplicate data) and Data Processing & Processing.

**UNIT - II:**

**Data Analytics**: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

**UNIT - III:**

**Regression** – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.
Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

**UNIT - IV:**

**Object Segmentation**: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction.

**UNIT - V:**

**Data Visualization**: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

**TEXT BOOKS:**

Student's Handbook for Associate Analytics – II, III.
Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

**REFERENCE BOOKS:**

Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
Data Mining Analysis and Concepts, M. Zaki and W. Meira
Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

## OPEN ELECTIVES OFFERED BY
## DEPARTMENT OF CIVIL ENGINEERING

## CE3211OE: BASICS OF CIVIL ENGINEERING

**B. Tech. III Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

To explain the concepts of Civil Engineering.
To Understand the Building Materials for construction
To understand the concept of Transportation
To explain the Soil Characteristics for best foundation
To know the Drinking water Standards & Water Treatment Units..

**Course Outcomes:** Upon completion of the Course, the students will have the:

Identify different types of building materials for construction.
Discuss types of Traffic Flow Characteristics.
To know the soil classification and its properties.
Distinguish and understand Drinking water and Waste water properties..

**UNIT-I Building Materials for Construction**

**Bricks & Cement**: qualities of good bricks, types of brick, ingredients of cement, types of cement, Grade of cement.

**Concrete & Steel**: Properties of cement concrete, types of concrete based on usage & properties and uses of various types of steel, Admixtures.

Building components: lintels, walls, stair cases, types of floors, types of roofs, doors, windows-material-types, Finishers-Plastering, Painting, Tiles.

**UNIT- II Transportation Engineering**

**Highway**: History and Importance of Highways, Classification of roads, highway cross section, types of Pavement.

**Traffic**: Road safety-Traffic signals &its types. Road intersections & its types. Railway: Permanent way, Components parts its functions.

Airway: Typical Airport layout, Factors for airport site selection.

**UNIT – III Geotechnical Engineering**

Soil formation and its three phase diagram, I.S. Classification of soils. Permeability & its Factors affecting, capillary rise. Compaction – factors affecting compaction.

Geology- Different types & its properties of Rocks & Minerals.

**UNIT - IV Water Resources & Irrigation Engineering**

Hydrologic cycle, Forms of precipitation, measurement of precipitation by Symons rain gauge. Abstractions from precipitation: Infiltration, Evaporation & Runoff & their Factors affecting.

**Irrigation**: Water requirement of crops, canal & its losses, Types of lining-Advantages and disadvantages.

**Types of dams**, Factors affecting selection of a dam site. Tunneling- Purposes of tunneling.

**UNIT – V Environmental Engineering**

**Drinking Water**: types of water demand – factors affecting water quality and testing – drinking water standards. Layout and general outline of water treatment units.

**Waste water**: Waste water treatment plant Flow diagram. Waste water collection, manholes & house drainage.

**Air & Sound pollution** – Effects & Controlling methods.

**TEXT BOOKS:**

Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd., New Delhi.
Transportation Engineering by Khanna & Justo
Geotechnical Engineering by Arora
Water Resources & Irrigation Engineering by SK Garg
Environmental Engineering by Dr.B.C.Punmia

## CE3212OE: BUILDING MATERIALS AND CONSTRUCTION

| B. Tech. III Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

List the construction material.
Explain different construction techniques
Understand the building bye-laws
Highlight the smart building materials.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Define the Basic terminology that is used in the industry
Categorize different building materials, properties and their uses.

**Unit- I**

**Cement**: Introduction, ingredients of cement, types of cement, cement mortar uses.
**Concrete**: Properties of cement concrete, materials, standard concrete mix proportions, curing of concrete, methods-effects of improper curing.

**Unit -II**

**Bricks & Bricks masonry**: qualities of good bricks, types of bricks, brick masonry and types of brick masonry
**Timber**: Structure of a tree, defects in timber, seasoning of timber, qualities of good timber, important Indian timber trees.

**Unit -III**

**Construction Materials**: Stone-type of building stones, glass-types based on usage, plastics-advantages and disadvantages, uses, ceramics-types used in building industry.
Structural steel: properties and uses of various types of steel, types. Girders-types & uses

**Unit- IV**

**Building components**: lintels, walls, stair cases, types of floors, types of roofs, doors, windows-material-types.
**Fire protection**: hazards, classification of fire resistant materials and constructions.

**Unit- V**

**Building planning**: principles of building planning, classification of buildings and building bylaws.
**Building Services**: Plumbing-water distribution, sanitary-lines and fittings, ventilations: functional requirements, system of ventilations.

**TEXT BOOKS:**

Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.
Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi

Building Materials by Duggal, New Age International.
Building Materials by P. C. Varghese, PHI.
Building Construction by PC Varghese PHI.
Construction Technology – Vol – I & II by R. Chubby, Longman UK.
Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications.

## CE4121OE: ENVIRONMENTAL IMPACT ASSESSMENT

| B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

Define and Classify Environmental Impacts and the terminology
Understands the environmental Impact assessment procedure
Explain the EIA methodology
List and describe environmental audits.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Identify the environmental attributes to be considered for the EIA study
Formulate objectives of the EIA studies
Identify the methodology to prepare rapid EIA
Prepare EIA reports and environmental management plans.

**UNIT- I**

**Introduction**: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

**UNIT- II**

**EIA Methodologies**: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts.

**UNIT- III**

**Environmental Management Plan**: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

**UNIT- IV**

**Environmental Legislation and Life cycle Assessment**: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials- cost criteria case studies.

**UNIT- V**

**Case Studies**: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

**TEXT BOOKS:**

Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002.

