**With effect from 02/08/2016**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B.TECH. COURSE STRUCTURE (2016-17)**

(Common for Civil, ME, AE, ME (M), MME, AU, Mining, Petroleum, CEE, ME (Nanotech))

## I YEAR I SEMESTER

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | MA101BS | Mathematics-I | 3 | 1 | 0 | 3 |
| 2 | MA102BS | Mathematics-II | 4 | 1 | 0 | 4 |
| 3 | PH103BS | Engineering Physics | 3 | 0 | 0 | 3 |
| 4 | CS104ES | Computer Programming in C | 3 | 0 | 0 | 3 |
| 5 | ME105ES | Engineering Mechanics | 3 | 0 | 0 | 3 |
| 6 | ME106ES | Engineering Graphics | 2 | 0 | 4 | 4 |
| 7 | PH107BS | Engineering Physics Lab | 0 | 0 | 3 | 2 |
| 8 | CS108ES | Computer Programming in C Lab | 0 | 0 | 3 | 2 |
| 9 | *EA109MC | NSS | 0 | 0 | 0 | 0 |
| | | **Total Credits** | **18** | **2** | **10** | **24** |

## I YEAR II SEMESTER

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | AP201BS | Applied Physics | 3 | 0 | 0 | 3 |
| 2 | CH202BS | Engineering Chemistry | 4 | 0 | 0 | 4 |
| 3 | MA203BS | Mathematics-III | 4 | 1 | 0 | 4 |
| 4 | EN204HS | Professional Communication in English | 3 | 0 | 0 | 3 |
| 5 | EE205ES | Basic Electrical & Electronics Engineering | 4 | 0 | 0 | 4 |
| 6 | CH206BS | Engineering Chemistry Lab | 0 | 0 | 3 | 2 |
| 7 | EN207HS | English Language Communication Skills Lab | 0 | 0 | 3 | 2 |
| 8 | ME208ES | Engineering Workshop | 0 | 0 | 3 | 2 |
| 9 | *EA209MC | NCC/NSO | 0 | 0 | 0 | 0 |
| | | **Total Credits** | **18** | **1** | **9** | **24** |

*Mandatory Course

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B.TECH. CIVIL ENGINEERING**

**COURSE STRUCTURE & SYLLABUS (2016-17)**

**II YEAR I SEMESTER**

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | MA301BS | Mathematics - IV | 4 | 1 | 0 | 4 |
| 2 | CE302ES | Strength of Materials - I | 4 | 1 | 0 | 4 |
| 3 | CE303ES | Fluid Mechanics - I | 4 | 1 | 0 | 4 |
| 4 | CE304ES | Building Material, Construction and Planning | 3 | 0 | 0 | 3 |
| 5 | CE305ES | Surveying | 3 | 0 | 0 | 3 |
| 6 | CE306ES | Strength of Material Lab | 0 | 0 | 3 | 2 |
| 7 | CE307ES | Computer Aided Design – I Lab | 0 | 0 | 3 | 2 |
| 8 | CE308ES | Surveying lab - I | 0 | 0 | 3 | 2 |
| 9 | *MC300HS | Gender Sensitization Lab | 0 | 0 | 3 | 0 |
| | | **Total Credits** | **18** | **3** | **12** | **24** |

**II YEAR II SEMESTER**

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | CE401ES | Strength of Material - II | 4 | 1 | 0 | 4 |
| 2 | CE402ES | Fluid Mechanics - II | 4 | 1 | 0 | 4 |
| 3 | CE403ES | Structural Analysis | 4 | 1 | 0 | 4 |
| 4 | CV404ES | Engineering Geology | 3 | 0 | 0 | 3 |
| 5 | SM405MS | Business Economic and Financial Analysis | 3 | 0 | 0 | 3 |
| 6 | CE406ES | Fluid Mechanics Lab | 0 | 0 | 3 | 2 |
| 7 | CE408ES | Surveying - II Lab | 0 | 0 | 3 | 2 |
| 8 | CV407ES | Engineering Geology Lab | 0 | 0 | 3 | 2 |
| 9 | *MC400ES | Environmental Science and Technology | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **21** | **3** | **9** | **24** |

***Satisfactory/ Unsatisfactory**

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## B.TECH. CIVIL ENGINEERING
## III YEAR COURSE STRUCTURE & SYLLABUS (R16)

**Admitted From 2016-17 Admitted Batch**

### III YEAR I SEMESTER

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | CE501PC | Concrete Technology | 4 | 0 | 0 | 4 |
| 2 | CE502PC | Design of Reinforced Concrete Structures | 4 | 1 | 0 | 4 |
| 3 | CE503PC | Water Resources Engineering | 4 | 0 | 0 | 4 |
| 4 | SM504MS | Fundamentals of Management | 3 | 0 | 0 | 3 |
| 5 | | Open Elective –I | 3 | 0 | 0 | 3 |
| 6 | CE505PC | Concrete Technology Lab | 0 | 0 | 3 | 2 |
| 7 | CE506PC | Geographical Information Systems Lab | 0 | 0 | 3 | 2 |
| 8 | CE507PC | Hydraulics and Hydraulic Machinery Lab | 0 | 0 | 3 | 2 |
| 9 | *MC500HS | Professional Ethics | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **21** | **1** | **9** | **24** |

### III YEAR II SEMESTER

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | CE601PC | Design of Steel Structures | 4 | 1 | 0 | 4 |
| 2 | CE602PC | Environmental Engineering | 4 | 0 | 0 | 4 |
| 3 | CE603PC | Soil Mechanics | 4 | 0 | 0 | 4 |
| 4 | | Open Elective-II | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective-I | 3 | 0 | 0 | 3 |
| 6 | CE604PC | Soil Mechanics Lab | 0 | 0 | 3 | 2 |
| 7 | CE605PC | Computer Aided Drafting - II Lab | 0 | 0 | 3 | 2 |
| 8 | EN606HS | Advanced English Communication Skills Lab | 0 | 0 | 3 | 2 |
| | | **Total Credits** | **18** | **1** | **9** | **24** |

***During Sumer Vacation between III and IV Years: Industry Oriented Mini Project**

**Professional Elective - I**

| | |
|---|---|
| CE611PE | Air Pollution and Control. |
| CE612PE | Advanced Structural Analysis. |
| CE613PE | Ground Water Development and Management. |
| CE614PE | Earth and Rock fill Dams and Slope Stability. |

***Open Elective** subjects' syllabus is provided in a separate document.

***Open Elective –** Students should take Open Electives from The List of Open Electives Offered by Other Departments/Branches Only.

**Ex: -** A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING**
**IV YEAR COURSE STRUCTURE & SYLLABUS (R16)**

**Applicable From 2016-17 Admitted Batch**

**IV YEAR I SEMESTER**

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | CE701PC | Transportation Engineering | 4 | 0 | 0 | 4 |
| 2 | CN702PC | Soil Mechanics | 4 | 0 | 0 | 4 |
| 3 | | Professional Elective - II | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective - III | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective - IV | 3 | 0 | 0 | 3 |
| 6 | CE703PC | Transportation Engineering Lab | 0 | 0 | 3 | 2 |
| 7 | CN704PC | Geotechnical Engineering Lab | 0 | 0 | 3 | 2 |
| 8 | CN705PC | Industry Oriented Mini Project | 0 | 0 | 3 | 2 |
| 9 | CN706PC | Seminar | 0 | 0 | 2 | 1 |
| | | **Total Credits** | **17** | **0** | **11** | **24** |

**IV YEAR II SEMESTER**

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Open Elective - III | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective - V | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective - VI | 3 | 0 | 0 | 3 |
| 4 | CN801PC | Major Project | 0 | 0 | 30 | 15 |
| | | **Total Credits** | **9** | **0** | **30** | **24** |

**Professional Elective - I**

| | |
|---|---|
| CE611PE | Air Pollution and Control |
| CN612PE | Watershed Management |
| CN613PE | Environmental Sanitation |
| CN614PE | Environmental Chemistry |

**Professional Elective - II**

| | |
|---|---|
| CN721PE | Prestressed Concrete |
| CN722PE | Irrigation and Hydraulic Structures |
| CN723PE | Advanced Structural Analysis |
| CN724PE | Construction Management |

**Professional Elective - III**

| | |
|---|---|
| CN731PE | Solid Waste Management |
| CN732PE | Ground Water development and Management |
| CN733PE | Industrial Waste water Treatment |

| | |
|---|---|
| CN734PE | Ecology and Microbiology |

**Professional Elective - IV**

| | |
|---|---|
| CN741PE | Construction Technology and Management |
| CE742PE | Bridge Engineering |
| CN743PE | Water Quality Management |
| CN744PE | Ground Water Hydrology |

**Professional Elective - V**

| | |
|---|---|
| CN851PE | Estimation and Costing |
| CN852PE | Finite Element Methods for Civil Engineering |
| CN853PE | Geoenvironmental Engineering |
| CN854PE | Foundation Engineering |

**Professional Elective - VI**

| | |
|---|---|
| CN861PE | Stochastic Hydrology |
| CN862PE | Traffic Engineering |
| CN863PE | Ground Improvement Techniques |
| CN864PE | Elements of Earthquake Engineering |

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## LIST OF OPEN ELECTIVES OFFERED BY VARIOUS DEPARTMENTS FOR B.TECH. III AND IV YEARS

| S. No. | Name of the Department Offering Open Electives | Open Elective – I (Semester – V) | Open Elective – II (Semester – VI) |
|---|---|---|---|
| 1 | Aeronautical Engg. | AE511OE: Introduction to Space Technology | AE621OE: Introduction to Aerospace Engineering |
| 2 | Automobile Engg. | CE511OE: Disaster Management<br>MT512OE: Intellectual Property Rights | MT621OE: Data Structures<br>MT622OE: Artificial Neural Networks |
| 3 | Biomedical Engg. | BM511OE: Reliability Engineering | BM621OE: Medical Electronics |
| 4 | Civil Engg. | CE511OE: Disaster Management. | CE621OE: Remote Sensing and GIS<br>CE622OE: Geo-Informatics<br>CE623OE: Intellectual Property Rights |
| 5 | Civil and Environmental Engg. | CE511OE: Disaster Management | CN621OE: Environmental Impact Assessment<br>CE623OE: Intellectual Property Rights |
| 6 | Computer Science and Engg. / Information Technology | CS511OE: Operating Systems<br>CS512OE: Database Management Systems | CS621OE: Java Programming<br>CS622OE: Software Testing Methodologies<br>CS623OE: Cyber Security |
| 7 | Electronics and Communication Engg. / Electronics and Telematics Engg. | EC511OE: Principles of Electronic Communications | EC621OE: Principles of Computer Communications and Networks |
| 8 | Electronics and Computer Engg. | EM511OE: Scripting Languages | EM621OE: Soft Computing Techniques |
| 9 | Electrical and Electronics Engg. | EE511OE: Non-Conventional Power Generation<br>EE512OE: Electrical Engineering Materials<br>EE513OE: Nanotechnology | EE621OE: Design Estimation and Costing of Electrical Systems<br>EE622OE: Energy Storage Systems<br>EE623OE: Introduction to Mechatronics |
| 10 | Electronics and Instrumentation Engg. | EI511OE: Electronic Measurements and Instrumentation | EI621OE: Industrial Electronics |
| 11 | Mechanical Engg. | ME511OE: Optimization Techniques<br>ME512OE: Computer Graphics<br>ME513OE: Introduction to | ME621OE: World Class Manufacturing<br>ME622OE: Fundamentals of Robotics<br>ME623OE: Fabrication |

| | | | |
|---|---|---|---|
| | | Mechatronics<br>ME514OE: Fundamentals of Mechanical Engineering | Processes |
| 12 | Mechanical Engg. (Material Science and Nanotechnology) | NT511OE: Fabrication Processes<br>NT512OE: Non destructive Testing Methods<br>NT513OE: Fundamentals of Engineering Materials | NT621OE: Introduction to Material Handling<br>NT622OE: Non-Conventional Energy Sources<br>NT623OE: Robotics |
| 13 | Mechanical Engg. (mechatronics) | MT511OE: Analog and Digital I.C. Applications<br>MT512OE: Intellectual Property Rights<br>MT513OE: Computer Organization | MT621OE: Data Structures<br>MT622OE: Artificial Neural Networks<br>MT623OE: Industrial Management |
| 14 | Metallurgical and Materials Engg. | MM511OE: Materials Characterization Techniques | MM621OE: Science and Technology of Nano Materials<br>MM622OE: Metallurgy of Non Metallurgists |
| 15 | Mining Engg. | MN511OE: Introduction to Mining Technology | MN621OE: Coal Gasification, Coal Bed Methane and Shale Gas |
| 16 | Petroleum Engg. | PE511OE: Materials Science and Engineering<br>PE512OE: Renewable Energy Sources<br>PE513OE: Environmental Engineering | PE621OE: Energy Management and Conservation<br>PE622OE: Optimization Techniques<br>PE623OE: Entrepreneurship and Small Business Enterprises |

| **S. No.** | **Name of the Department Offering Open Electives** | **Open Elective –III (Semester – VIII)** |
|---|---|---|
| 1 | Aeronautical Engg. | AE831OE: Air Transportation Systems<br>AE832OE: Rockets and Missiles |
| 2 | Automobile Engg. | AM831OE: Introduction to Mechatronics<br>AM832OE: Microprocessors and Microcontrollers |
| 3 | Biomedical Engg. | BM831OE: Telemetry and Telecontrol<br>BM832OE: Electromagnetic Interference and Compatibility |
| 4 | Civil Engg. | CE831OE: Environmental Impact Assessment<br>CE832OE: Optimization Techniques in Engineering<br>CE833OE: Entrepreneurship and Small Business Enterprises |
| 5 | Civil and Environmental Engg. | CN831OE: Remote Sensing and GIS<br>CE833OE: Entrepreneurship and Small Business |

| | | |
|---|---|---|
| | | Enterprises |
| 6 | Computer Science and Engg. / Information Technology | CS831OE: Linux Programming<br>CS832OE: R Programming<br>CS833OE: PHP Programming |
| 7 | Electronics and Communication Engg. / Electronics and Telematics Engg. | EC831OE: Electronic Measuring Instruments |
| 8 | Electronics and Computer Engg. | EM831OE: Data Analytics |
| 9 | Electrical and Electronics Engg. | EE831OE: Entrepreneur Resource Planning<br>EE832OE: Management Information Systems<br>EE833OE: Organizational Behaviour |
| 10 | Electronics and Instrumentation Engg. | EI831OE: Sensors and Transducers,<br>EI832OE: PC Based Instrumentation |
| 11 | Mechanical Engg. | ME831OE: Total Quality Management<br>ME832OE: Industrial Safety, Health, and Environmental Engineering<br>ME833OE: Basics of Thermodynamics<br>ME834OE: Reliability Engineering |
| 12 | Mechanical Engg. (Material Science and Nanotechnology) | NT831OE: Concepts of Nano Science And Technology<br>NT832OE: Synthesis of Nanomaterials<br>NT833OE: Characterization of Nanomaterials |
| 13 | Mechanical Engg. (mechatronics) | MT831OE: Renewable Energy Sources<br>MT832OE: Production Planning and Control<br>CE833OE: Entrepreneurship and Small Business Enterprises |
| 14 | Metallurgical and Materials Engg. | MM831OE: Design and Selection of Engineering Materials |
| 15 | Mining Engg. | MN831OE: Solid Fuel Technology<br>MN832OE: Health & Safety in Mines |
| 16 | Petroleum Engg. | PE831OE: Disaster Management<br>PE832OE: Fundamentals of Liquefied Natural Gas<br>PE833OE: Health, Safety and Environment in Petroleum Industry |

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**MATHEMATICS- I**
**(Linear Algebra and Differential Equations)**

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **MA101BS** | **3** | **1/0/0** | **3** |

**Prerequisites:** Foundation course (No prerequisites)**.**

**Course Objectives:**

To learn

- types of matrices and their properties
- the concept of rank of a matrix and applying the same to understand the consistency
- solving the linear systems
- the concepts of eigen values and eigen vectors and reducing the quadratic forms into their canonical forms
- partial differentiation, concept of total derivative
- finding maxima and minima of functions of two variables
- methods of solving the linear differential equations of first and higher order
- the applications of the differential equations
- formation of the partial differential equations and solving the first order equations.

**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 analyze the solution of the system of equations
- find the Eigen values and Eigen vectors which come across under linear transformations
- find the extreme values of functions of two variables with/ without constraints.
- identify whether the given first order DE is exact or not
- solve higher order DE's and apply them for solving some real world problems

**UNIT–I**

**Initial Value Problems and Applications**

Exact differential equations - Reducible to exact.

Linear differential equations of higher order with constant coefficients: Non homogeneous terms with RHS term of the type $e^{ax}$, sin ax, cos ax, polynomials in x, $e^{ax}$V(x), xV(x)- Operator form of the differential equation, finding particular integral using inverse operator, Wronskian of functions, method of variation of parameters.

Applications: Newton's law of cooling, law of natural growth and decay, orthogonal trajectories, Electrical circuits.

**UNIT–II**

**Linear Systems of Equations**

Types of real matrices and complex matrices, rank, echelon form, normal form, consistency and solution of linear systems (homogeneous and Non-homogeneous) - Gauss elimination, Gauss Jordon and LU decomposition methods- Applications: Finding current in the electrical circuits.

**UNIT–III**

**Eigen values, Eigen Vectors and Quadratic Forms**

Eigen values, Eigen vectors and their properties, Cayley - Hamilton theorem (without proof), Inverse and powers of a matrix using Cayley - Hamilton theorem, Diagonalization, Quadratic forms, Reduction of Quadratic forms into their canonical form, rank and nature of the Quadratic forms – Index and signature.

**UNIT–IV**

**Partial Differentiation**

Introduction of partial differentiation, homogeneous function, Euler's theorem, total derivative, Chain rule, Taylor's and Mclaurin's series expansion of functions of two variables, functional dependence, Jacobian.

Applications: maxima and minima of functions of two variables without constraints and Lagrange's method (with constraints)

**UNIT-V**

**First Order Partial Differential Equations**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, Lagranges method to solve the first order linear equations and the standard type methods to solve the non linear equations.

**Text Books:**


1. A first course in differential equations with modeling applications by Dennis G. Zill, Cengage Learning publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.


**References:**


1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons Publisher.
2. Engineering Mathematics by N. P. Bali, Lakshmi Publications.

**MATHEMATICS- II**
**(Advanced Calculus)**

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **MA102BS/MA202BS** | **4** | **1/0/0** | **4** |

**Prerequisites:** Foundation course (No prerequisites)**.**

**Course Objectives:**

To learn

- concepts & properties of Laplace Transforms
- solving differential equations using Laplace transform techniques
- evaluation of integrals using Beta and Gamma Functions
- evaluation of multiple integrals and applying them to compute the volume and areas of regions
- the physical quantities involved in engineering field related to the 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 course the student must be able to

- use Laplace transform techniques for solving DE's
- evaluate integrals using Beta and Gamma functions
- evaluate the multiple integrals and can apply these concepts to find areas, volumes, moment of inertia etc of regions on a plane or in space
- evaluate the line, surface and volume integrals and converting them from one to another

**UNIT–I**

**Laplace Transforms:** Laplace transforms of standard functions, Shifting theorems, derivatives and integrals, properties- Unit step function, Dirac's delta function, Periodic function, Inverse Laplace transforms, Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

**UNIT-II**

**Beta and Gamma Functions:** Beta and Gamma functions, properties, relation between Beta and Gamma functions, evaluation of integrals using Beta and Gamma functions.

Applications: Evaluation of integrals.

**UNIT–III**

**Multiple Integrals:** Double and triple integrals, Change of variables, Change of order of integration.

Applications: Finding areas, volumes& Center of gravity (evaluation using Beta and Gamma functions).

**UNIT–IV**

**Vector Differentiation:** Scalar and vector point functions, Gradient, Divergence, Curl and their physical and geometrical interpretation, Laplacian operator, Vector identities.

**UNIT–V**

**Vector Integration:** Line Integral, Work done, Potential function, area, surface and volume integrals, Vector integral theorems: Greens, Stokes and Gauss divergence theorems (without proof) and related problems.

**Text Books:**

1. Advanced Engineering Mathematics by R K Jain & S R K Iyengar, Narosa Publishers
2. Engineering Mathematics by Srimanthapal and Subodh C. Bhunia, Oxford Publishers

**References:**

1. Advanced Engineering Mathematics by Peter V. O. Neil, Cengage Learning Publishers.
2. Advanced Engineering Mathematics by Lawrence Turyn, CRC Press

## ENGINEERING PHYSICS/ENGINEERING PHYSICS - I

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **PH103BS** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To understand interaction of light with matter through interference, diffraction and polarization.
- To able to distinguish ordinary light with a laser light and to realize propagation of light through optical fibers.
- To understand various crystal systems and there structures elaborately.
- To study various crystal imperfections and probing methods like X-RD.

**Course outcomes:** after completion of this course the student is able to

- Realize the importance of light phenomena in thin films and resolution.
- Learn principle, working of various laser systems and light propagation through optical fibers.
- Distinguish various crystal systems and understand atomic packing factor.
- Know the various defects in crystals.

**UNIT-I**

**Interference:** Coherence, division of amplitude and division of wave front, interference in thin films (transmitted and reflected light), Newton's rings experiment.

**Diffraction:** Distinction between Fresnel and Fraunhoffer diffraction, diffraction due to single slit, N-slits, Diffraction grating experiment.

**UNIT-II**

**Polarization:** Introduction, Malus's law, double refraction, Nicol prism, Quarter wave and half wave plates.

**Lasers:** Characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein coefficients, population inversion, ruby laser, helium – neon laser, semi conductor laser, applications of lasers

**UNIT-III**

**Fiber Optics:** Principle of optical fiber, construction of fiber, acceptance angle and acceptance cone, numerical aperture, types of optical fibers: step index and graded index fibers, attenuation in optical fibers, applications of optical fibers in medicine and sensors**.**

**UNIT-IV**

**Crystallography:** Space lattice, unit cell and lattice parameters, crystal systems, Bravais lattices, atomic radius, co-ordination number and packing factor of SC, BCC, FCC, HCP and diamond, Miller indices, crystal planes and directions, inter planar spacing of orthogonal crystal systems.

**UNIT**-V

**X-ray Diffraction and Defects in Crystals:** Bragg's law, X-ray diffraction methods: Laue method, powder method; point defects: vacancies, substitutional, interstitial, Frenkel and

Schottky defects, line defects (qualitative) and Burger's vector, surface defects: stacking faults, twin, tilt and grain boundaries.

**Text Books:**


1. Physics Vol. 2, Halliday, Resnick and Kramer John wiley and Sons, Edition 4.
2. Modern Engineering Physics, K. Vijaya Kumar and S. Chandra Lingam, S. Chand and Co. Pvt. Ltd.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Student edition.


**Reference Books:**


1. X-Ray Crystallography, Phillips, John Wiley publishers.
2. Waves, Frank S Crawford Jr, Berkeley Physics course, Volume 3.
3. Solid State Physics, AJ Dekker, MacMilan Publishers.
4. Introduction to Crystallography, Phillips, John Wiley publishers.

# COMPUTER PROGRAMMING IN C

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **CS104ES/CS204ES** | **3** | **0/0/0** | **3** |

**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 how to write modular and readable C Programs.
- To learn to write programs using structured programming approach in C to solve problems.

**Course Outcomes:**

- Demonstrate the basic knowledge of computer hardware and software.
- Ability to write algorithms for solving problems.
- Ability to draw flowcharts for solving problems.
- Ability to code a given logic in C programming language.
- Gain knowledge in using C language for solving problems.

## UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Program Development, algorithms and flowcharts , Number systems-Binary, Decimal, Hexadecimal and Conversions, storing integers and real numbers.

Introduction to C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Operators(Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements- Selection Statements(making decisions) – if and switch statements, Repetition statements ( loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Program examples.

## UNIT - II

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Limitations of recursion, example C programs.

Arrays – Concepts, using arrays in C, inter function communication, array applications- linear search, binary search and bubble sort, two – dimensional arrays, multidimensional arrays, C program examples.

## UNIT - III

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications-Arrays and Pointers, Pointer Arithmetic and arrays, Passing an array to a function, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

**UNIT - IV**

Enumerated, Structure ,and Union Types– The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures-Nested structures, structures containing arrays, structures containing pointers, arrays of structures, structures and functions, Passing structures through pointers, self referential structures, unions, bit fields, C programming examples, command–line arguments, Preprocessor commands.

**UNIT – V**

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling), Positioning functions (fseek ,rewind and ftell), C program examples.

**Text books:**


1) Computer Science: A Structured Programming Approach Using C, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2) Programming in C. P. Dey and M Ghosh , Second Edition, Oxford University Press.


**Reference books:**


1) The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, Second Edition, Pearson education.
2) Programming with C, B. Gottfried, 3rd edition, Schaum's outlines, McGraw Hill Education (India) Pvt Ltd.
3) C From Theory to Practice, G S. Tselikis and N D. Tselikas, CRC Press.
4) Basic computation and Programming with C, Subrata Saha and S. Mukherjee, Cambridge University Press.

## ENGINEERING MECHANICS

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **ME105ES** | **3** | **0/0/0** | **3** |

**Pre Requisites:** None

**Course Objectives:**

- To understand the resolving forces and moments for a given force system
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

**UNIT-I**

**Introduction to Mechanics**: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

**UNIT-II**

**Friction**: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions -Motion of Bodies –Wedge Screw, Screw-jack and differential screw –jack.

**UNIT-III**

**Centroid and Center of Gravity**: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

**Area moments of Inertia**: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration. Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

**UNIT-IV**

**Mass Moment of Inertia:** Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

**Virtual Work:** Theory of virtual work-Application.

**UNIT-V**

**Kinetics:** Kinetics of a particle-D'Alemberts principle-Motion in a curved path – work, energy and power. Principle of conservation of energy- Kinetics of rigid body in translation, rotation-work done-Principle of work-energy-Impulse-momentum.

**Mechanical Vibrations**: Definitions, Concepts-Simple Harmonic motion- free vibrations-Simple and compound pendulums

**Text Books:**


1. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy, J. Suresh Kumar/ BSP
2. Engineering Mechanics/ Irving Shames, G. Krishna Mohan Rao / Prentice Hall

3. Foundations and applications of Engineering Mechanics by HD Ram and AK Chouhan, Cambridge publications.

**References:**


1. A Text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain / Academic Publishing Company
2. Engineering Mechanics / Bhattacharyya/ Oxford.

# ENGINEERING GRAPHICS

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **ME106ES/ME205ES** | **2** | **0/0/4** | **4** |

**Pre-requisites:** None

**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:**

- 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 Involute. Scales – Plain, Diagonal and Vernier Scales.

**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.

**UNIT – IV**

Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

**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 Auto CAD: Basic principles only.

**Text books:**

- Engineering Drawing / Basant Agrawal and Mc Agrawal/ Mc Graw Hill
- Engineering Drawing/ M.B. Shah, B.C. Rane / Pearson.

**Reference books**:

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

## ENGINEERING PHYSICS LAB

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **PH107BS/PH207BS** | **0** | **0/3/0** | **2** |

**(Any TEN experiments compulsory)**

1) Dispersive power of the material of a prism – Spectrometer.
2) Determination of wavelengths of white source – Diffraction grating.
3) Newton's Rings – Radius of curvature of Plano convex lens.
4) Melde's experiment – Transverse and longitudinal modes.
5) Charging, discharging and time constant of an R-C circuit.
6) L-C-R circuit – Resonance & Q-factor.
7) Magnetic field along the axis of current carrying coil – Stewart and Gees method and to verify Biot – Savart's law.
8) Study the characteristics of LED and LASER diode.
9) Bending losses of fibres & Evaluation of numerical aperture of a given fibre.
10) Energy gap of a material of p-n junction.
11) Torsional pendulum – Rigidity modulus.
12) Wavelength of light, resolving power and dispersive power of a diffraction grating using laser.
13) V-I characteristics of a solar cell.

# COMPUTER PROGRAMMING IN C LAB

| **B.Tech. I Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| Course Code: **CS108ES/CS208ES** | **0** | **0/3/0** | **2** |

**Course Objective:**

- To write programs in C using structured programming approach to solve the problems.

**Course Outcomes**

- **1.** Ability to design and test programs to solve mathematical and scientific problems.
- **2.** Ability to write structured programs using control structures and functions.

**Recommended Systems/Software Requirements:**

- Intel based desktop PC
- GNU C Compiler

**1. a)** Write a C program to find the factorial of a positive integer.
**b)** Write a C program to find the roots of a quadratic equation.

**2. a)** Write a C program to determine if the given number is a prime number or not.
**b)** 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.

**3. a)** Write a C program to construct a pyramid of numbers.
**b)** Write a C program to calculate the following Sum:
Sum=$1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

**4. a)** The least common multiple (lcm) of two positive integers a and b is the smallest integer that is evenly divisible by both a and b. Write a C program that reads two integers and calls lcm (a, b) function that takes two integer arguments and returns their lcm. The lcm (a, b) function should calculate the least common multiple by calling the gcd (a, b) function and using the following relation:

LCM (a,b) = ab / gcd (a,b)

**b)** Write a C program that reads two integers n and r to compute the ncr value using the following relation:
ncr (n,r) = n! / r! (n-r)! . Use a function for computing the factorial value of an integer.

**5. a)** Write C program that reads two integers x and n and calls a recursive function to compute $x^n$
**b)** Write a C program that uses a recursive function to solve the Towers of Hanoi problem.
**c)** Write a C program that reads two integers and calls a recursive function to compute ncr value.

**6. a)** Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user using Sieve of Eratosthenes algorithm.
**b)** Write a C program that uses non recursive function to search for a Key value in a given list of integers. Use linear search method.

**7. a)** 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.
**b)** Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers. Use binary search method.

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

**b)** Write a C program that reads two matrices and uses functions to perform the following:

i) Addition of two matrices

ii) Multiplication of two matrices

**9. a)** Write a C program that uses functions to perform the following operations:

i) to insert a sub-string into a given main string from a given position.

ii) to delete n characters from a given position in a given string.

**b)** Write a C program that uses a non recursive function to determine if the given string is a palindrome or not.

**10. a)** Write a C program to replace a substring with another in a given line of text.

**b)** Write a C program that reads 15 names each of up to 30 characters, stores them in an array, and uses an array of pointers to display them in ascending (ie. alphabetical) order.

**11. a)** 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

**b)** Write a C program to convert a positive integer to a roman numeral. Ex. 11 is converted to XI.

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

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

**13. a)** Writ**e a C** program to count the number of times a character occurs in a text file. The file name and the character are supplied as command-line arguments.

**b)** Write a C program to compare two files, printing the first line where they differ.

**14. a)** Write a C program to change the nth character (byte) in a text file. Use fseek function.

**b)** Write a C program to reverse the first n characters in a file. The file name and n are specified on the command line. Use fseek function.