**REFERENCE BOOKS:**

Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

## CE4122OE: INDUSTRIAL WASTE WATER TREATMENT

| B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite:** Environmental Engineering | 3 | 0 | 0 | 3 |

**Course Objectives:**

To present the information of wastewater generation from various industries
To inform about the conventional treatment processes for specific industrial wastewaters
To explain about the new developments in industrial wastewater treatment technologies.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Identify the characteristics of industrial wastewaters
Describe pollution effects of disposal of industrial effluent
Identify and design treatment options for industrial wastewater
Formulate environmental management plan.

**UNIT - I**

**Introduction**: Wastewater Characteristics, Standards of Disposal, Treatment Objective and Strategies, Layouts of Primary, Secondary and Advanced Treatment Units.

**UNIT - II**

**Design of Preliminary and Primary Treatment Operations**: Screens, Grit Chambers, Skimming Tank, Primary and Secondary Sedimentation Tanks.

**UNIT - III**

**Biological Treatment Processes**: Types, Kinetics of Plug Flow and Completely Mixed Systems. Attached Growth Processes: Trickling Filters (Standard Rate, High Rate), Biofilters, Practices, Features and Design, Operational Difficulties and Remedial Measures, Rotating Biological Contactors. Suspended Growth Processes:

**UNIT - IV**

**Activated Sludge Process**, Modifications and Design Equations, Process Design Criteria, Oxygen and Nutrient Requirements - Classification and Design of Oxidation Ponds, Lagoons.

**UNIT - V**

**Sludge Treatment and Disposal**: Sludge Thickening, Aerobic and Anaerobic Sludge Digestion Processes, Design of Digester Tank, Sludge Dewatering, Ultimate Disposal, Sludge Drying Beds, Other Methods of Sludge Treatment.

**TEXT BOOKS:**

Wastewater Treatment – Concepts and Design Approach, by G L Karia and R A Christian, Prentice Hall of India, 2006
Environmental Engineering by Gerard Kiely, McGraw Hill Education (India) Pvt Ltd, 2013
Environmental Engineering – A Design Approach by A. P. Sincero and G A Sincero, Prentice

Wastewater Engineering - Collection, Treatment, Disposal and Reuse by Metcalf and Eddy, , McGraw Hill Education (India) Pvt Ltd, 2013
Industrial Waste Treatment by Nelson Leonard Nemerow, Butterworth-Heinemann, 2007.
Biological Process Designs for Wastewater Treatment by Benefield L.D. and Randall C.D. Prentice Hall Pub. Co., 1980.

## CE4231OE: REMOTE SENSING AND GIS

| B. Tech. IV Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre Requisites:** Surveying | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Retrieve the information content of remotely sensed data
Analyze the energy interactions in the atmosphere and earth surface features
Interpret the images for preparation of thematic maps
Apply problem specific remote sensing data for engineering applications
Analyze spatial and attribute data for solving spatial problems
Create GIS and cartographic outputs for presentation.

**UNIT – I**

**Introduction to Photogrammetry**: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

**UNIT – II**

**Remote Sensing**: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process.Electro- magnetic Spectrum, Energy interactions with atmosphere and with earth surfacefeatures (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

**UNIT – III**

**Geographic Information Systems**: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input-Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters- Commonly used Map Projections - Projected coordinate Systems

**UNIT – IV**

**Vector Data Model**: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object BasedVector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules

**UNIT – V**

**Raster Data Model**: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

**TEXT BOOKS:**

Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015.

**REFERENCE BOOKS:**

Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

## CE4232OE: DISASTER MANAGEMENT

| B. Tech. IV Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. The subject provides different disasters, tools and methods for disaster management.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Understanding Disasters, man-made Hazards and Vulnerabilities
Understanding disaster management mechanism
Understanding capacity building concepts and planning of disaster managements.

**UNIT - I**

**Understanding Disaster**: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

**UNIT - II**

**Disaster Management Mechanism**: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

**UNIT - III**

**Capacity Building**: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

**UNIT - IV**

**Coping with Disaster**: Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

**UNIT - V**

**Planning for disaster management**: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans.

**TEXT BOOKS:**

Manual on Disaster Management, National Disaster Management, Agency Govt of India.
Disaster Management by Mrinalini Pandey Wiley 2014.
Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd

Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf).

**OPEN ELECTIVES OFFERED BY**

**DEPARTMENT OF COMPUTER SCIENCE ENGINEERING**

## CS3211OE: INTRODUCTION TO DATA

| B. Tech. SCIENCE III Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

Learn data science project concepts
Learn to collect data and process
Learn to visualize data

**Course Outcomes:** Upon completion of the Course, the students will be able to:

Able to collect data from various resources and process data
Able to plot data using various methods
Able to develop and evaluate models

**Unit – I: Introduction**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

**Unit – II: Data Collection and Data Pre-Processing**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

**Unit – III: Exploratory Data Analytics**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

**Unit – IV: Model Development**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

**Unit – V: Model Evaluation**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing multiple Parameters by using Grid Search.

**REFERENCES:**

Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

## CS3212OE: DATA MINING

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

Learn data mining concepts understand association rules mining.
Discuss classification algorithms learn how data is grouped using clustering techniques.
To develop the abilities of critical analysis to data mining systems and applications.
To implement practical and theoretical understanding of the technologies for data mining
To understand the strengths and limitations of various data mining models;

**Course Outcomes:** Upon completion of the Course, the students will be able to:

Ability to perform the preprocessing of data and apply mining techniques on it.
Ability to identify the association rules, classification and clusters in large data sets.
Ability to solve real world problems in business and scientific information using data mining
Ability to classify web pages, extracting knowledge from the web

**Unit – I:**

**Introduction to Data Mining:** Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of Similarity and Dissimilarity- Basics.