**15. a)** 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).

**b)** Define a macro that finds the maximum of two numbers. Write a C program that uses the macro and prints the maximum of two numbers.

**Reference Books:**


1. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.
2. Computer Programming in C, V. Rajaraman, PHI.
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. C++: The complete reference, H. Schildt, TMH Publishers.

## AP201BS: APPLIED PHYSICS

| **B.Tech. I Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To understand the elastic behavior of materials.
- To understand basic principles of acoustics and architecture of buildings.
- To study production and applications of ultrasonics.
- To understand magnetic, dielectric and superconducting properties.

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

- Realize the importance of elastic behavior of materials.
- Learn Sabine's formula for reverberation time and apply in architecture of buildings.
- Learn various methods of producing ultrasonics and their uses.
- Learn magnetic, dielectric and superconducting properties of materials and their applications.

**UNIT - I**

**Elastic properties:** stress and strain, Hooke's law, elastic behavior of a material, factors affecting elasticity, three modulii of elasticity, work done for unit volume in deforming a body, relation between three modulii of elasticity, determination of rigidity modulus – torsional pendulum.

**UNIT - II**

**Acoustics of buildings and acoustic quieting:** Introduction, basic requirement for the acoustically good halls, reverberation and time of reverberation, transmission of sound and transmission loss, factors affecting the architectural acoustics and their remedy, sound absorbing materials, sabine formulae, absorption coefficients, stadium seating, movie theater, acoustic quieting,

**UNIT - III**

**Ultrasonics:** Introduction, production of ultrasonic waves, magnetostriction method, piezo electric method, detection of ultrasonic waves, properties of ultrasonic waves, use of ultrasonics for nondestructive testing, applications of ultrasonics.

**UNIT - IV**

**Dielectric Properties:** Electric dipole, dipole moment, dielectric constant, polarizability, electric susceptibility, displacement vector, electronic, ionic and orientation polarizations and calculation of their polarizabilitites, internal field, Clausius-Mossotti relation, Piezoelectricity, pyroelectricity and ferroelectricity-$BaTiO_3$ structure.

**UNIT - V**

**Magnetic Properties:** Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility, origin of magnetic moment, Bohr magneton, classification of dia, para

and ferro magnetic materials on the basis of magnetic moment, hysteresis curve based on domain theory, soft and hard magnetic materials, properties of anti-ferro and ferri magnetic materials.

**Superconductivity**: Superconductivity phenomenon, Meissner effect, applications of superconductivity.

**Text books:**


1. Solid State Physics, A. J. Dekkar, MacMillan publishers
2. Fundamentals of Physics, Alan Giambattisa, BM Richardson and Robert C Richardson, Tata McGraw hill Publishers
3. Fundamentals of Acoustics, Kinster and Frey, John Wiley and Sons.


**Reference Books:**


1. Solid state physics, Charles Kittel, Wiley student edition
2. University Physics, Francis W. Sears, Hugh D. Young, Marle Zeemansky and Roger A Freedman, Pearson Education.
3. Introduction to Magnetic Materials, B.D. Cullity, C.D.Graham, A John Wiley & Sons, Inc., Publication.
4. Elastic and Inelastic Stress Analysis, Irving H. Shames, Francis A. Cozzarelli, Taylor, & Francis Group.

## CH102BS/CH202BS: ENGINEERING CHEMISTRY

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

**4 0/0/0 4**

**Course Objectives:**

- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- To include the importance of water in industrial usage, significance of corrosion control to protect the structures, polymers and their controlled usage.
- To acquire knowledge of engineering materials and about fuels and batteries.
- To acquire required knowledge about engineering materials like cement, refractories and composites..

**Course Outcomes:**

- Students will gain the basic knowledge of electrochemical procedures related to corrosion and its control.
- They can understand the basic properties of water and its usage in domestic and industrial purposes.
- They learn the use of fundamental principles to make predictions about the general properties of materials.
- They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs

**UNIT - I**

**Water and its treatment:** Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Numerical problems. Potable water and its specifications- Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Ozonization. Defluoridation – Nalgonda technique - Determination of $F^-$ ion by ion- selective electrode method.

**Boiler troubles:** sludges, scales, and Caustic embrittlement. Internal treatment of Boiler feed water – Calgon conditioning – Phosphate conditioning - Colloidal conditioning – Softening of water by ion-exchange processes. Desalination of water – Reverse osmosis. Numerical problems – Sewage water - Steps involved in treatment of sewage.

**UNIT - II**

**Electrochemistry:** Electrode- electrode potential, standard electrode potential, types of electrodes – Construction and functioning of Standard hydrogen electrode, calomel and glass electrode. Nernst equation - electrochemical series and its applications. Electrochemical cells: Daniel cell – cell notation, cell reaction, and cell emf -– Concept of concentration cells – Electrolyte concentration cell –Numerical problems.

**Batteries:** Cell and battery - Primary battery (dry cell, alkaline cell and Lithium cell) and Secondary battery (lead acid, Ni-Cd and lithium ion cell), **Fuel cells:** Hydrogen –oxygen and methanol-oxygen fuel cells – Applications.

**UNIT – III**

**Polymers**: Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples.

**Plastics:** Definition and characteristics- thermoplastic and thermosetting plastics, compounding, and fabrication of plastics (compression and injection moulding). Preparation, Properties, and engineering applications of PVC and Bakelite.

**Fibers:** Characteristics of fibers – preparation, properties and applications of Nylon-6,6 and Dacron. Fiber reinforced plastics (FRP) – Applications.

**Rubbers:** Natural rubber and its vulcanization - compounding of rubber.

**Elastomers:** Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

**Conducting polymers:** Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

**Biodegradable polymers:** Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

**UNIT - IV**

**Fuels & Combustion:** Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking – types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG. **Combustion:** Definition, Calorific value of fuel – HCV, LCV; Calculation of air quantity required for combustion of a fuel.

**UNIT - V**

**Cement:** Portland cement, its composition, setting and hardening of Portland cement.

**Special cements:** White cement, water proof cement, High alumina cement, and Acid resistant cement.

**Refractories:** Classification, characteristics of good refractories, Refractoriness, refractoriness under load, porosity, and chemical inertness – applications of refractories.

**Lubricants:** Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

**Composites:** Introduction- Constituents of composites – advantages, classification and constituents of composites. Applications of composites.

**Text books:**

1. Engineering Chemistry by P.C. Jain & M. Jain, Dhanpatrai Publishing Company, New Delhi (2010)

2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016)

**Reference Books:**

1. Engineering Chemistry by Shashi Chawla, Dhanpatrai & Company (P) Ltd. Delhi (2011)
2. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
3. Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).

**MA203BS: Mathematics - III**
**(Statistical and Numerical Methods)**

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

**Prerequisites:** Foundation course (No prerequisites)**.**

**Course Objectives:** To learn

- random variables that describe randomness or an uncertainty in certain realistic situation
- binomial geometric and normal distributions
- sampling distribution of mean, variance, point estimation and interval estimation
- the testing of hypothesis and ANOVA
- the topics those deals with methods to find roots of an equation
- to fit a desired curve by the method of least squares for the given data
- solving ordinary differential equations using numerical techniques

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

- differentiate among random variables involved in the probability models which are useful for all branches of engineering
- calculate mean, proportions and variances of sampling distributions and to make important decisions s for few samples which are taken from a large data
- solve the tests of ANOVA for classified data
- find the root of a given equation and solution of a system of equations
- fit a curve for a given data
- find the numerical solutions for a given first order initial value problem

**UNIT – I**

**Random variables and Distributions:**

Introduction, Random variables, Discrete random variable, Continuous random variable, Probability distribution function, Probability density function, Expectation, Moment generating function, Moments, and properties.

Discrete distributions: Binomial and geometric distributions. Continuous distribution: Normal distributions.

**UNIT – II**

**Sampling Theory:** Introduction, Population and samples, Sampling distribution of means ($\sigma$ Known)-Central limit theorem, t-distribution, Sampling distribution of means ( $\sigma$ unknown)-Sampling distribution of variances – $\chi^2$ and F- distributions, Point estimation, Maximum error of estimate, Interval estimation.

**UNIT – III**

**Tests of Hypothesis:** Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, One tail and two-tail tests, Tests concerning one mean

and proportion, two means-proportions and their differences-ANOVA for one-way classified data.

**UNIT – IV**

**Algebraic and Transcendental Equations & Curve Fitting:** Introduction, Bisection Method, Method of False position, Iteration methods: fixed point iteration and Newton Raphson methods. Solving linear system of equations by Gauss-Jacobi and Gauss-Seidal Methods.

**Curve Fitting:** Fitting a linear, second degree, exponential, power curve by method of least squares.

**UNIT – V**

**Numerical Integration and solution of Ordinary Differential equations:** Trapezoidal rule-Simpson's $1/3^{rd}$ and $3/8^{th}$ rule- Solution of ordinary differential equations by Taylor's series, Picard's method of successive approximations, Euler's method, Runge-Kutta method (second and fourth order)

**Text Books:**


1. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E. Freund, New Delhi, Prentice Hall.
2. Probability and Statistics for Engineers and Sciences by Jay L. Devore, Cengage Learning.
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain, New Age International Publishers


**References:**


1. Fundamentals of Mathematical Statistics by S. C. Guptha & V. K. Kapoor, S. Chand.
2. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematics for engineers and scientists by Alan Jeffrey, $6^{th}$ edition, CRC press.

## EN104HS/EN204HS: PROFESSIONAL COMMUNICATION IN ENGLISH

**B.Tech. I Year II Sem.** **L T/P/D C**
**3 0/0/0 3**

**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 and communicative 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/poems silently leading to reading comprehension. Reading comprehension passages are 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, from newspaper articles, advertisements, promotional material, etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills.*

**Course Objectives:** The course will help students to:

- Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- Equip students to study academic subjects more effectively using the theoretical and Practical components of English syllabus.
- Develop study skills and communication skills in formal and informal situations.

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

- Use English Language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently in formal and informal contexts.

**SYLLABUS**

**Reading Skills**

**Objectives**

1. To develop an awareness in students about the significance of silent reading and comprehension.
2. To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc., by way of:

- Skimming and Scanning the text
- Intensive and Extensive Reading
- Reading for Pleasure
- Identifying the topic sentence
- Inferring lexical and contextual meaning

- Recognizing Coherence/Sequencing of Sentences

**NOTE:** The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.

**Writing Skills**

**Objectives**

1. To develop an awareness in the students about writing as an exact and formal skill
2. To create an awareness in students about the components of different forms of writing, beginning with the lower order ones through;
    - Writing of sentences
    - Use of appropriate vocabulary
    - Paragraph writing
    - Coherence and cohesiveness
    - Narration / description
    - Note Making
    - Formal and informal letter writing
    - Describing graphs using expressions of comparison

In order to improve the proficiency of the students in the acquisition of language skills mentioned above, the following text and course contents, divided into Five Units, are prescribed:

The course content / study material is divided into **Five Units.**

**Note:** ***Listening and speaking skills are covered in the syllabus of ELCS Lab.***

**UNIT – I**

Chapter entitled '***Presidential Address' by Dr. A.P.J. Kalam*** from ***"Fluency in English– A Course book for Engineering Students"*** published by Orient BlackSwan, Hyderabad.

**Vocabulary**: Word Formation -- Root Words --The Use of Prefixes and Suffixes– Collocations– Exercises for Practice.

**Grammar:** Punctuation – Parts of Speech- Articles -Exercises for Practice.

**Reading:** ***Double Angels*** by David Scott-Reading and Its Importance- Techniques for Effective Reading- Signal Words- Exercises for Practice

**Writing:** Writing Sentences- Techniques for Effective Writing-- Paragraph Writing- Types, Structure and Features of a Paragraph-Coherence and Cohesiveness: Logical, Lexical and Grammatical Devices - Exercises for Practice

**UNIT – II**

Chapter entitled ***Satya Nadella: Email to Employees on his First Day as CEO*** from ***"Fluency in English– A Course book for Engineering Students"*** Published by Orient BlackSwan, Hyderabad.

**Vocabulary**: Synonyms and Antonyms – Homonyms, Homophones, Homographs- Exercises for Practice (Chapter 17 ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press may also be followed.)

**Grammar:** Verbs-Transitive, Intransitive and Non-finite Verbs – Mood and Tense—Gerund – Words with Appropriate Prepositions – Phrasal Verbs - Exercises for Practice

**Reading:** Sub-skills of Reading- Skimming, Scanning, Extensive Reading and Intensive Reading - ***The Road Not Taken*** by **Robert Frost** -- Exercises for Practice

**Writing:** Letter Writing –Format, Styles, Parts, Language to be used in Formal Letters- Letter of Apology – Letter of Complaint-Letter of Inquiry with Reply – Letter of Requisition –- Exercises for Practice

**UNIT – III**

From the book entitled ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press.

**Vocabulary**: Introduction- A Brief History of Words – Using the Dictionary and Thesaurus– Changing Words from One Form to Another – Confusables (From Chapter 17 entitled '*Grammar and Vocabulary Development*')

**Grammar:** Tenses: Present Tense- Past Tense- Future Tense- Active Voice – Passive Voice- Conditional Sentences – Adjective and Degrees of Comparison. (From Chapter 17 entitled '*Grammar and Vocabulary Development*')

**Reading:** Improving Comprehension Skills – Techniques for Good Comprehension- Skimming and Scanning- Non-verbal Signals – Structure of the Text – Structure of Paragraphs – Punctuation – Author's viewpoint (Inference) – Reader Anticipation: Determining the Meaning of Words – Summarizing- Typical Reading Comprehension Questions. (From Chapter 10 entitled '*Reading Comprehension*')

**Writing:** Introduction- Letter Writing-Writing the Cover Letter- Cover Letters Accompanying Resumes- Emails. (From Chapter 15 entitled '*Formal Letters, Memos, and Email'*)

**UNIT – IV**

Chapter entitled ***'Good Manners' by J.C. Hill*** from ***Fluency in English – A Course book for Engineering Students"*** published by Orient Blackswan, Hyderabad.

**Vocabulary**: Idiomatic Expressions –One- word Substitutes --- Exercises for Practice (Chapter 17 ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press may also be followed.)

**Grammar:** Sequence of Tenses- Concord (Subject in Agreement with the Verb) – Exercises for Practice

**Reading:** ***'If'*** poem by **Rudyard Kipling**--Tips for Writing a Review --- Author's Viewpoint – Reader's Anticipation-- Herein the Students will be required to Read and Submit a Review of a Book (Literary or Non-literary) of their choice – Exercises for Practice.

**Writing:** Information Transfer-Bar Charts-Flow Charts-Tree Diagrams etc., -- Exercises for Practice.

Introduction - Steps to Effective Precis Writing – Guidelines- Samples (Chapter 12 entitled '*The Art of Condensation*' from ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press)

**UNIT – V**

Chapter entitled ***'Father Dear Father'*** **by Raj Kinger** from ***Fluency in English – A Course book for Engineering Students"*** Published by Orient BlackSwan, Hyderabad

**Vocabulary**: Foreign Words—Words borrowed from other Languages- Exercises for Practice

**Grammar:** Direct and Indirect Speech- Question Tags- Exercises for Practice

**Reading:** Predicting the Content- Understanding the Gist – SQ3R Reading Technique- Study Skills – Note Making - Understanding Discourse Coherence – Sequencing Sentences. (From Chapter 10 entitled **'Reading Comprehension'** - ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

**Writing:** Technical Reports- Introduction – Characteristics of a Report – Categories of Reports –Formats- Prewriting – Structure of Reports (Manuscript Format) - Types of Reports - Writing the Report. (From Chapter 13 entitled **'Technical Reports'** - ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

- **Exercises from both the texts not prescribed shall be used for classroom tasks.**

**Text Books:**

1. ***"Fluency in English – A Course book for Engineering Students"*** by Board of Editors**: Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.**
2. Raman, Meenakshi & Sharma, Sangeeta**. "*Technical Communication- Principles and Practice*". Third Edition. New Delhi: Oxford University Press. 2015. Print.**

**References:**


1. Green, David. *Contemporary English Grammar –Structures and Composition.* MacMillan India. 2014 (Print)
2. Rizvi, M. Ashraf. *Effective Technical Communication*. Tata Mc Graw –Hill. 2015 (Print).