**UNIT - II**

**Association Rules**: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.

**UNIT - III**

**Classification**: Problem Definition, General Approaches to solving a classification problem , Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction , Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbor classification-Algorithm and Characteristics.

**UNIT - IV**

**Clusterin**g: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm;
Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection.

**UNIT - V**

**Web and Text Mining**: Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

**TEXT BOOKS:**

Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
Data mining Techniques and Applications, Hongbo Du Cengage India Publishing

**REFERENCE BOOKS:**

Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.
Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press

## CS3213OE: COMPUTER FORENSICS

| B. Tech. III Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To understand the cyberspace.
To understand the forensics fundamentals.
To understand the evidence capturing process.
To understand the preservation of digital evidence.

**Course Outcomes:** Upon completion of the Course, the students will be able to:

Students will understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.
It gives an opportunity to students to continue their zeal in research in computer forensics.

**UNIT - I**

**Computer Forensics Fundamentals**: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

**UNIT-II**

**Evidence Collection and Data Seizure**: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

**UNIT - III**

**Computer Forensics analysis and validation**: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case

**UNIT - IV**

**Current Computer Forensic tools**: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

**UNIT - V**

**Working with Windows and DOS Systems**: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

**TEXT BOOKS:**

Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
Data mining Techniques and Applications, Hongbo Du Cengage India Publishing

**REFERENCE BOOKS:**

Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.
Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press

## CS4121OE: PYTHON PROGRAMMING

| B. Tech. IV Year I Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To be able to introduce core programming basics and program design with functions using Python programming language.
To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
To understand the high-performance programs designed to strengthen the practical expertise.

**Course Outcomes:** Upon completion of the Course, the students will be able to:

Able to write programs using classes and objects
Able to develop GUI.

**UNIT - I**

**Introduction to Python:** Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.
Data types and Expressions: Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.

**UNIT - II**

**Control Statements**: Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration.
File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.
Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules.

**UNIT - III**

**Strings and Text Files**: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

**UNIT - IV**

**Design with Classes**: Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes.

**UNIT - V**

**Graphical User Interfaces**: Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.
Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

**TEXT BOOKS:**

Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.
Think Python First Edition, by Allen B. Downey, Orielly publishing

**REFERENCE BOOKS:**

Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing
Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)
Charles Dierach, Introduction to Computer Science using Python

## CS4122OE: R PROGRAMMING

| B. Tech. IV Year I Sem. | L | T | P | C |
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**Course Objectives:**

Understanding and being able to use basic programming concepts
Automate data analysis
Working collaboratively and openly on code
Knowing how to generate dynamic documents
Being able to use a continuous test-driven development approac

**Course Outcomes:** Upon completion of the Course, the students will be able to:

be able to use and program in the programming language R
be able to use R to solve statistical problems
be able to implement and describe Monte Carlo the technology
be able to minimize and maximize functions using R.

**UNIT – I**

**Introduction**: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

**UNIT – II**

**Control structures**, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

**UNIT – III**

**Lists**: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

**UNIT - IV**

**FACTORS AND TABLES**, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable,
Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

**UNIT - V**

**OBJECT-ORIENTED PROGRAMMING**: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

**TEXT BOOKS:**

R Programming for Data Science by Roger D. Peng
The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.

## CS4123OE: JAVA PROGRAMMING

| B. Tech. IV Year I Sem. | L | T | P | C |
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**Course Objectives:**

To introduce the object-oriented programming concepts.
To understand object-oriented programming concepts, and apply them in solving problems.
To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
To introduce the implementation of packages and interfaces
To introduce the concepts of exception handling and multithreading.
To introduce the design of Graphical User Interface using applets and swing controls.

**Course Outcomes:** Upon completion of the Course, the students will be:

Able to solve real world problems using OOP techniques.
Able to understand the use of abstract classes.
Able to solve problems using java collection framework and I/o classes.
Able to develop multithreaded applications with synchronization.
Able to develop applets for web applications.
Able to design GUI based applications.

**UNIT - I**

**Object-Oriented Thinking**- A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling.

Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance-specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

**UNIT - II**

**Packages**- Defining a Package, CLASSPATH, Access protection, importing packages.

Interfaces- defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

**UNIT - III**

**Exception handling** - Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

**UNIT - IV**

**The Collections Framework (java.util)**- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable, Properties, Stack, Vector

More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

**UNIT - V**

**GUI Programming with Swing** – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout,

**Grid Bag Layout.**

**Event Handling**- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, Painting in Swing, A Paint example, Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

**TEXT BOOKS:**

Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.

Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson

An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons

Introduction to Java programming, Y. Daniel Liang, Pearson Education.

Object Oriented Programming through Java, P. Radha Krishna, University Press.

Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.

Java Programming and Object-oriented Application Development, R. A. Johnson, Cengage Learning

## CS4231OE: MACHINE LEARNING

| B. Tech. IV Year I Sem. | L | T | P | C |
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**Course Objectives:**

To be able to formulate machine learning problems corresponding to different applications.
To understand a range of machine learning algorithms along with their strengths and weaknesses.
To understand the basic theory underlying machine learning.

**Course Outcomes:** Upon completion of the Course, the students will be:

Student should be able to understand the basic concepts such as decision trees and neural networks.
Ability to formulate machine learning techniques to respective problems.
Apply machine learning algorithms to solve problems of moderate complexity.

**UNIT – I**

**Introduction**: An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions. Concept Learning: Version spaces. Inductive Bias. Active queries. Mistake bound/ PAC model. basic results. Overview of issues regarding data sources, success criteria.