## EE106ES/EE205ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

| **B.Tech. I Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| | **4** | **0/0/0** | **4** |

**Pre-requisite: None**

**Course Objectives:**

- To introduce the concept of electrical circuits and its components
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

**Course Outcomes:** After this course, the student will be able

- To analyze and solve electrical circuits using network laws and theorems.
- To identify and characterize diodes and various types of transistors.

**UNIT - I**

**Basic Concepts of Electrical Circuits and Single Phase AC Circuits**

**Electrical Circuits:** R-L-C Parameters, Voltage and Current, Independent and Dependent Sources, Source Transformation – V-I relationship for passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series-parallel, star-to-delta, delta-to-star transformation, Nodal Analysis,

**Single Phase AC Circuits:** R.M.S. and Average values, Form Factor, steady state analysis of series, parallel and series-parallel combinations of R, L and C with sinusoidal excitation, concept of reactance, impedance, susceptance and admittance – phase and phase difference, Concept of power factor, j-notation, complex and polar forms of representation.

**UNIT - II**

**Resonance:** Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.

**Network Theorems:** Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Tellegen's, Millman's and Compensation theorems for DC and AC excitations.

**UNIT - III**

**P-N Junction Diode:** Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.

**Rectifiers and Filters:** P-N junction diode as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, $\pi$- section Filters.

**UNIT - IV**

**Bipolar Junction Transistor (BJT):** Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations.

Transistor Biasing And Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in $V_{BE}$ and $\beta$, Bias Compensation using Diodes and Transistors.

**Transistor Configurations:** BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, Comparison of CE, CB and CC configurations.

**UNIT- V**

**Junction Field Effect Transistor:** Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, Small Signal Model, Biasing FET.

**Special Purpose Devices:** Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With help of Energy band diagram) and Varactor Diode, Principle of Operation of SCR.

**Text Books:**


1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath Mc Graw Hill Education


**References:**


1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabratajit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches)- 2nd edition by Raymond A. DeCarlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan & C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.

## CH206BS: ENGINEERING CHEMISTRY LAB

**B.Tech. I Year II Sem.** **L T/P/D C**
**0 0/3/0 2**

### LIST OF EXPERIMENTS

**Volumetric Analysis:**

1. Estimation of Ferrous ion by Dichrometry.
2. Estimation of hardness of water by Complexometric method using EDTA.
3. Estimation of Ferrous and Ferric ions in a given mixture by Dichrometry.
4. Estimation Ferrous ion by Permanganometry.
5. Estimation of copper by Iodomery.
6. Estimation of percentage of purity of $MnO_2$ in pyrolusite
7. Determination of percentage of available chlorine in bleaching powder.
8. Determination of salt concentration by ion- exchange resin.

**Instrumental methods of Analysis:**

1. Estimation of HCl by Conductometry.
2. Estimation of Ferrous ion by Potentiometry.
3. Determination of Ferrous iron in cement by Colorimetric method.
4. Determination of viscosity of an oil by Redwood / Oswald's Viscometer.
5. Estimation of manganese in $KMnO_4$ by Colorimetric method.
6. Estimation o f HCl and Acetic acid in a given mixture by Conductometry.
7. Estimation of HCl by Potentiometry.

**Preparation of Polymers:**

1. Preparation of Bakelite and urea formaldehyde resin.

**Note:** All the above experiments must be performed.

**Text Books:**


1. Vogel's Text Book of Quantitative Chemical Analysis, 5th Edition (2015) G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney.
2. A Text Book on experiments and calculations in Engineering Chemistry by S.S. Dara S. Chand & Company Ltd., Delhi (2003).

**EN107HS/EN207HS: ENGLISH LANGUAGE COMMUNICATION SKILLS LAB**

| **B.Tech. I Year II Sem.** | **L** | **T/P/D** | **C** |
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The **English Language Communication Skills (ELCS) 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 the 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, group discussions and interviews

**Course 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 Communication Skills Lab (ELCS) shall have two parts:

- Computer Assisted Language Learning (CALL) Lab
- Interactive Communication Skills (ICS) Lab

**Listening Skills: Objectives:**

- To enable students develop their listening skills so that they may appreciate the 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
    - Describing objects/situations/people
    - Role play – Individual/Group activities
    - Just A Minute (JAM) Sessions.

The following course content is prescribed for the **English Language Communication Skills Lab**.

**Exercise – I**

**CALL Lab**:

*Understand:* Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

*Practice*: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker.

*Testing Exercises*

**ICS Lab**:

*Understand:* Spoken vs. Written language- Formal and Informal English.

*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– Weak Forms and Strong Forms – Sentence Stress – Intonation.

*Practice:* Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Sentence Stress – Intonation.

*Testing Exercises*

**ICS Lab**:

*Understand:* Features of Good Conversation – Strategies for Effective Communication.

*Practice:* Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

**Exercise - III**

**CALL Lab:**

*Understand:* Errors in Pronunciation-the Influence of Mother Tongue (MTI).

*Practice:* Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.

*Testing Exercises*

**ICS Lab**:

*Understand:* Descriptions- Narrations- Giving Directions and Guidelines.

*Practice:* Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

**Exercise – IV**
**CALL Lab**:
*Understand:* Listening for General Details.
*Practice:* Listening Comprehension Tests.
*Testing Exercises*
**ICS Lab**:
*Understand:* Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.
*Practice:* Making a Short Speech – Extempore- Making a Presentation.

**Exercise – V**
**CALL Lab:**
*Understand:* Listening for Specific Details.
*Practice:* Listening Comprehension Tests.
*Testing Exercises*
**ICS Lab**:
*Understand:* Group Discussion- Interview Skills.
*Practice:* Group Discussion- Mock Interviews.

**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 T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

**Prescribed Lab Manuals:**
1. A book entitled "***ELCS Lab Manual – A Workbook for CALL and ICS Lab Activities"*** by Board of Editors: Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.

2. Hart, Steve; Nair, Aravind R.; Bhambhani, Veena. ***"EMBARK- English for undergraduates"*** Delhi: Cambridge University Press. 2016. Print.

**Suggested Software:**

1. Cambridge Advanced Learners' English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley.
3. Punctuation Made Easy by Darling Kindersley.
4. Oxford Advanced Learner's Compass, 8th Edition.
5. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
6. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
7. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

**References:**


1. Jayashree Mohanraj. *Let Us Hear Them Speak.* New Delhi: Sage Texts. 2015. Print.
2. Hancock, M. *English Pronunciation in Use. Intermediate Cambridge*: Cambridge University Press. 2009. Print.

## ME108ES/ME208ES: ENGINEERING WORKSHOP

| **B.Tech. I Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| | **0** | **0/3/0** | **2** |

**Pre-requisites**: Practical skill

**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.

**1. TRADES FOR EXERCISES:**

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

- Carpentry
- Fitting
- Tin-Smithy and Development of jobs carried out and soldering.
- Black Smithy
- House-wiring
- Foundry
- Welding
- Power tools in construction, wood working, electrical engineering and mechanical
- Engineering.

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

- Plumbing, Machine Shop, Metal Cutting (Water Plasma)

**Text Books:**

1. Workshop Practice /B. L. Juneja / Cengage

2. Workshop Manual / K. Venugopal / Anuradha.

**Reference Books:**

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

**MA301BS: MATHEMATICS - IV**
**(Complex Variables and Fourier Analysis)**

| **B.Tech. II Year I Sem.** | **L** | **T/P/D** | **C** |
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**Prerequisites:** Foundation course (No Prerequisites)**.**

**Course Objectives:** To learn

- differentiation and integration of complex valued functions
- evaluation of integrals using Cauchy's integral formula
- Laurent's series expansion of complex functions
- evaluation of integrals using Residue theorem
- express a periodic function by Fourier series and a non-periodic function by Fourier transform
- to analyze the displacements of one dimensional wave and distribution of one dimensional heat equation

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

- analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
- find the Taylor's and Laurent's series expansion of complex functions
- the bilinear transformation
- express any periodic function in term of sines and cosines
- express a non-periodic function as integral representation
- analyze one dimensional wave and heat equation

**UNIT–I**

**Functions of a complex variable:** Introduction, Continuity, Differentiability, Analyticity, properties, Cauchy, Riemann equations in Cartesian and polar coordinates**.** Harmonic and conjugate harmonic functions-Milne-Thompson method

**UNIT-II**

**Complex integration:** Line integral, Cauchy's integral theorem, Cauchy's integral formula, and Generalized Cauchy's integral formula, Power series: Taylor's series- Laurent series, Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).

**UNIT–III**

**Evaluation of Integrals:** Types of real integrals:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

Bilinear transformation- fixed point- cross ratio- properties- invariance of circles.

**UNIT–IV**

**Fourier series and Transforms:** Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

**UNIT–V**

**Applications of PDE:** Classification of second order partial differential equations, method of separation of variables, Solution of one dimensional wave and heat equations.

**TEXT BOOKS:**


1. A first course in complex analysis with applications by Dennis G. Zill and Patrick Shanahan, Johns and Bartlett Publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.
3. Advanced engineering Mathematics with MATLAB by Dean G. Duffy


**REFERENCES:**


1. Fundamentals of Complex Analysis by Saff, E. B. and A. D. Snider, Pearson.
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw Hill.

## CE302ES: STRENGTH OF MATERIALS - I

| B.Tech. II Year I Sem. | L | T/P/D | C |
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**Pre Requisites**: Engineering Mechanics

**Course Objectives:** The subject provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems.

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

- Analyze the statically determinate and indeterminate problems.
- Determine the stresses and strains in the members subjected to axial, bending.
- Evaluate the slope and deflection of beams subjected to loads.
- Determine the principal stresses and strains in structural members.

**UNIT – I**

**Simple Stresses and Strains:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Elastic constants.

**Strain Energy** – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

**UNIT – II**

**Shear Force and Bending Moment:** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

**UNIT – III**

**Flexural Stresses:** Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

**Shear Stresses:** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

**UNIT – IV**

**Deflection of Beams:**

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, Uniformly varying load-Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

**Conjugate Beam Method:** Introduction – Concept of conjugate beam method. Difference between a real beam and a conjugate beam. Deflections of determinate beams with constant and different moments of inertia.

**UNIT – V**

**Principal Stresses and Strains :** Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

**Theories of Failure**: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum shear stress theory- Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

**TEXT BOOKS:**


1. Strength of Materials by R. K. Bansal, Lakshmi Publications House Pvt. Ltd.
2. Strength of Materials by R. Subramanian, Oxford University Press.
3. Strength of Materials by W.A Nash, MC Graw Hills 2014 6th edition.
4. Mechanics of Materials by James M Gere and Barry J Goodno Cengage Learning India Pvt. Ltd Eight edition.


**REFERENCES:**


1. Strength of Materials by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
2. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
3. Strength of Materials by S. S. Rattan, McGraw Hill Education Pvt. Ltd.
4. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd.
5. Strength of Materials and Structures by John Case *et al.*, Butterworth-Heinemann.
6. Strength of Materials by Dr.Sadhu Singh Khanna Publishers 11th edition 2015.

## CE303ES: FLUID MECHANICS - I

| B.Tech. II Year I Sem. | L | T/P/D | C |
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**Pre Requisites**: Engineering Mechanics

**Course Objectives:** Students who take this class can expect to

- Develop an appreciation for the properties of Newtonian fluids.
- Study analytical solutions to variety of simplified problems.
- Understand the dynamics of fluid flows and the governing non-dimensional parameters.
- Apply concepts of mass, momentum and energy conservation to flows.
- Grasp the basic ideas of turbulence.

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

- Apply conservation laws to derive governing equations of fluid flows.
- Compute hydrostatic and hydrodynamic forces.
- Analyze and design simple pipe systems.
- Apply principles of dimensional analysis to design experiments.
- Compute drag and lift coefficients.

**UNIT - I**

**Introduction:** Dimensions and units – Physical properties of fluids specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion pressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressure- measurement of pressure. Pressure gauges, Manometers: differential and Micro Manometers. Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure. Derivations and problems.

**UNTI – II**

**Buoyancy and floatation:** stability of bodies, meta centre, liquids in relative equilibrium.

**Fluid Kinematics:** Description of fluid flow, Stream line, path line and streak lines and stream tube. Classification of flows : Steady, unsteady, uniform, non uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, circulation and vorticity, flownet analysis.

**UNIT – III**

**Fluid Dynamics and Measurement of Flow:** Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, (Navier – stokes equations (Explanationary) Momentum equation and its application – forces on pipe bend. Pitot tube,

Venturi meter, and orifice meter – classification of orifices, flow over rectangular, triangular and trapezoidal and Stepped notches - –Broad crested weirs.

**UNIT - IV**

**Closed Conduit Flow:** Reynold's experiment – Characteristics of Laminar & Turbulent flows. Laws of Fluid friction – Darcy's equation, ,variation of friction factor with Reynold's number – Moody's Chart, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line. Pipe network problems Flow between parallel plates, Flow through long tubes, flow through inclined tubes, water hammer.

**UNIT – V**

**Boundary Layer Theory:** Approximate Solutions of Navier Stokes Equations – Boundary layer – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarmen momentum integral equation, laminar and turbulent Boundary layers (no derivations) BL in transition, separation of BL, control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

**TEXT BOOKS:**


1. Fluid Mechanics by F.M. White McGraw Hill Education (India) Pvt. Ltd, New Delhi, 2011
2. Fluid Mechanics by V.L. Streeter., E.B.Wylie and K.W. Bedford, McGraw Hill Education (India) Pvt. Ltd, New Delhi2016.
3. Fluid Mechanics by P.N. Modi and S.M.Seth, Standard Book House, Delhi, 2011.


**REFERENCES:**


1. Mechanics of Fluids by Potter, M.C D.C Wiggers, B.H Ramdan Cengage, 2012.
2. Fluid Mechanics by J F Douglas, J M Gasiorek, J A Swaffield and L B Jack, Pearson 2015.
3. Fluid Mechanics and Fluid Machines by S. K. Som, Gautam Biswas and S. Chakraborty, McGraw Hill Education (India) Pvt. Ltd, New Delhi 2015.
4. Engineering Fluid Mechanics by K L Kumar, S Chand, Eurasia Publishing House, New Delhi, 2014.
5. Fluid Mechanics by Dr. A. K. Jain Khanna Publishers, twelfth edition 2014.

## CE304ES: BUILDING MATERIALS, CONSTRUCTION AND PLANNING

| **B.Tech. II Year I Sem.** | **L** | **T/P/D** | **C** |
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**Course Objectives:** To give the students a basic idea about the construction materials, building components and to introduce various.

**Course Outcomes:** At the end of the course, the student will be able to identify various building materials required for construction & planning.

**UNIT - I**

**Stones and Bricks, Tiles:** Building stones – classifications and quarrying – properties – structural requirements – dressing.

Bricks – Composition of Brick earth – manufacture and structural requirements, Fly ash, Ceramics.

**Timber, Aluminum, Glass, Paints and Plastics:** Wood - structure – types and properties – seasoning – defects; alternate materials for Timber – GI / fibre – reinforced glass bricks, steel & aluminum, Plastics.

**UNIT - II**

**Cement & Admixtures:** Ingredients of cement – manufacture – Chemical composition – Hydration - field & lab tests.

Admixtures – mineral & chemical admixtures – uses.

**UNIT - III**

**Building Components :** Lintels, Arches, walls, vaults – stair cases – types of floors, types of roofs – flat, curved, trussed ; foundations – types ; Damp Proof Course ; Joinery – doors – windows – materials – types.

**Building Services:** Plumbing Services: Water Distribution, Sanitary – Lines & Fittings; Ventilations: Functional requirements systems of ventilations. Air-conditioning - Essentials and Types; Acoustics – characteristic – absorption – Acoustic design; Fire protection – Fire Harzards – Classification of fire resistant materials and constructions

**UNIT - IV**

**Mortars, Masonry and Finishing's**

**Mortars:** Lime and Cement Mortars

Brick masonry – types – bonds; Stone masonry – types; Composite masonry – Brick-stone composite; Concrete, Reinforced brick.

**Finishers:** Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.

**Form work: Types**: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

**UNIT – V**

**Building Planning:** Principles of Building Planning, Classification of buildings and Building by laws.

**TEXT BOOKS:**


1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.


**REFERENCES:**


1. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.
2. Building Materials by Duggal, New Age International.
3. Building Materials by P. C. Varghese, PHI.
4. Building Construction by PC Varghese PHI.
5. Construction Technology – Vol – I & II by R. Chubby, Longman UK.
6. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications.

## CE305ES: SURVEYING

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

| L | T/P/D | C |
|---|---|---|
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**Course Objectives:** The first step in engineering practice is surveying and the soundness of any civil engineering work is dependent on the reliability and accuracy of surveying. Therefore, it is imperative that a student of engineering should have good knowledge of surveying. To impart the knowledge of surveying and latest technologies in surveying it is necessary to introduce this subject in the curriculum.

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

- Calculate angles, distances and levels
- Identify data collection methods and prepare field notes
- Understand the working principles of survey instruments
- Estimate measurement errors and apply corrections
- Interpret survey data and compute areas and volumes

**UNIT - I**

**Introduction and Basic Concepts:** Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

**Measurement of Distances and Directions**

**Linear distances-** Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method.

**Prismatic Compass**- Bearings, included angles, Local Attraction, Magnetic Declination, and dip.

**UNIT - II**

**Levelling and Contouring**

**Leveling-** Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

**Contouring-** Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

**Computation of Areas and Volumes**

**Areas -** Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

**Volumes -** Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

**UNIT - III**

**Theodolite Surveying:** Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

**Traversing:** Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

**UNIT - IV**

**Tacheometric Surveying:** Principles of Tacheometry, stadia and tangential methods of Tacheometry.

**Curves:** Types of curves and their necessity, elements of simple curve, setting out of simple Curves, Introduction to compound curves.

**UNIT - V**

**Modern Surveying Methods:** Total Station and Global Positioning System. : Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

**TEXT BOOKS:**


1. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.
2. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
3. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.


**REFERENCES:**


1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000.
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004.
3. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.
4. Chandra A M, "Plane Surveying", New Age International Pvt. Ltd., New Delhi, 2002.
5. Surveying by Bhavikatti; Vikas publishing house ltd.
6. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.
7. Surveying and leveling by R. Agor Khanna Publishers 2015.

## CE306ES: STRENGTH OF MATERIALS LAB

| B.Tech. II Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| | 0 | 0/3/0 | 2 |

**Course Objectives:** The objective of the course is to make the student understand the behavior of materials under different types of loading for different types structures

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

- Conduct tension test on Materials like steel etc.
- Conduct compression tests on spring, wood and concrete
- Conduct flexural and torsion test to determine elastic constants
- Determine hardness of metals

**List of Experiments:**

1. Tension test
2. Bending test on (Steel / Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges
12. Continuous beam – deflection test.

**List of Major Equipment:**

1. UTM for conducting tension test on rods
2. Steel beam for flexure test
3. Wooden beam for flexure test
4. Torsion testing machine
5. Brinnell's / Rock well's hardness testing machine
6. Spring testing machine
7. Compression testing machine
8. Izod Impact machine
9. Shear testing machine
10. Beam setup for Maxwell's theorem verification.
11. Continuous beam setup
12. Electrical Resistance gauges.

## CE307ES: COMPUTER AIDED DRAFTING LAB

| **B.Tech. II Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| | **0** | **0/3/0** | **2** |

**Course Objectives:** The objective of this lab is to teach the student basic drawing fundamentals in various civil engineering applications, specially in building drawing.

**Course Outcomes:** At the end of the course, the student will be able to:
Master the usage of Autocad commands for drawing 2D & 3D building drawings required for different civil engg applications.

1. Introduction to computer aided drafting
2. Software for CAD – Introduction to different softwares
3. Practice exercises on CAD software
4. Drawing of plans of buildings using software
   a) Single storied buildings b) multi storied buildings
5. Developing sections and elevations for
   a) Single storied buildings b) multi storied buildings
6. Detailing of building components like Doors, Windows, Roof Trusses etc. using CAD softwares
7. Exercises on development of working drawings of buildings

**TEXT BOOKS:**


1. Computer Aided Design Laboratory by M. N. Sesha Praksh & Dr. G. S. Servesh – Laxmi Publications.
2. Engineering Graphics by P. J. Sha – S. Chand & Co.

## CE308ES: SURVEYING LAB – I

| B.Tech. II Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| | 0 | 0/3/0 | 2 |

**Pre Requisites**: Surveying Theory

**Course Objectives:** To impart the practical knowledge in the field, it is essential to introduce in curriculum. Drawing of Plans and Maps and determining the area are pre requisites before taking up any Civil Engineering works.

**Course Outcomes:** At the end of the course, the student will be able to:
Practically able to draw plans & maps to determine the areas before taking up any civil engineering works.

1. Surveying of an area by chain survey (closed traverse) & plotting.
2. Chaining across obstacles
3. Determine of distance between two inaccessible points with compass
4. Survey of a given area by prismatic compass (closed traverse) and plotting after adjustment.
5. Radiation method, intersection methods by plane table survey.
6. Two point and three point problems in plane table survey.
7. Levelling – Longitudinal and cross-section and plotting
8. Trigonometric leveling using theodolite
9. Height and distances using principles of tacheometric surveying
10. a) Measurement of Horizontal angle & vertical angle.
    b) Distance between inaccessible point by theodolite

## MC300HS: GENDER SENSITIZATION LAB

| B.Tech. II Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| | 0 | 0/3/0 | 2 |

**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:**

- 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**

**Gender:** Why Should We Study It? (*Towards a World of Equals*: Unit -1)

**Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

**UNIT-II**

**GENDER AND BIOLOGY**

**Missing Women:** Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.

**Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

**UNIT-III**

**GENDER AND LABOUR**

**Housework:** the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

**Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

**UNIT-IV**

**ISSUES OF VIOLENCE**

**Sexual Harassment:** Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu"*.

**Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

**UNIT-V**

**GENDER: CO - EXISTENCE**

**Just Relationships:** Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

**TEXTBOOK**

All the five Units in the Textbook***, "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 and published by **Telugu Akademi, Hyderabad**,Telangana State in the year **2015**.

**Note:** Since it is an 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.

**REFERENCE BOOKS:**


1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "*I Fought For My Life…and Won*."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

## CE401ES: STRENGTH OF MATERIALS – II

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 4 | 1/0/0 | 4 |

**Pre Requisites**: Strength of Materials - I

**Course Objectives:** Study of the subject provides the understanding of principal stress, strains, springs, columns, and structures.

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

- Determine stresses in the member subjected to Torsion
- Analyze columns and struts
- Understand the concept of direct and bending stresses
- Analyze and design springs, thin and thick cylinders
- Understand the concept of unsymmetrical bending.

**UNIT – I**

**Torsion of Circular Shafts:** Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

**Springs:** Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

**UNIT – II**

**Columns and Struts:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns-assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

**Beam Columns:** Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading.

**UNIT - III**

**Direct and Bending Stresses:** Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and bending moment about both axis.

**Beams Curved In Plan:** Introduction – circular beams loaded uniformly and supported on symmetrically placed Columns – Semi-circular beam simply-supported on three equally spaced supports.

**UNIT – IV**

**Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Thin spherical shells.

**Thick Cylinders:** Introduction - Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

**UNIT – V**

**Unsymmetrical Bending:** Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis - Deflection of beams under unsymmetrical bending.

**Shear Centre:** Introduction - Shear centre for symmetrical and unsymmetrical (channel, I, T and L) sections

**TEXT BOOKS:**


1. Mechanics of Materials Ferdinand P. Beer et al., Tata McGraw Hill Education Pvt. Ltd 5th edition 2009.
2. Strength of Materials R. Subramanian, Oxford University Press 2010
3. Strength of Materials by B.S. Basavarajaiah, B.S. Mahadevappa, Universities Press 3rd Edition 2015.


**REFERENCES:**


1. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
2. Introduction to Strength of Materials by U. C. Jindal, Galgotia Publications Pvt. Ltd.
3. Mechanics of Materials by R. C. Hibbeler, Pearson Education
4. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
5. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.
6. Strength of Materials by S.S Bhavikatti, Vikas Publishing House Pvt. Ltd.

## CE402ES: FLUID MECHANICS - II

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 4 | 1/0/0 | 4 |

**Pre Requisites**: Fluid Mechanics

**Course Objectives:** To understand basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing.

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

- Understand the concepts o channel flows.
- Compute flow profiles in channel transitions and analyze hydraulic transients
- Design the working proportions of hydraulic machines

**UNIT – I**

**Open Channel Flow:** Types of flows - Type of channels – Velocity distribution – Energy and momentum correction factors – Chezy's, Manning's; and Bazin formulae for uniform flow Stickler's formula for Mannings 'n' – Most Economical sections. Critical flow: Specific energy-critical depth – computation of critical depth – critical sub-critical and super critical flows. Non uniform flow-Dynamic equation for G.V.F., Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- for surface profiles -Rapidly varied flow, hydraulic jump, energy dissipation. Surges – Types

**UNIT - II**

**Hydraulic Similitude:** Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations. Distorted and non-distorted models. Scale Effect.

**UNIT – III**

**Basics of Turbo Machinery:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle, Applications to radial flow turbines.

**UNIT - IV**

**Hydraulic Turbines:** Layout of a typical Hydropower installation – Heads and efficiencies-classification of turbines-pelton wheel-Francis turbine-Kaplan turbine-working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and function efficiency. Governing of turbines-surge tanks-unit and specific turbines-unit speed-unit quantity-unit power-specific speed performance characteristics-geometric similarity-cavitation and preventive measures

**UNIT – V**

**Centrifugal Pump:** installation details-classification-types work done- Manometric head-minimum starting speed-losses and efficiencies-specific speed multistage pumps-pumps in parallel- performance of pumps-characteristic curves- NPSH-cavitation.

**Reciprocating pumps:** Basics, types, air vessels, slip

Classification of Hydropower plants – Definition of terms – load factor, utilization factor, capacity factor, estimation of hydropower potential.

**TEXT BOOKS:**


1. Open Channel flow by K. Subramanya, Tata McGraw Hill Education (India) Pvt Ltd.
2. Fluid Mechanics & Machinery by CSP Ojha, P.N. Chandramouli and R. Berndtsson Oxford University Press.
3. Hydraulic Machines by K. Subramanya McGraw Hill Education(India) Pvt Ltd, 2013


**REFERENCES:**


1. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard Book House, New Delhi.
2. Elements of Open channel flow by Ranga Raju, McGraw Hill Education(India) Pvt Ltd, 2013
3. Flow Through Open Channels by Rajesh Srivastava, Oxford University Press, 2011
4. Open Channel flow Hydraulics by R.H. French, McGraw Book Company, New York, 1986.
5. Fluid Mechanics by Dr. A. K. Jain Khanna Publishers 2016

## CE403ES: STRUCTURAL ANALYSIS

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 4 | 1/0/0 | 4 |

**Pre Requisites**: Strength of Materials –I

**Course Objectives:** To make the students to understand the principles of analysis of structures subjected to static and moving loads by various methods.

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

- Analyze Perfect , Imperfect And Redundant Frames
- Formulate Equilibrium and compatibility equations for structural members
- Analyze one dimensional and two dimensional problems using classical methods
- Analyze indeterminate structures
- Analyze structures for gravity loads, moving loads and lateral loads

**UNIT - I**

**Introduction to Structures and Indeterminacy:** Equilibrium and compatibility equations - types of supports and reactions, types of joints and equilibrium equations, Static and kinematic indeterminacies of beams and frames. Effect of force releases like moment hinge, shear releases, link on static indeterminacy, Relative Merits of indeterminate structures over determinate structures.

**Propped Cantilever and Fixed Beams:** Types of props : Elastic and Rigid props, Determination of - Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - Shear force and Bending moment diagrams for Propped Cantilever and Fixed Beams-Deflection of Propped cantilever and fixed beams; effect of sinking of support, effect of rotation of a support.

**UNIT – II**

**Frames:** Classification- plane and space frames, pin jointed and rigid jointed frames.

**Analysis of Perfect Frames:** Types of frames- Perfect, Imperfect and Redundant pin jointed frames, assumptions, transfer of load to joints from wind and other forces - Analysis of determinate pin jointed frames using method of joints and method of sections for vertical loads, horizontal loads and inclined loads.

**UNIT – III**

**Energy Theorems:** Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Unit Load Method. Deflections of simple beams and pin- jointed plane trusses.

**Three Hinged Arches –** Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches. Linear Arch. Eddy's theorem. Analysis of Three hinged arches. Normal Thrust and radial shear in an arch. Geometrical properties of parabolic and circular arch. Three hinged circular arch at different levels. Absolute maximum bending moment diagram for a three hinged arch.

**UNIT – IV**

**Slope Deflection Method:** Derivation of slope-deflection equation, application to continuous beams with and without settlement of supports. Shear force and bending moment diagrams and Elastic curve.

Moment Distribution Method: application to continuous beams with and without settlement of supports. Shear force and bending moment diagrams and Elastic curve.

**UNIT – V**

**Moving Loads and Influence Lines:** Introduction-applications to bridges (only description), Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a section - Point loads, UDL longer than the span, UDL shorter than the span- maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load UDL longer than the span, UDL shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length. Influence lines for forces in members of deck and through type trusses like Pratt and Warren trusses. Equivalent uniformly distributed load. Focal length. Muller Breslau's principle for determinate and indeterminate beams (qualitative)

**TEXT BOOKS:**


1. Structural Analysis Vol –I & II by V. N. Vazirani and M. M. Ratwani, Khanna Publishers.
2. Structural Analysis Vol I & II by G. S. Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Ltd.
3. Mechanics of Structures Vol – I and II by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.


**REFERENCES:**


1. Structural Analysis by R. C. Hibbeler, Pearson Education
2. Structural Analysis by Devdas Menon, Narosa Publishing House.
3. Basic Structural Analysis by C. S. Reddy., Tata McGraw Hill Education Pvt. Ltd.
4. Fundamentals of Structural Analysis by M. L. Gamhir, PHI Learning Pvt. Ltd
5. Structural Analysis -I by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.