**UNIT – II**

**Decision Tree Learning**: - Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over fitting. Neural Network Learning: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

**UNIT – III**

**Sample Complexity and Over fitting**: Errors in estimating means. Cross Validation and jackknifing VC dimension. Irrelevant features: Multiplicative rules for weight tuning.
Support Vector Machines: functional and geometric margins, optimum margin classifier, constrained optimization, Lagrange multipliers, primal/dual problems, KKT conditions, dual of the optimum margin classifier, soft margins, and kernels.
Bayesian Approaches: The basics Expectation Maximization. Bayes theorem, Naïve Bayes Classifier, Markov models, Hidden Markov Models

**UNIT - IV**

**Instance-based Techniques**: Lazy vs. eager generalization. K nearest neighbor, case- based reasoning. Clustering and Unsupervised Learning: K-means clustering, Gaussian mixture density estimation, model selection

**UNIT - V**

**Genetic Algorithms**: Different search methods for induction - Explanation-based Learning: using prior knowledge to reduce sample complexity.
Dimensionality reduction: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, manifold learning

**TEXT BOOKS:**

Tom Michel, Machine Learning, McGraw Hill, 1997
Trevor Has tie, Robert Tibshirani & Jerome Friedman. The Elements of Statically Learning, Springer Verlag, 2001

**REFERENCE BOOKS:**

Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001
Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.

## CS4232OE: CLOUD COMPUTING

| B. Tech. IV Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To explain the evolving computer model called cloud computing.
To introduce the various levels of services that can be achieved by cloud.
To describe the security aspects in cloud.

**Course Outcomes:** Upon completion of the Course, the students will have the:

1. Ability to understand the virtualization and cloud computing concepts.

**UNIT - I**

**Systems Modeling, Clustering and Virtualization**: Distributed System Models and Enabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centers.

**UNIT - II**

**Foundations**: Introduction to Cloud Computing, Migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, The Enterprise Cloud Computing Paradigm.

**UNIT - III**

**Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS)**: Virtual machines provisioning and Migration services, On the Management of Virtual machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data Storage in Cloud Computing.
Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments.

**UNIT - IV**

**Monitoring, Management and Applications**: An Architecture for Federated Cloud Computing, SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Best Practices in Architecting Cloud Applications in the AWS cloud, Building Content Delivery networks using Clouds, Resource Cloud Mashups.

**UNIT - V**

**Governance and Case Studies**: Organizational Readiness and Change management in the Cloud age, Data Security in the Cloud, Legal Issues in Cloud computing, Achieving Production Readiness for Cloud Services.

**TEXT BOOKS:**

Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
Distributed and Cloud Computing, Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.

Cloud Computing : A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
Cloud Computing: Implementation, Management and Security, John W. Rittinghouse, James F.Ransome, CRC Press, rp2012.
Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly, SPD, rp2011.
Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

## CS4233OE: NATURAL LANGUAGE PROCESSING

| B. Tech. IV Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.

Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems

Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.

Able to design, implement, and analyze NLP algorithms

Able to design different language modeling Techniques.

**UNIT - I**

**Finding the Structure of Words**: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

**UNIT - II**

**Syntax Analysis**: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

**UNIT - III**

**Semantic Parsing**: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

**UNIT - IV**

**Predicate**-Argument Structure, Meaning Representation Systems, Software.

**UNIT - V**

**Discourse Processing**: Cohension, Reference Resolution, Discourse Cohension and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling

**TEXT BOOKS:**

Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication

Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

**REFERENCE BOOKS:**

Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

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## EE3211OE: ELECTRICAL INSTALLATION AND COSTING

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
To design and estimation of wiring
To design overhead and underground distribution lines, substations and illumination.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Understand the design considerations of electrical installations.
Design electrical installation for buildings and small industries.
Identify and design the various types of light sources for different applications.

**UNIT - I**

**Design Considerations of Electrical Installations**: Electric Supply System, Three phase fourwire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections , Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches,Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

**UNIT - II**

**Electrical Installation for Different Types of Buildings and Small Industries**: Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

**UNIT - III**

**Overhead and Underground Transmission and Distribution Lines**: Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

**UNIT - IV**

**Substations**: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

**UNIT - V**

**Design of Illumination Schemes**: Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

**TEXT BOOKS:**

"K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
"Er. V. K. Jain, Er. Amitabh Bajaj", "Design of Electrical Installations", University Science Press.

**REFERENCE BOOKS:**

Code of practice for Electrical wiring installations,(System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS:4648-1968.
Electrical Installation buildings Indian Standard Institution, IS: 2032.
Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding 650 V), Indian Standard Institution, IS: 3106-1966.
Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.
"Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013.

**EE3212OE : ELECTRICAL ENGINEERING MATERIALS**

| B. Tech. III Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite:** Engineering chemistry and Engineering Physics - II | 3 | 0 | 0 | 3 |

**Course Objectives:**

To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Understand various types of dielectric materials, their properties in various conditions.
Evaluate magnetic materials and their behavior.
Evaluate semiconductor materials and technologies.
Acquire Knowledge on Materials used in electrical engineering and applications.

**UNIT- I**

**Dielectric Materials**: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curiepoint, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

**UNIT – II**

**Magnetic Materials**: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis

**UNIT – III**

**Semiconductor Materials**: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI)

**UNIT – IV**

**Materials for Electrical Applications**: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electriccontact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseousinsulating materials, Effect of moisture on insulation.

**UNIT – V**

**Special Purpose Materials**: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oilas per ISI.

**TEXT BOOKS:**

"R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
"T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
"AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

**EE4121OE: Renewable Energy Sources**

| B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Understand various types of dielectric materials, their properties in various conditions.
Evaluate magnetic materials and their behavior.
Evaluate semiconductor materials and technologies.
Acquire Knowledge on Materials used in electrical engineering and applications.

**UNIT - I**

**Introduction**: Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy Economics-Calculation of Electricity Generation Costs – Demand side Management Options – Supply side Management Options-Modern Electronic Controls of Power Systems.