## CV404ES: ENGINEERING GEOLOGY

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

**Course Objectives:** The objectives was course is to give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures, basic Geology, Geological Hazardous and Environmental Geology which gives a complete picture on the Geological aspects that are to be considered for the planning and construction of major Civil Engineering projects

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

- Understand weathering process and mass movement
- Distinguish geological formations
- Identify geological structures and processes for rock mass quality
- Identify subsurface information and groundwater potential sites through geophysical investigations
- Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

**UNIT - I**

**Introduction:** Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.

**Weathering of Rocks :** Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like “Granite”

**UNIT - II**

**Mineralogy:** Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldsper, Quartiz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite. Study of other common economics minerals such as Pyrite, Hematite , Magnetite, Chrorite , Galena , Pyrolusite, Graphite, Magnesite, and Bauxite.

**Petrology:** Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of igneous. Sedimentary and metamorphic rocks. Their distinguishing features, Megascopic and microscopic and microscopic study of Granite, Dolerite, Basalt, Pegmatite, Laerite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

**UNIT - III**

**Structural Geology:** Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults uncomfornities, and joints - their important types and case studies. Their importance Insitu and drift soils, common types of soils, their origin and occurrence in India, Stabilisation of soils. Ground water, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration.

**UNIT - IV**

**Earth Quakes:** Causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, their causes and effect; measures to be taken to prevent their occurrence. Importance of study of ground water, earth quakes and landslides.

**Importance of Geophysical Studies:** Principles of geophysical study by Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and geothermal method. Special importance of Electrical resistivity methods, and seismic refraction methods. Improvement of competence of sites by grouting etc. Fundamental aspects of Rock mechanics and Environmental Geology.

**UNIT - V**

**Geology of Dams, Reservoirs, and Tunnels:** Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factors contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs - Purposes of tunneling, Effects of Tunneling on the ground Role of Geological Considerations (i.e. Tithological, structural and ground water) in tunneling over break and lining in tunnels.

**TEXT BOOKS:**


1. Engineering Geology by N. Chennakesavulu, McMillan, India Ltd. 2005
2. Engineering Methods by D. Venkat Reddy; Vikas Publishers 2015.
3. Engineering Geology by S K Duggal, H K Pandey Mc Graw Hill Education Pvt Ltd 2014
4. Principles of Engineering Geology by K.V.G.K. Gokhale – B.S publications


**REFERENCES:**


1. F.G. Bell, Fundamental of Engineering B.S. Publications, 2005.
2. Krynine & Judd, Principles of Engineering Geology & Geotechnics, CBS Publishers & Distribution
3. Engineering Geology by Subinoy Gangopadhyay, Oxford university press.
4. Engineering Geology for Civil Engineers – P.C. Varghese PHI

## SM405MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 3 | 0/0/0 | 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 in 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 & 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, and Monopolistic Competition.

**Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and 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, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Introduction to Fund Flow and Cash Flow Analysis (simple problems).

**TEXT BOOKS:**


1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.


**REFERENCES:**


1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013

## CE406ES: FLUID MECHANICS LAB

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 0 | 0/3/0 | 2 |

**Pre Requisites**: FM Theory

**Course Objectives:** To give the student an exposure to various hydraulic devices and Pipe Flow.

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

- Determine coefficient of discharge for orifice and mouthpiece.
- Calibrate notches venturimeter orifice meters
- Determine miner losses in pipes

**List of Experiments:**

1. Determination of Coefficient of discharge for a small orifice.
2. Determination of Coefficient of discharge for a mouthpiece by constant head method.
3. Calibration of contracted Rectangular Notch / Triangular Notch/Trapezoidal Notch.
4. Determination of friction factor of a pipe
5. Calibration of Venturimeter
6. Calibration of Orifice meter
7. Determination of Coefficient for minor losses - Sudden Expansion
8. Determination of Coefficient for minor losses- Sudden Contraction
9. Verification of Bernoulli's equation.
10. Study of Water Hammer due to sudden Closure of valve.

## CE408ES: SURVEYING - II LAB

| B.Tech. II Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| | 0 | 0/3/0 | 2 |

**Course Objective:** To impart the practical knowledge in the field to set out any Civil Engineering work

**Course Outcome:** Perform surveying on any civil engineering work

1. Determine of area using total station
2. Traversing using total station
3. Contouring using total station
4. Determination of remote height using total station
5. Stake out using total station
6. Distance, gradient, differential height between two inaccessible points using total station.
7. Curve settling using total station
8. Resection using total station
9. Setting out works for buildings and pipe lines
10. Finding position of stations using G.P.S

## CV407ES: ENGINEERING GEOLOGY LAB

| **B.Tech. II Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| | **0** | **0/3/0** | **2** |

**Pre Requisites**: Engineering Geology Theory

**Course Objectives:** The object of this lab is that to provide practical knowledge about physical properties of minerals, rocks, drawing of geological maps, showing faults, uniformities etc.

**Course Outcomes:** At the end of the course, the student will be able to:
Identify the various rocks, minerals depending on geological classifications

1. Study of physical properties and identification of minerals referred under theory.
2. Megascopic description and identification of rocks referred under theory.
3. Microscopic study of rocks.
4. Interpretation and drawing of sections for geological maps showing tilted beds, faults, uniformities etc.
5. Simple Structural Geology problems.
6. Electrical resistivity meter.

**LAB EXAMINATION PATTERN:**

1. Description and identification of SIX minerals
2. Description and identification of Six (including igneous, sedimentary and metamorphic rocks)
3. Interpretation of a Geological map along with a geological section.
4. Simple strike and Dip problems.
5. Microscopic identification of rocks.

## MC400ES: ENVIRONMENTAL SCIENCE AND TECHNOLOGY

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

**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 inturn 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, Biomagnification, 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 Problems 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.

**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, 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:**


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


**REFERENCE BOOKS:**


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

# CONCRETE TECHNOLOGY

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | |
| **Course Code: CE501PC** | **4** | **0/0/0** | **4** |

**Pre Requisites**: Building Materials

**Course Objectives:** Concrete is the basic construction material in the advancemans present construction industry Lot of advances are taking place in the concrete technology on par with development taking place in the engineering. The present day industry needs the knowledge of concrete technology thoroughly. The subject is designed to give the basic knowledge as well as latest developments in concrete technology

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

- Identify Quality Control tests on concrete making materials
- Understand the behavior of fresh and hardened concrete
- Design concrete mixes as per IS and ACI codes
- Understand the durability requirements of concrete
- Understand the need for special concretes

**UNIT - I**

**Cement:** Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement. Admixtures: Types of admixtures – mineral and chemical admixtures.

**UNIT - II**

**Aggregates:** Classification of aggregate – Particle shape & texture –, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

**UNIT – III**

**Fresh Concrete:** Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

**UNIT - IV**

**Hardened Concrete :** Water / Cement ratio – Abram's Law – Gelspaoe ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compressive & tensile strength - Curing.

**Testing Of Hardened Concrete:** Compression tests – Tension tests– Flexure tests – Splitting tests – Pull-out test, Non-destructive testing methods – codal provisions for NDT.

Elasticity, Creep & Shrinkage – Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage.

**UNIT – V**

**Mix Design:** Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by– BIS method and ACI mix design.

**Special Concretes:** Introduction to light weight concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Polymer concrete – High performance concrete – Self compacting concrete.

**TEXT BOOKS:**

1. Properties of Concrete by A. M. Neville Pearson 5th edition Education ltd 2016.
2. Concrete Technology by M. S. Shetty. – S. Chand & Co. 2004
3. Concrete Technology by Job Thomas -Cengage learning India Pvt Ltd 2015.

**REFERENCES:**

1. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
2. Concrete: Micro structure, Properties and Materials – P. K. Mehta and J. M. Monteiro, McGraw Hill Publishers

## DESIGN OF REINFORCED CONCRETE STRUCTURES

| | | | |
|---|---|---|---|
| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
| **Course Code: CE502PC** | **4** | **1/0/0** | **4** |

**Pre-Requisites:** Structural Analysis I & II

**Course Objectives:** Structural elements are subjected to different loading to with stand the structures, for external loading we need to design the structures for its safety and serviceability.

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

- Design RC Structural elements
- Design the Reinforced Concrete beams using limit state Design
- Design Reinforced Concrete slabs
- Design the Reinforced Concrete Columns and footings
- Design structures for serviceability
- Design staircases, canopy

**UNIT – I**

Concepts of RC. Design – Working Stress Method - Limit State method – Material Stress-Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456 – 2000. **Beams:** Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections

**UNIT – II**

Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing; Design of canopy.

**UNIT – III**

Short and Long columns – under axial loads, uniaxial bending and biaxial bending – I S Code provisions.

**UNIT – IV**

**Footings:** Different types of footings – Design of isolated, square, rectangular, circular footings and combined footings.

**UNIT - V**

Design of one way slab, Two-way slabs and continuous slab Using I S Coefficients Limit state design for serviceability for deflection, cracking and codal provision. Design of dog-legged staircase.

**TEXT BOOKS:**

1. Reinforced concrete design by S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill, New Delhi.
2. Reinforced concrete design by N. Subrahmanian Oxford University Press.
3. Limit state designed of reinforced concrete – P. C. Varghese, Prentice Hall of India, New Delhi.

**REFERENCES:**

1. Design of Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & company.
2. Fundamentals of reinforced concrete by N.C. Sinha and S.K Roy, S. Chand publishers
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata McGraw-Hill, 3rd Edition, 2005.

## WATER RESOURCES ENGINEERING

| B.Tech. III Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: CE503PC | 4 | 1/0/0 | 4 |

**Pre-Requisites:** Fluid Mechanics & HHM

**Course Objectives:** The objectives of the course is to study the concepts of

- Engineering Hydrology and its applications like Runoff estimation, estimation of design discharge and flood routing.
- Irrigation Engineering – Water utilization for crop growth and their designs.

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

- Analyze hydro-meteorological data
- Estimate abstractions from precipitation
- Compute yield from surface and subsurface basin
- Develop rainfall-runoff models
- Formulate and solve hydrologic flood routing models
- Estimate runoff, design discharge from catchment

**UNIT - I**

Introduction to engineering hydrology and its applications, Hydrologic cycle, types and forms of precipitation, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, processing of rainfall data - Adjustment of record -Rainfall Double Mass Curve. Runoff- Factors affecting Runoff – Runoff over a Catchment- Empirical and Rational Formulae.

Abstraction from rainfall-evaporation, factors affecting evaporation, measurement of evaporation- Evapotranspiration- Penman and Blaney & Criddle Methods -Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices..

**UNIT - II**

Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

**UNIT - III**

Ground water Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, Darcy's law, radial flow to wells in confined and unconfined aquifers. Types of wells,- Well Construction – Well Development.

**UNIT - IV**

Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility –Crop Rotation, preparation of land for Irrigation, standards of quality for Irrigation water.

Soil-water-plant relationship, vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, Duty and delta, factors affecting duty- Design

discharge for a water course. Depth and frequency of Irrigation, irrigation efficiencies-Water Logging.

**UNIT - V**

Classification of canals, Design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting, IS standards for a canal design canal lining.

Design Discharge over a catchment, Computation of design discharge-rational formulae etc.

**TEXT BOOKS:**

1. Engineering Hydrology by K. Subramanya McGraw Education (India) Pvt Ltd, 2014.
2. Engineering Hydrology by Jayarami Reddy, Laxmi publications pvt. Ltd., New Delhi
3. Irrigation and Water Resources & Water Power by P. N. Modi, Standard Book House

**REFERENCES:**

1. Engineering Hydrology by CSP Ojha, R. Brendtsson and P. Bhunya Oxford University Press,2010
2. Irrigation and water power engineering by Punmia & Lal, Laxmi publications Pvt. Ltd., New Delhi
3. Applied hydrology by V.T. Chow, D.R. Maidment and L. W Mays McGraw Education (India) Pvt Ltd, 2014.
4. Hydrology in Practice by E. M. Shaw, K. J. Beven, CRC Press, 2015.

## FUNDAMENTALS OF MANAGEMENT

| B.Tech. III Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: SM504MS | 3 | 0/0/0 | 3 |

**Course Objective:** To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

**Course Outcome:** The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

**UNIT - I**

**Introduction to Management:** Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

**UNIT – II**

**Planning and Decision Making:** General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

**UNIT - III**

**Organization and HRM:** Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

**UNIT - IV**

**Leading and Motivation:** Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

**UNIT - V**

**Controlling:** Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

**TEXT BOOKS:**

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

**REFERENCES:**

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.

## CONCRETE TECHNOLOGY LAB

| B.Tech. III Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: CE505PC | 0 | 0/3/0 | 2 |

**Pre-Requisites:** Concrete Technology Theory

**Course Objectives:** The objectives of the course is to gain the practical knowledge of properties of concrete materials, behavior of concrete properties of fresh and hardened concrete

**Course Outcomes:** At the end of the course, the student will be able to:
Understand properties of concrete material, behavior of concrete & properties of fresh & hardened concrete

**I. Test on Cement**

1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity of cement
4. Soundness of cement.
5. Compressive strength of cement.
6. Workability test on concrete by compaction factor, slump and Vee-bee.

**II. Test on Aggregate**

1. Sieve Analysis and gradation chairs
2. Bulking of sand.
3. Bulk and compact densities of fine and coarse aggregates

**III. Test on Fresh Concrete**

1. Slump test
2. CF (compact factor stress)
3. Vee-bee Test
4. Flow Table Test

**Self Compacting Concrete**

1. Slump cone
2. V funnel
3. L Box

**IV. Test on hardened concrete**

1. compression test on cubes & Cylinders
2. flexure test
3. Splitting Tensile Test
4. Modulus of Elasticity

**V. Non Destructive test of concrete**

1. Rebound hammer
2. Ultrasound pulse Velocity (UPV)

**TEXT BOOK:**

1. Concrete Technology by M.S. Shetty – S. Chand & Co.
2. Concrete Manual by M.L. Gambhir, Dhanpat Rai & Sons

## GEOGRAPHICAL INFORMATION SYSTEMS LAB

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code: CE506PC** | **0** | **0/3/0** | **2** |

**Prerequisites:** Surveying

**Course Objectives:** To Develop GIS interface to field problems through geofencing.

**Course Outcomes:** At the end of the course, the student is exposed to spatial technologies, mapping the field problems and solution convergence through GIS.

**UNIT - I**
Development of georeferencing of maps either from cadastral or AutoCAD based map.

**UNIT - II**
Identification of best locations of ground control points and mosaicing the different sources of maps of information like topo sheets & satellite data and other drawings.

**UNIT - III**
Digitization and GIS coordination.

**UNIT - IV**
GIS interface and features using open Source Software QGIS.

**UNIT - V**
Case example on mapping like water distinguish, Road alignment road network etc.,

**TEXT BOOKS:**

1. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
2. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.
3. Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersey, 2001.
4. DeMers, M.N., Fundamentals of Geographic Information Systems, John Wiley & Sons, New York, 2000.
5. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.

## HYDRAULICS AND HYDRAULIC MACHINERY LAB

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code: CE507PC** | **0** | **0/3/0** | **2** |

**Pre Requisites**: HHM Theory

**Course Objectives:** To give the student an exposure to various hydraulic machines.

**Course Outcomes:** Hydraulics & Hydraulic Machinery

- Compute drag coefficients
- Test the performance of pumps and turbines
- Determine Manning's and Chezy's coefficients for smooth and rough channels
- Determine Energy loss in Hydraulic jump and Calibrate standing wave flume

1. Impact of jet on vanes
2. Study of Hydraulic jump in Open Channel.
3. Performance test on Pelton wheel turbine.
4. Performance test on Francis turbine.
5. Performance test on Kaplan turbine.
6. Performance characteristics of a single stage centrifugal pump.
7. Performance characteristics of a multi-stage centrifugal pump.
8. Performance characteristics of a reciprocating pump.
9. Study of Flow in Open Channel (Applying Chezy's and Manning's equations).
10. Determination of Coefficient of discharge for the given Weir (Sharp crested /Broad crested / Cippoletti weir).

## PROFESSIONAL ETHICS

| B.Tech. III Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: MC500HS | 3 | 0/0/0 | 0 |

**Course Objective:** To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

**Course Outcome:** The students will understand the importance of Values 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**

**Introduction to Professional Ethics**: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

**UNIT - II**

**Basic Theories:** Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

**UNIT - III**

**Professional Practices in Engineering:** Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

**UNIT - IV**

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

**UNIT - V**

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

**TEXT BOOKS:**

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

**REFERENCES:**

1. Engineering Ethics, Concepts Cases : Charles E Harris Jr., Michael S Pritchard , Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

## DESIGN OF STEEL STRUCTURES

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE601PC** | **4** | **1/0/0** | **4** |

**Pre-Requisites:** Structural Analysis I & II

**Course Objectives:** The objective of the course is to make the student conversant with the design principles of steel structural elements as per IS Codal provisions

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

- Design tension and compression members
- Design beams and beam columns
- Design bolt and weld connections
- Design built up members and Column base
- Design of plate girders and Roof Trusses

**UNIT – I**

Materials – types of structural steel – mechanical properties of steel – Concepts of plasticity – yield strength. Loads – and combinations local buckling behavior of steel. Concept of limit State Design – Limit States – Design Strengths- deflection limits – serviceability – stability check. Bolted connections – Riveted connections – IS – 800 – 2007 - specifications – Design strength – efficiency of joint – prying action. Welded connections – Types of welded joints – specifications - design requirements.

**UNIT – II**

Design of tension members – Design strength – Design procedure splice - lug angle.
Design of compress in members – Buckling class – slenderness ratio / strength design – laced – battened columns – splice – column base – slab base.

**UNIT – III**

Plastic Theory, Plastic hinge, Theorems of plastic Analysis Classifications of beams as per I.S 800-2007.
Design of Beams – Plastic moment – Bending and shear strength / buckling – Built up sections – laterally / supported beams - Design of eccentric connections – Framed – stiffened / seat connection.

**UNIT – IV**

Design of plate girders – elements – economical depth – design of main section – connections between web and flange – design of stiffness bearing – intermediate stiffeners – Design of Websplica & Flange splica.

**UNIT – V**

Design of roof trusses – Types of roof trusses, loads on trusses – purlin design – truss design, Design of joints and end bearings.

**TEXT BOOKS:**

1. Design of steel structures – N. Subramanian, Oxford University Press – 2009.
2. Limit State Design of steel structures, S.K. Duggal, Tata McGraw-Hill, 2010

**REFERENCES:**

1. Fundamental of Structural Steel Design by M L Gambhir MC Graw Hill Education Pvt Ltd 2013
2. Design of Steel Structures Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer Tata McGraw-Hill Education pvt. Ltd.
3. Design of steel structures, S.S. Bhavikatti, IK International Publication House, New Delhi, 2010.
4. Structural Design and Drawing by N. Krishna Raju, Universities Press.
5. Design of Steel structures by K.S. Sai Ram, Person Education.

## ENVIRONMENTAL ENGINEERING

| B.Tech. III Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: CE602PC | 4 | 0/0/0 | 4 |

**Course Objectives:** This subject provides the knowledge of water sources, water treatment, design of distribution system waste water treatment, and safe disposal methods. The topics of characteristics of waste water, sludge digestion are also included.

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

- Analyze characteristics of water and wastewater
- Estimate the quantity of drinking water and domestic wastewater generated
- Design components of water supply systems Design sewerage system

**UNIT – I**

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

**UNIT – II**

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices- Miscellaneous treatment methods.

**UNIT – III**

Distribution systems requirement –method and layouts -Design procedures- Hardy Cross and equivalent pipe methods pipe – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house - Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow

**UNIT - IV**

characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – components requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming – dilution.

**UNIT – V**

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – standard and high rate – Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

**TEXT BOOKS:**

1. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanog lous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Water Supply & Environmental Engineering by A.K. Chatterjee.
4. Water Supply and sanitary Engineering by G.S. Bindi, Dhanpat Rai & Sons Publishers.

**REFERENCES:**

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.

## SOIL MECHANICS

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE603PC** | **4** | **0/0/0** | **4** |

**Pre-Requisites:** Engineering Geology, Applied Mechanics, Fluid Mechanics

**Course Objectives:** To enable the student to study the properties of soil and to determine the behaviour soil under various conditions and loads.

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

- Understand the mechanism Behaviour of Soil for different loads
- and from Soil Condition will be able to determine properties of soil

**UNIT – I**

Introduction: Soil formation and structure – moisture content – Mass- volume relationship – Relative density.

Index Properties Of Soils**:** Grain size analysis – Sieve–

**UNIT – II**

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law-permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered soils – In-situ permeability tests (Pumping in & Pumping out test).

Effective Stress & Seepage Through Soils**:** Total, neutral and effective stress – principle of effective stress - quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

**UNIT – III**

Stress Distribution In Soils**:** Boussinesq's and Westergaard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and Newmark's influence chart for irregular areas.

Compaction: Mechanism of compaction – factors affecting compaction effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

**UNIT – IV**

Consolidation**:** Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil - preconsolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods - computation of total settlement and time rate of settlement.

**UNIT - V**

Shear Strength Of Soils: Importance of shear strength **–** Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops – Shear strength of sands - dilatancy – critical void ratio.

**TEXT BOOKS:**

1. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers, 8th Edition, (2014).
2. Geotechnical Engineering Principles and Practices by Cuduto, PHI International
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt. Ltd.

**REFERENCES:**

1. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw Hill Publishers New Delhi.
2. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
3. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

## AIR POLLUTION AND CONTROL
## (Professional Elective - I)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | |
| **Course Code**: **CE611PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Environmental Engineering

**Course Objectives:** The subject provides the knowledge of various effects of Air pollution on human beings and Vegetation and Materials. The topics of control methods, details of control equipment, and the methods of controlling gaseous are also included. The objective of the course is to study the moment, occurrence of ground water and its development and management.

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

- Identify sampling and analysis techniques for air quality assessment
- Describe the plume behavior for atmospheric stability conditions
- Able to control air pollution by properties various techniques to control

**UNIT – I**

Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non-Point, Line and Areal Sources of air pollution- stationary and mobile sources.

**UNIT – II**

Effects of Air pollutants on man, material and vegetation; Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.

**UNIT - III**

Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like $SO_x$; $NO_x$; CO; HC etc., air-fuel ratio. Computation and Control of products of combustion.
Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity; Influence of Meteorological phenomena on Air Quality-wind rose diagrams.

**UNIT - IV**

Lapse Rates, Pressure Systems, Winds and moisture plume behavior and plume Rise Models; Gaussian Model for Plume Dispersion.
Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control.
Equipment's – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

**UNIT – V**

General Methods of Control of $NO_x$ and $SO_x$ emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.
Air Quality Management – Monitoring of SPM, $SO_x$; $NO_x$ and CO Emission Standards.

**TEXT BOOKS:**

1. Air pollution By M. N. Rao and H. V. N. Rao – Tata McGraw Hill Company.
2. Air pollution by Wark and Warner. - Harper & Row, New York.

**REFERENCE:**

1. Air pollution and control By K.V.S.G. Murali Krishna, Kaushal Publishers. Kakinada.

## ADVANCED STRUCTURAL ANALYSIS
## (Professional Elective-I)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | |
| **Course Code**: **CE612PE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To understand the influence line concepts for indeterminate structures
- To understand the methods of analysis of intermediate trusses for external loads, lack of fit and thermal effect
- To study behavior of arches and their methods of analysis
- To know the concept and analysis of cable stayed bridge
- To study the multi storey frames subjected to gravity loads and lateral loads

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

- Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames.
- Apply the methods of indeterminate truss analysis
- Demonstrate the behavior of arches and their methods of analysis analyze cable suspension bridges
- Analyze multistory frames subjected to gravity loads and lateral loads

**UNIT – I**

**Analysis of Frames:** Castigliano's second theorem

**Indeterminate Trusses:** Determination of static and kinematic indeterminacies – Analysis of trusses having single and two degrees of internal and external indeterminacies.

**Two Hinged Arches:** Introduction – Classification of Two hinged Arches – Analysis of two hinged parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening of rib.

**UNIT - II**

**Slope Deflection Method:** Analysis of Single Bay – single storey Portal Frames by Slope Deflection Method Including Side Sway. Shear force and bending moment diagrams. Elastic curve, Analysis of inclined frames

**Moment Distribution Method** - Analysis of Single Bay Single Storey Portal Frames including side Sway. Analysis of inclined frames.

**UNIT – III**

**Kani's Method**: Analysis of continuous beams including settlement of supports. Analysis of single bay single storey and single bay two Storey Frames by Kani's Method Including Side Sway. Shear force and bending moment diagrams. Elastic curve.

**UNIT – IV**

**Matrix Methods of Analysis:** Introduction – Static and Kinematic Indeterminacy - Analysis of continuous beams including settlement of supports, using stiffness method. Analysis of pin-jointed plane frames using stiffness method- Analysis of single bay single storey frames including side sway, using stiffness method. Analysis of continuous beams upto three degree of indeterminacy using flexibility method. Shear force and bending moment diagrams.

.

**UNIT – V**

**Approximate Methods of Analysis:** Introduction – Analysis of multi-storey frames for lateral loads: Portal Method, Cantilever method and Factor method. Analysis of multi-storey frames for gravity (vertical) loads. Substitute Frame method.

**Influence Lines for Indeterminate Beams:** Introduction – ILD for two span continuous beams with constant and variable moments of inertia. ILD for propped cantilever beams. Muller Breslau's principle.

**TEXT BOOKS:**

1. Structural Analysis Vol – I &II by Vazarani and Ratwani, Khanna Publishers.
2. Structural Analysis Vol I & II by Pundit and Gupta. Tata McGraw Hill Publishers.
3 Structural Analysis SI edition by Aslam Kassimali, Cengage Learning

**REFERENCES:**

1. Matrix Analysis of Structures by Singh, Cengage Learning Pvt. Ltd.
2. Structural Analysis by R. C. Hibbeler Pearson Education.
3. Basic Structural Analysis by C. S. Reddy., Tata McGraw Hill Publishers.
4. Matrix Analysis of Structures by Pundit and Gupta. Tata McGraw Hill Publishers.
5. Advanced Structural Analysis by A. K. Jain, Nem Chand Bros

## GROUND WATER DEVELOPMENT AND MANAGEMENT
## (Professional Elective - I)

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE613PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Water Resources Engineering

**Course Objectives:** The objective of the course is to study the moment, occurrence of ground water and its development and management

**Course Outcomes:** At the end of the course, the student will be able to Understand Ground Water occurrence, Ground Water Movement Well constructional etc..

**UNIT – I**
Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

**UNIT – II**
Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water flow contours their applications.

**UNIT – III**
Steady groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well Well interface and well tests – Recuperation Test.

Unsteady flow towards a well – Non equilibrium equations – Theis' solution – Jocob and Chow's simplifications, Leaky aquifers – Well Interference.

**UNIT – IV**
Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Ground Water: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies.

**UNIT – V**
Well Construction – Drilling Equipment used for Well Construction – Bore log – Interpretation of Log Data.

Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunction use, Case studies.

**TEXT BOOKS:**

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
2. Groundwater by H. M. Raghunath, Wiley Eastern Ltd.
3. Ground Water Hydrology by D.K. Todd and L.R Mays John Willey.

**REFERENCES:**

1. Groundwater Hydrology by Bower, John Wiley & sons.
2. Groundwater System Planning & Management – R. Willes & W. W. G. Yeh, Prentice Hall.
3. Applied Hydrogeology by C. W. Fetta, CBS Publishers & Distributers.

## EARTH AND ROCKFILL DAMS AND SLOPE STABILITY
## (Professional Elective-I)

| B.Tech. III Year II Sem. | L | T/P/D | C |
|---|---|---|---|
| Course Code: CE614PE | 3 | 0/0/0 | 3 |

**Course Objectives:**

- Have an understanding of seismic design concepts and current practices for earth dams and other similar structures to enable them to plan and direct the construction activity appropriately.
- Understand the soil dynamic testing procedure and methodology of seismic design to be able to execute a proper design.
- Have a clear understanding of design methodology and the interpretation in the seismic codes.

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

- Describe the behaviour of natural and engineered soil / rock slopes under various weather and engineering conditions.
- Explain the factors that may affect the stability of slopes.
- Select an appropriate slope stability analysis method subject to geometry of slope, material properties, and uncertainty of observations.
- Assess the potential landslide risk of slopes.

**UNIT - I**

**Earth and Rockfill Dams**: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

**UNIT - II**

**Failures, Damages and Protection of Earth Dams**: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design.

**UNIT - III**

**Slope Stability Analysis**: Types of Failure: Failure surfaces - Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes. Taylor Charts.

**UNIT - IV**

**Methods of Slope Stability**: Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Janbu Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime treatment), surface protection (vegetation/erosion control mats/shotcrete).

**UNIT - V**

**Rockfill Dams**: Requirements of compacted rockfill, Shear strength of rockfill, Rockfill mixtures, Rockfill embankments, Earth-core Rockfill dams, Stability, Upstream & Downstream slopes.

**TEXT BOOK:**

1. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963

**REFERENCES:**

1. Bharat Singh and Sharma, H. D. – Earth and Rockfill Dams, 1999
2. Sowers, G. F. and Salley, H. I. – Earth and Rockfill Dams, Willams, R.C., and Willace, T.S. 1965.
3. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilization methods – John Wiley & sons. (2002)
4. Bromhead, E. N. (1992). The Stability of Slopes, Blackie academic and professional, London.
5. Christian, Earth & Rockfill Dams – Principles of Design and Construction, Kutzner Published Oxford and IBH.
6. Ortiago, J. A. R. and Sayao, A. S. F. J. - Handbook of Slope Stabilization, 2004.

## SOIL MECHANICS LAB

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE604PC** | **0** | **0/3/0** | **2** |

**Pre-Requisites:** Soil Mechanics (Co-requisite)

**Course Objectives:** To obtain index and engineering properties of locally available soils, and to understand the behavior of these soil under various loads.

**Course Outcomes:** At the end of the course, the student will be able to Classify and evaluate the behavior of the soils subjected to various loads.

**LIST OF EXPERIMENTS**

1. Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
2. a) Field density by core cutter method and
   b) Field density by sand replacement method
3. Determination of Specific gravity of soil Grain size distribution by sieve analysis
4. Permeability of soil by constant and variable head test methods
5. Standard Proctor's Compaction Test
6. Determination of Coefficient of consolidation (square root time fitting method)
7. Unconfined compression test
8. Direct shear test
9. Vane shear test
10. Differential free swell index (DFSI) test

**REFERENCE:**

1. Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International

## COMPUTER AIDED DRAFTING – II LAB

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE605PC** | **0** | **0/3/0** | **2** |

**Pre-Requisites:** CAD Lab – I & Excel, C - Programming

**Course Objectives:** To make students understand detailing of all kinds of structures such as reinforced concrete, plain concrete, steel structures.

**Course Outcomes:** At the end of the course, the student will be able to Student can draft various structures

1. Detailing of reinforcement in Cantilever, Simply supported and Continuous Beams (Both Singly & Doubly Reinforced Beams)
2. Detailing of reinforcement in canopy & columns (both uniaxial & biaxial)
3. Detailing of reinforcement in RC isolated footings square, rectangular, circular and combined footings.
4. Detailing of reinforcement in RC one-way, two-way slabs and dog-legged staircases.
5. Drawing of Steel bolted and welded connections.
6. Drawing of steel compression and tension members.
7. Drafting of steel beams-built-up sections.
8. Drafting of steel plate girder
9. Drafting of steel roof truss.