Wind Power Plants: Appropriate Location -Evaluation of Wind Intensity -Topography - Purpose of the Energy Generated - General Classification of Wind Turbines-Rotor Turbines- Multiple-Blade Turbines Drag Turbines -Lifting Turbines-Generators and Speed Control used in Wind Power Energy Analysis of Small Generating Systems.

**UNIT - II**

**Photovoltaic Power Plants**: Solar Energy-Generation of Electricity by Photovoltaic Effect - Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics- Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems- Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy.

Fuel Cells: The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues Constructional Features of Proton Exchange-Membrane Fuel Cells – Reformers-Electro-lyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit-Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

**UNIT - III**

**Induction Generators:** Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated-Self- Excited Induction Generator-Magnetizing Curves and Self-Excitation Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation - Speed and Voltage Control -Economical Aspects.

**UNIT - IV**

**Storage Systems**: Energy Storage Parameters- Lead–Acid Batteries-Ultra Capacitors- Flywheels – Superconducting Magnetic Storage System-Pumped Hydroelectric Energy Storage - Compressed Air Energy Storage - Storage Heat -Energy Storage as an Economic Resource.

**UNIT - V**

**Integration of Alternative Sources of Energy**: Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

Interconnection of Alternative Energy Sources with the Grid: Interconnection Technologies - Standards and Codes for Interconnection - Interconnection Considerations - Interconnection Examples for Alternative Energy Sources.

**TEXT BOOKS:**

Felix A. Farret, M. Godoy Simoes, “Integration of Alternative Sources of Energy”, John Wiley&Sons, 2006.

Solanki: Renewable Energy Technologies: Practical Guide for Beginners, PHI Learning

1. D. Mukherjee: Fundamentals of Renewable Energy Systems, NewAge International publishers, 2007.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic andWind Power Systems, John Wiley & Sons, 2011.

Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.

## EE4122OE: RELIABILITY

| ENGINEERING B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| **Prerequisite:** Mathematics-III (Laplace Transforms, Numerical Methods and Complex variables) | 3 | 0 | 0 | 3 |

**Course Objectives:**

To introduce the basic concepts of reliability, various models of reliability
To analyze reliability of various systems
To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

**Course Outcomes:** Upon completion of the Course, the students will have the:

model various systems applying reliability networks
evaluate the reliability of simple and complex systems
estimate the limiting state probabilities of repairable systems
apply various mathematical models for evaluating reliability of irreparable systems.

**UNIT - I**

**Basic Probability Theory**: Elements of probability, probability distributions, Random variables, Densityand Distribution functions- Mathematical expected – variance and standard deviation Binomial Distribution: Concepts, properties, engineering applications.

**UNIT- II**

**Network Modeling and Evaluation of Simple Systems**: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems - Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling and Evaluation of Complex Systems

Conditional probability method- tie set, Cut-set approach- Event tree and reduced event tree methods-Relationships between tie and cut-sets- Examples.

**UNIT - III**

**Probability Distributions In Reliability Evaluation**: Distribution concepts, Terminology of distributions, General reliability functions, Evaluation of the reliability functions, shape of reliability functions –Poisson distribution – normal distribution, exponential distribution, Weibull distribution.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

**UNIT - IV**

**Discrete Markov Chains**: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Application.

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation ofsingle and two component repairable systems

**UNIT - V**

**Frequency and Duration Techniques**: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

**TEXT BOOKS:**

Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press.
E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited

**REFERENCE BOOKS:**

Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMHPublications.
Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

## EE4231OE: INSTRUMENTATION AND CONTROL

| B. Tech. IV Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| **Pre-requisite:** Basic Electrical Engineering, Analog Electronics, Mathematics | 3 | 0 | 0 | 3 |

**Course Objectives:**

To introduce the basic principles of all measuring instruments
To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
To understand the basic concepts of Control Engineering.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Understand different types of measuring instruments, their construction, operation andcharacteristics
Identify the instruments suitable for typical measurements
Apply the knowledge about transducers and instrument transformers to use them effectively.
Apply the knowledge of basic control engineering.

**UNIT–I**

**Characteristics of Signals**: Measuring Systems, Performance Characteristics - Static characteristics, Dynamic Characteristics; Errors in Measurement- Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

**UNIT–II**

**Oscilloscope**: Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes- applications of CRO- Measurement of phase and frequency - lissajous patterns - Sampling oscilloscope-analog and digital type.

**UNIT–III**

**Transducers**: Definition of transducers, Classification of transducers, Advantages of electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor, inductor, LVDT and capacitor transducers.

**UNIT–IV**

**Measurement of Non-Electrical Quantities**: Measurement of strain, Gauge sensitivity, Displacement, Force Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow

**UNIT–V**

**Introduction to Control System**: 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.

**TEXT BOOKS:**

G. K. Banerjee, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition,2016
S. C. Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.
B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995

**REFERENCE BOOKS:**

1. A. K. Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co.Publications, 2005.
R. K. Rajput, “Electrical & Electronic Measurement & Instrumentation”, S. Chand and CompanyLtd., 2007.
Buckingham and Price, “Electrical Measurements”, Prentice – Hall, 1988.

4. Reissland, M. U, “Electrical Measurements: Fundamentals, Concepts, Applications”, New AgeInternational (P) Limited Publishers, 1st Edition 2010.

## EE4232OE: Energy Storage Systems

| B. Tech. IV Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To enable the student to understand the need for energy storage, devices and technologies available and their applications.

**Course Outcomes:** Upon completion of the Course, the students will have the:

Analyze the characteristics of energy from various sources and need for storage.
Classify various types of energy storage and various devices used for the purpose.
Identify various real time applications.

**UNIT - I**

**Electrical Energy Storage Technologies**: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

**UNIT - II**

**Needs for Electrical Energy Storage**: Emerging needs for EES, More renewable energy, lessfossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles fromthe viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

**UNIT - III**

**Features of Energy Storage Systems**: Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

**UNIT - IV**

**Types of Electrical Energy Storage systems**: Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems , Standards for EES, Technical comparison of EES technologies.

**UNIT - V**

**Applications**: Present status of applications, Utility use (conventional power generation, grid operation service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA– aggregation of many dispersed batteries.

**TEXT BOOKS:**

"James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
The Electrical Energy Storage by IEC Market Strategy Board.

"Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

**OPEN ELECTIVES OFFERED BY**
**DEPARTMENT OF MECHANICAL ENGINEERING**

## ME3211OE: OPERATIONS RESEARCH

| B. Tech. III Year II Sem. | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Prerequisites**: None

**Course Objectives:** Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.
**Course Outcome:** Understanding the problem, identifying variables & constants, Formulation of optimization model and applying appropriate optimization technique

**UNIT I**

Development-definition-characteristics and phases-Types of models-Operations Research models- applications.

**Allocation:** Linear Programming Problem Formulation-Graphical solution- Simplex method-Artificial variable techniques: Two-phase method, Big-M method.

**UNIT. II**

**Transportation problem** – Formulation - Optimal solution, unbalanced transportation problem-Degeneracy.

**Assignment problem**- Formulation-Optimal solution, - Variants of Assignment problem-Travelling salesman problem.

**UNIT III**

**Sequencing.** Introduction-Flow-Shop sequencing- n jobs through two machines - n jobs through three machines- Job shop sequencing-two jobs through 'm' machines – graphical model **Replacement**: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

**UNIT IV**

**Theory of Games**: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle- m x 2 & 2 x n games- Graphical method.

**Inventory**: Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models - Demand may be discrete variable or continuous variable- single period model and no setup cost.

**UNIT. V**

**Waiting lines**: Introduction- Terminology- Single channel- Poisson arrivals and Exponential service times with infinite population and finite population models.

**Dynamic Programming:** Introduction- Terminology, Bellman's principle of optimality Applications of Dynamic programming- shortest path problem- linear programming problem.

**TEXT BOOK:**

Operations Research/ J. K. Sharma / MacMilan
Introduction to OR/ Hillier & Libemann /TMH

**REFERENCE BOOKS:**

Introduction to OR /Taha /PHI
Operations Research/NVS Raju/SMS Education/3rd Revised Edition
Operations Research /A. M. Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.

## ME3212OE: FUNDAMENTALS OF MECHANICAL ENGINEERING

**B.Tech. III Year II Sem.**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Prerequisites:** None

**Course Objectives**: Understanding of basic principles of Mechanical required in various field of engineering. Engineering is

**Course Outcomes:** After learning the course the students should be able to

To understand the fundamentals of mechanical systems.

To understand and appreciate significance of mechanical engineering in different Fields of engineering.

**UNIT - I**

**Introduction**: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law.

**Energy:** Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion.

**UNIT - II**

**Properties of gases:** Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process

**Properties of Steam:** Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters.

**Steam Boilers:** Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

**UNIT - III**

**Heat Engines:** Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles.

**Internal Combustion Engines:** Introduction, Classification, Engine details, four- stroke/two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies.

**UNIT - IV**

**Pumps:** Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming

**Air Compressors:** Types and operation of Reciprocating and Rotary air compressors, significance of Multistage.

**Refrigeration & Air Conditioning:** Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.

**UNIT - V**

**Couplings, Clutches and Brakes:** Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc).

**Transmission of Motion and Power:** Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive

**Engineering Materials:** Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

**TEXT BOOKS:**

Basic Mechanical Engineering / Pravin Kumar/ Pearson

Introduction to Engineering Materials / B.K. Agrawal/ Mc Graw Hill

**REFERENCE BOOKS:**

Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI

Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

## ME3213OE: METALLURGY OF NON METALLURGISTS

**B.Tech. III Year II Sem.** **L TPC 3003**

**Prerequisites:** None

**Course Objectives**:

To describe the basic principles of metallurgy and the importance of metallurgy in various discipline of engineering.

Gain a thorough knowledge about heat treatment of steels.

3. Gain knowledge about properties and uses of cast irons and non-ferrous metals.

Gain a working knowledge of basic testing methods for metals.

**Course Outcomes**: At the end of the course Student would be able 1. To use and apply metallurgy in his own branch of engineering.

The student will be able to justify the various testing methods adopted for metals.

**UNIT - I**

**Introduction**: Crystal structure and defects, Crystal structure of metals, Classification of steels, Carbon steels.

**Engineering Materials:** Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

**UNIT - II**

**Heat Treatment of Steels:** The Iron carbon systems, Common phases in steels, Annealing, Normalizing, Hardening and tempering.

**UNIT - III**

**Cast irons:** Properties and applications of Ductile irons, Malleable irons, Compacted graphite iron.

**UNIT - IV**

**Non Ferrous Metals:** Properties and applications of Light Metals (Al, Be, Mg, Ti), Super alloys.

**UNIT - V**

**Testing of Metals:** Hardness testing, Tensile Testing, Impact Testing, Fatigue Testing.

**TEXT BOOKS:**

Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL, 1997

Mechanical Metallurgy – G. E. Dieter

**REFERENCE BOOKS:**

Engineering Physical Metallurgy and Heat treatment – Y Lakhtin

C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, John Wiley, NJ, USA, 2006

Foundations of Materials Science and Engineering – WF Smith

**ME4121OE: FABRICATION PROCESSES**

| **B.Tech. IV Year I Sem.** | **L** | **T** | **P** | **C** |
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| | **3** | **0** | **0** | **3** |

**Prerequisites:** None

**Course Objectives**: To understand the philosophies of various Manufacturing process.
**Course Outcomes:** At the end of the course, for given product, one should be able identify the manufacturing process.

**UNIT - I**

**Casting:** Steps involved in making a casting – Advantage of casting and its applications; Patterns Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.

Methods of Melting - Crucible melting and cupola operation – Defects in castings;

Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

**UNIT - II**

**Welding:** Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermite welding.

Inert Gas Welding - TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

**UNIT - III**

Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth. Stamping, forming, and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning. Types of presses and press tools. Forces and power requirement in the above operations.

**UNIT - IV**

**Extrusion of Metals:** Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion.

**UNIT - V**

**Forging Processes:** Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

**TEXT BOOKS:**

Manufacturing Technology / P.N. Rao / Mc Graw Hill
Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

**REFERENCE BOOKS:**

Metal Casting / T. V Ramana Rao / New Age
Métal Fabrication Technology/ Mukherjee/PHI

**ME4122OE: TOTAL QUALITY MANAGMENT**

| **B.Tech. IV Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **0** | **0** | **3** |

**Prerequisites:** None

**Course Objectives**:
**Course Outcomes:**

**UNIT - I**

**Introduction**: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

**UNIT -II**

**Customer Focus and Satisfaction:** Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.
**Bench Marking:** Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

**UNIT- III**

**Organizing for TQM:** The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram, Kepner &Tregoe Methodology.

**UNIT- IV**

**The Cost of Quality:** Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

**UNIT -V**

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

**TEXT BOOK:**

Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
Total Quality Management/P. N. Mukherjee/PHI

**REFERENCE BOOKS:**

Beyond TQM / Robert L.Flood
Statistical Quality Control / E.L. Grant.
Total Quality Management:A Practical Approach/H. Lal
Quality Management/Kanishka Bedi/Oxford University Press/2011
Total Engineering Quality Management/Sunil Sharma/Macmillan

**ME4123OE: ENERGY MANAGEMENT AND CONSERVATION**
**B.Tech. IV Year I Sem.** **L T P C 3003**

**Prerequisites:** None
**Course Objectives**: To acquaint the student with the conventional energy sources and their utilization. To understand the importance of heat recovery and energy conservation methods and energy audit.
**Course Outcomes:** Students would have a good knowledge about conventional energy sources and their audit. Ability to apply the fundamentals of energy conservation and management.

**UNIT-I**

Introduction: Global & Indian Energy Scenario-Classification of Energy sources-Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns, Basics of Energy and its various forms.

**UNIT-II**

Energy Audit: Types of energy audit, Energy management (audit) approach understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

**UNIT-III**

Energy Action Planning, Financial Management: Financial analysis techniques- Risk and sensitivity analysis- Financing options, Energy performance contracts and role of ESCOs-Energy Monitoring and Targeting: Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM).

**UNIT-IV**

Building Envelope – principles of analysis – Envelope performance -Envelope analysis of Existing and new buildings – Building standards for new and Existing constructions. HVAC Systems types – Energy conservation opportunities – cooling equipment – Domestic hot water Estimating HVAC Energy consumption.

**UNIT-V**

Principles of Electric Energy Management, Energy Management control systems – Energy systems maintenance. Energy management in water and waste water treatment – solid waste treatment- air pollution control systems .Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration – Waste Heat recovery. Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act.

**TEXT BOOKS:**

Energy Management by Murfy

General Aspects of Energy Management and Audit, National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management)

**REFERENCE BOOKS:**

Energy Management Handbook, W.C. Turner, 5th Edition, Marcel Dekker, Inc, New York, 2005.

Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.

Energy Management by O.P. Collagan

**ME4231OE: RELIABILITY ENGINEERING**

| **B.Tech. IV Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **0** | **0** | **3** |

**Prerequisites:** Mathematics III

**Course Objectives**:

1. To introduce the basic concepts of reliability, various models of reliability
   To analyze reliability of various systems
   To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

**Course Outcomes:** After completion of this course, the student will be able to 1. model various systems applying reliability networks
   evaluate the reliability of simple and complex systems
3. estimate the limiting state probabilities of repairable systems
4. apply various mathematical models for evaluating reliability of irreparable systems

**UNIT - I**

**Basic Probability Theory:** Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

**Definition of Reliability:** Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

**UNIT – II**

**Network Modeling and Evaluation of Simple Systems:** Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems partially redundant systems- Examples.

**Network Modeling and Evaluation of Complex systems:** Conditional probability methodtie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples.

**UNIT – III**

**Time Dependent Probability:** Basic concepts- Reliability function f(t). F(t), R(t) and h(t) - Relationship between these functions.

**Network Reliability Evaluation Using Probability Distributions:** Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

**UNIT – IV**

**Discrete Markov Chains:** Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples.

**Continuous Markov Processes:** Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

**UNIT – V**

**Frequency and Duration Techniques:** Frequency and duration concepts, application to multi state problems, Frequency balance approach.

**Approximate System Reliability Evaluation:** Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

**TEXT BOOKS:**

Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.

E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

**REFERENCE BOOK:**

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993.

**ME4232OE: INDUSTRIAL MANAGEMENT**

| **B.Tech. IV Year I Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **0** | **0** | **3** |

**Prerequisites:** None

**Course objectives:**

Understand the philosophies of management gurus

Understand the various types of organization structures and their features, and their advantages and disadvantages.

Learning various Industrial Engineering Practices like Operations Management techniques, work study, statistical quality control techniques, Job evaluation techniques and network analysis techniques.

**Course outcomes:**

Able to apply principles of management

Able to design the organization structure

Able to apply techniques for plant location, design plant layout and value analysis

Able to carry out work study to find the best method for doing the work and establish standard time for a given method

Able to apply various quality control techniques and sampling plans

Able to do job evaluation and network analysis.

**UNIT. I**

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

**UNIT. II**

Designing Organizational Structures: Departmentalization and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

**UNIT. III**

Operations Management: Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

**UNIT. IV:**

Work Study: Introduction - definition - objectives - steps in work study - Method study - definition, objectives - steps of method study. Work Measurement - purpose - types of study -

stop watch methods - steps - key rating - allowances - standard time calculations - work sampling. Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R

chart, - Attributes- Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

**UNIT. V**

Job Evaluation: Methods of job evaluation - simple routing objective systems - classification method factor comparison method, point method, benefits of job evaluation and limitations. Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

**TEXT BOOKS:**

Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.

Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers.

**REFERENCE BOOKS:**

Motion and Time Study by Ralph M Barnes! John Willey & Sons Work Study by lLO.

Human factors in Engineering & Design/Ernest J McCormick / TMH.

Production & Operation Management / Paneer Selvam/ PHI.

Industrial Engineering Management / NVS Raju/ Cengage Learning.

Industrial Engineering Hand Book / Maynard.

Industrial Engineering Management I Ravi Shankar/Galgotia.

## ME4233OE: RENEWABLE ENERGY SOURCES

| B.Tech. IV Year II Sem. | L | T | P | C |
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**Prerequisites:** None

**Course Objectives:**

To explain the concepts of Non-renewable and renewable energy systems

To outline utilization of renewable energy sources for both domestic and industrial applications

To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

**Course Outcomes:**

Understanding of renewable energy sources

Knowledge of working principle of various energy systems

Capability to carry out basic design of renewable energy systems

**UNIT I**

**Global and National Energy Scenario:** Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

**UNIT II**

**Solar Energy:** Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

**UNIT III**

**Wind Energy:** Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy - Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Safety and environmental aspects, wind energy potential and installation in India.

**UNIT IV**

**Biogas:** Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

**UNIT V**

**Ocean Energy:** Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion

(OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

**Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

**Geothermal Energy:** Geothermal power plants, types of Geothermal resources, hot springs and steam ejection.

**TEXT BOOKS:**

Renewable Energy Sources / Twidell, J.W. and Weir, A. / EFN Spon Ltd., 1986.

Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers

**REFERENCE BOOKS:**

Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012

Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

Non-Conventional Energy Resources by E H Khan

**List of proposed Open Electives to be offered by Electronics and Communication Engineering**

**Open electives-1**

| | |
|---|---|
| EC3211OE | Fundamentals of Internet of Things |

**Open electives-2**

| | |
|---|---|
| EC4121OE | Principles of Computer Communications and Networks |

**Open electives-3**

| | |
|---|---|
| EC4231OE | Electronic Measuring Instruments |

## EC3211OE: FUNDAMENTALS OF INTERNET OF THINGS

| B. Tech. III Year II Sem. | L | T | P | C |
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**Course Objectives:** The objectives of the course are to:

Understand the concepts of Internet of Things and able to build IoT applications
Learn the programming and use of Arduino and Raspberry Pi boards.
Known about data handling and analytics in SDN.

**Course Outcomes:** Upon completing this course, the student will be able to

Known basic protocols in sensor networks.
Program and configure Arduino boards for various designs.
Python programming and interfacing for Raspberry Pi.
Design IoT applications in different domains.

**UNIT – I**

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

**UNIT - II**

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino,

**UNIT – III**

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

**UNIT - IV**

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics,

**UNIT - V**

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

**TEXT BOOKS:**

"The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
“Make sensors”: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.
"Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

**REFERENCE BOOKS:**

Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

## EC4121OE: PRINCIPLES OF COMPUTER COMMUNICATIONS AND NETWORKS

| B. Tech. IV Year I Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives:**

To understand the concept of computer communication.
To learn about the networking concept, layered protocols.
To understand various communications concepts.
To get the knowledge of various networking equipment.

**Course Outcomes:**

The student can get the knowledge of networking of computers, data transmission between computers.
Will have the exposure about the various communication concepts.
Will get awareness about the structure and equipment of computer network structures.

**UNIT - I**

**Overview of Computer Communications and Networking:** Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

**UNIT - II**

**Essential Terms and Concepts:** Computer Applications and application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes, analog and Digital Communications , Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model.

**UNIT - III**

**Analog and Digital Communication Concepts:** Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction, Digital Carrier Systems.

**UNIT - IV**

**Physical and data link layer Concepts:** The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer , the logical link control and medium access control sub-layers.

**UNIT - V**

**Network Hardware Components:** Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

**TEXT BOOKS**:

1. Computer Communications and Networking Technologies, Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.
   Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition MC GRAW HILL EDUCATION, 2006.

**REFERENCE BOOK**S:

Principles of Computer Networks and Communications, M. Barry Dumas, Morris Schwartz, Pearson.
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

## EC4231OE: ELECTRONIC MEASURING INSTRUMENTS

| B. Tech. IV Year II Sem. | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Note: No detailed mathematical treatment is required.**

**Course Objectives:**

It provides an understanding of various measuring systems functioning and metrics for performance analysis.

Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.

Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

**Course Outcomes:** On completion of this course student can be able to

Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.

Measure various physical parameters by appropriately selecting the transducers.

Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

**UNIT - I**

**Block Schematics of Measuring Systems and Performance Metrics:** Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

**UNIT - II**

**Signal Generators:** AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

**UNIT - III**

**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. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

**UNIT - IV**

**Recorders:** X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving mechanisms, Magnetic Recording, Magnetic recording techniques.

**UNIT - V**

**Transducers:** Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

**TEXT BOOKS:**

Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.

Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

**REFERENCES:**

Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.

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