**Note:** Drafting of all the exercises is to be carried out using commercially available drafting softwares.

## ADVANCED ENGLISH COMMUNICATION SKILLS (AECS) LAB

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **EN606HS** | **0** | **0/3/0** | **2** |

**Introduction**

A course on *Advanced English Communication Skills (AECS) Lab* is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

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

- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioral skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

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

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

**Syllabus**

The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. **Inter-personal Communication and Building Vocabulary** - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.
2. **Reading Comprehension** –General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.
3. **Writing Skills** – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.

4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments… etc.,
5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process, Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

**Minimum Hardware Requirement**

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**
- **Eight round tables with five movable chairs for each table.**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **Computer with suitable configuration**

**Suggested Software:**

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

- **Oxford Advanced Learner's Compass**, 8th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**

**REFERENCES:**

1. Kumar, Sanjay and Pushp Lata. ***English for Effective Communication***, Oxford University Press, 2015.
2. Konar, Nira. ***English Language Laboratories – A Comprehensive Manual,*** PHI Learning Pvt. Ltd., 2011.

# TRANSPORTATION ENGINEERING

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE701PC** | **4** | **0/0/0** | **4** |

**Pre-Requisites:** Surveying

**Course Objectives:** It deals with different components of Transportation Engineering like highway; Railway & Airport Engineering Emphasis is a Geometric Design of different elements in Transportation Engineering.

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

- Understand Plan highway networks
- Design highway geometrics.
- Design Intersections and prepare traffic management plans.
- Design flexible and rigid pavements.

**UNIT - I**

**Highway Development and Planning**: Highway Development in India – Necessity for Highway Planning- Different Road Development Plans; Classification of Roads - Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports – Highway Project.

**UNIT – II**

**Highway Geometric Design:** Importance of Geometric Design - Design controls and Criteria - Highway Cross Section Elements - Sight Distance Elements- Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance - Design of Horizontal Alignment - Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical alignment-Gradients- Vertical curves.

**UNIT – III**

**Traffic Engineering & Regulations:** Basic Parameters of Traffic-Volume, Speed and Density - Traffic Volume Studies - Data Collection and Presentation - Speed studies - Data Collection and Presentation - Origin & Destination studies, Parking Studies – Onstreet & Off street Parking - Road Accidents - Causes and Preventive Measures - Accident Data Recording – Condition Diagram and Collision Diagrams - Traffic Signs – Types and Specifications – Road Markings - Need for Road Markings-Types of Road Markings - Design of Traffic Signals – Webster Method.

**UNIT – IV**

**Intersection Design:** Types of Intersections – Conflicts at Intersections – Requirements of At-Grade Intersections - Types of At-Grade Intersections: Channelized and Unchannelized Intersections – Traffic Islands - Types of Grade Separated Intersections - Rotary Intersection – Concept of Rotary – Design Factors of Rotary – Advantages and Limitations of Rotary Intersections.

**UNIT - V**

**Pavement Design:** Design of Pavements: Design of Flexible pavement by CBR method as per IRC 37-2012 and theory of empirical mechanistic method. Stresses in rigid pavement by westergards and IRC methods. Design of overlay by Benkelman beam method.

**TEXT BOOKS:**

1. Highway Engineering – S. K. Khanna & C. E. G. Justo, Nemchand & Bros., 7th edition (2000).
2. Traffic Engineering & Transportation Planning – Dr. L. . Kadyali, Khanna Publications – 6th Edition – 1997.

**REFERENCES:**

1. Principles of Traffic and Highway Engineering – Garber & Hoel, Cengage Learning.
2. Principles and Practices of Highway Engineering – Dr. L. R. Kadiyali and Dr. N. B Lal - Khanna Publications.
3. Highway Engineering – S. P. Bindra , Dhanpat Rai & Sons. – 4th Edition (1981)
4. IRC 37-2012 : Tentative guidelines for design of flexible pavement
5. IRC 58-2011: Guidelines for design of plain jointed rigid pavements.
6. IRC 81-1997 : Guidelines for design of overlay using Benkalman Beam Deflection Technique

# SOIL MECHANICS

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN702PC** | **4** | **0/0/0** | **4** |

**Pre-Requisites:** Engineering Geology, Applied Mechanics, Fluid Mechanics

**Course Objectives:** To enable the student to study the properties of soil and to determine the behaviour soil under various conditions and loads.

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

- Understand the mechanism Behaviour of Soil for different loads
- and from Soil Condition will be able to determine properties of soil

**UNIT – I**

Introduction: Soil formation and structure – moisture content – Mass- volume relationship – Relative density.

Index Properties Of Soils**:** Grain size analysis – Sieve–

**UNIT – II**

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law-permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered soils – In-situ permeability tests (Pumping in & Pumping out test).

Effective Stress & Seepage Through Soils**:** Total, neutral and effective stress – principle of effective stress - quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

**UNIT – III**

Stress Distribution In Soils**:** Boussinesq's and Westergaard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and Newmark's influence chart for irregular areas.

Compaction: Mechanism of compaction – factors affecting compaction effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

**UNIT – IV**

Consolidation**:** Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil - preconsolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods - computation of total settlement and time rate of settlement.

**UNIT - V**

Shear Strength Of Soils: Importance of shear strength **–** Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops – Shear strength of sands - dilatancy – critical void ratio.

**TEXT BOOKS:**

1. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers, 8th Edition, (2014).
2. Geotechnical Engineering Principles and Practices by Cuduto, PHI International
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt. Ltd.

**REFERENCES:**

1. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw Hill Publishers New Delhi.
2. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
3. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

# PRESTRESSED CONCRETE
## (Professional Elective - II)

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN721PE/CE732PE** | **3** | **0/0/0** | **3** |

**Pre-Requisites:** Reinforced Concrete Design

**Course Objectives:** Prestressing is the techniques often used in bridges and other structural elements for longer span and hearer loads. This subject covers various aspects of prestressing and design techniques to give the student an overall exposure in the analysis and design of Prestressed concrete structures.

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

- Able to design prestressed concrete structures
- Understand the concepts of pre-stressing in concrete structures and identify the Materials for pre-stressing
- Analysis of sections for flexure and shear
- Understand the concepts of transfer of prestress in pretensioned members
- Analysis of composite beams and importance of deflections

**UNIT - I**

**Introduction:** Historic development- General principles of prestressing pretensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing- Materials- high strength concrete and high tensile steel their characteristics.

**UNIT - II**

**Methods and Systems of prestressing:** Pretensioning and Post tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system. **Losses of Prestress:** Loss of prestress in pre-tensioned and post-tesnioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses IS 1343-2012 code provisions

**UNIT - III**

**Flexure:** Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams- Elastic design of PSC slabs and beams of rectangular and I sections- Kern line – Cable profile and cable layout.

**Shear:** General Considerations- Principal tension and compression- Improving shear resistance of concrete by horizontal and vertical prestressing and by using inclined or parabolic cables- Analysis of rectangular and I beams for shear – Design of shear reinforcements- IS Code provisions**.**

**UNIT - IV**

**Transfer of Prestress in Pretensioned Members :** Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS code provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by Guyon, Magnel, Zienlinski and Rowe's methods – Anchorage zone reinforcement- IS 1343-2012 code Provisions

**UNIT - V**

**Composite Beams:** Different Types- Propped and Unpropped- stress distribution- Differential shrinkage- Analysis of composite beams- General design considerations.

**Deflections:** Importance of control of deflections- Factors influencing deflections – Short term deflections of uncracked beams- prediction of long time deflections- IS code requirements.

**REFERENCES:**

1. Prestressed concrete by Krishna Raju, Tata Mc Graw Hill Book – Co. New Delhi.
2. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, New York.
3. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.
4. Prestressed Concrete by N. Rajagopalan Narosa Publishing House

# IRRIGATION AND HYDRAULIC STRUCTURES
## (Professional Elective - II)

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN722PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Water Resources Engineering

**Course Objectives:** To study various types of reservoirs and diversion headwork. The subject also covers the topics such as gravity dams and earth dams.

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

- Plan an Irrigation System
- Design irrigation canals and canal network
- Plan and design diversion head works
- Design irrigation canal structures
- Analyze gravity and earth dams
- Design spillways and energy dissipations works
- Analyze and design gravity dams

**UNIT - I**

Storage Works-Reservoirs - Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve-Reservoir Sedimentation – Life of Reservoir.. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

**UNIT - II**

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile, and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety - Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.

**UNIT - III**

Earth dams: types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage. Spillways: types of spillways, Design principles of Ogee spillways - Spillway gates. Energy Dissipaters and Stilling Basins Significance of Jump Height Curve and Tail Water Rating Curve - USBR and Indian types of Stilling Basins.

**UNIT - IV**

Diversion Head works: Types of Diversion head works- weirs and barrages, layout of diversion head work - components. Causes and failure of Weirs and Barrages on permeable foundations,-Silt Ejectors and Silt Excluders

Weirs on Permeable Foundations – Creep Theories - Bligh's, Lane's and Khosla's theories, Determination of uplift pressure- Various Correction Factors – Design principles of weirs on permeable foundations using Creep theories - exit gradient, U/s and D/s Sheet Piles - Launching Apron.

**UNIT - V**

Canal Falls - types of falls and their location, Design principles of Notch Fall and Sarada type Fall.

Canal regulation works, principles of design of distributor and head regulators, Canal Cross Regulators -canal outlets, types of canal modules, proportionality, sensitivity and flexibility. Cross Drainage works: types, selection of site, Hydropower- classification, and principal components of hydroelectric power plants.

**TEXT BOOKS:**

1. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers.
2. Irrigation engineering by K. R. Arora Standard Publishers.
3. Irrigation and water power engineering by Punmia & Lal, Laxmi publications Pvt. Ltd., New Delhi

**REFERENCES:**

1. Theory and Design of Hydraulic structures by Varshney, Gupta & Gupta
2. Irrigation Engineering by R.K. Sharma and T.K. Sharma, S. Chand Publishers 2015.
3. Irrigation Theory and Practice by A. M. Micheal Vikas Publishing House 2015.

# ADVANCED STRUCTURAL ANALYSIS
## (Professional Elective - II)

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN723PE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To understand the influence line concepts for indeterminate structures
- To understand the methods of analysis of intermediate trusses for external loads, lack of fit and thermal effect
- To study behavior of arches and their methods of analysis
- To know the concept and analysis of cable stayed bridge
- To study the multi storey frames subjected to gravity loads and lateral loads

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

- Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames.
- Apply the methods of indeterminate truss analysis
- Demonstrate the behavior of arches and their methods of analysis analyze cable suspension bridges
- Analyze multistory frames subjected to gravity loads and lateral loads

**UNIT – I**

**Analysis of Frames:** Castigliano's second theorem

**Indeterminate Trusses:** Determination of static and kinematic indeterminacies – Analysis of trusses having single and two degrees of internal and external indeterminacies.

**Two Hinged Arches:** Introduction – Classification of Two hinged Arches – Analysis of two hinged parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening of rib.

**UNIT - II**

**Slope Deflection Method:** Analysis of Single Bay – single storey Portal Frames by Slope Deflection Method Including Side Sway. Shear force and bending moment diagrams. Elastic curve, Analysis of inclined frames

**Moment Distribution Method** - Analysis of Single Bay Single Storey Portal Frames including side Sway. Analysis of inclined frames.

**UNIT – III**

**Kani's Method**: Analysis of continuous beams including settlement of supports. Analysis of single bay single storey and single bay two Storey Frames by Kani's Method Including Side Sway. Shear force and bending moment diagrams. Elastic curve.

**UNIT – IV**

**Matrix Methods of Analysis:** Introduction – Static and Kinematic Indeterminacy - Analysis of continuous beams including settlement of supports, using stiffness method. Analysis of pin-jointed plane frames using stiffness method- Analysis of single bay single storey frames including side sway, using stiffness method. Analysis of continuous beams upto three degree of indeterminacy using flexibility method. Shear force and bending moment diagrams.

.

**UNIT – V**

**Approximate Methods of Analysis:** Introduction – Analysis of multi-storey frames for lateral loads: Portal Method, Cantilever method and Factor method. Analysis of multi-storey frames for gravity (vertical) loads. Substitute Frame method.

**Influence Lines for Indeterminate Beams:** Introduction – ILD for two span continuous beams with constant and variable moments of inertia. ILD for propped cantilever beams. Muller Breslau's principle.

**TEXT BOOKS:**

1. Structural Analysis Vol – I &II by Vazarani and Ratwani, Khanna Publishers.
2. Structural Analysis Vol I & II by Pundit and Gupta. Tata McGraw Hill Publishers.
3 Structural Analysis SI edition by Aslam Kassimali, Cengage Learning

**REFERENCES:**

1. Matrix Analysis of Structures by Singh, Cengage Learning Pvt. Ltd.
2. Structural Analysis by R. C. Hibbeler Pearson Education.
3. Basic Structural Analysis by C. S. Reddy., Tata McGraw Hill Publishers.
4. Matrix Analysis of Structures by Pundit and Gupta. Tata McGraw Hill Publishers.
5. Advanced Structural Analysis by A. K. Jain, Nem Chand Bros

# CONSTRUCTION MANAGEMENT
## (Professional Elective – II)

| B.Tech. IV Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| **Course Code**: **CN724PE** | 3 | 0/0/0 | 3 |

**Pre Requisites**: Building Materials & Building Construction

**Course Objectives:**

- This subject deals with overall planning, coordination and control of projects.
- This course gives the students scientific principles involved in construction , an understanding of the behavior of construction materials and fundamentals of structural mechanics.

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

- Able to clarify construction project
- Understand contracts
- Able to perform construction operation planning & management

**UNIT - I**

Management process- Roles management theories Social responsibilities planning and strategic management strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

**UNIT - II**

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications .Preliminary Planning- Collection of Data- Contract Planning – Scientific Methods of Management: Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.

**UNIT - III**

Resource planning - planning for manpower, materials, costs, equipment. Labour, - Scheduling .Forms of scheduling - Resource allocation . budget and budgetary control methods

**UNIT - IV**

Contract - types of contract, contract document, specification, important conditions of contract – tender and tender document - Deposits by the contractor - Arbitration . negotiation - M. Book - Muster roll -stores.

**UNIT - V**

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance

and Safety Regulations - Workmen's Compensation Act -other labour Laws - Safety in construction: legal and financial aspects of accidents in construction. Occupational and safety hazard assessment. Human factors in safety. Legal and financial aspects of accidents in construction. Occupational and safety hazard assessment

**TEXT BOOKS:**

1. Ghalot, P.S., Dhir,D.M., Construction Planning and Management, Wiley Eastern Limited,1992.
2. Chitkara,K.K., Construction Project Management¸ Tata McGraw Hill Publishing Co, Ltd., New Delhi,998.
3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987.

**REFERENCE:**

1. Construction Management and Planning by: sengupta, b. guha, Tata McGraw-hill publications

# SOLID WASTE MANAGEMENT
## (Professional Elective - III)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code**: **CN731PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Environmental Engineering

**Course Objectives:** To make the students to understand solid waste, its collection, process and disposal

**Course Outcomes:** At the end of the course, the student will be able to understand solid waste, its collection, process disposal

**UNIT - I**

Solid Waste and their Handling: Definition of solid wastes – types of solid wastes – Sources - Industrial, mining, agricultural and domestic – Characteristics. Solid waste Characteristics – Proximate and Ultimate analysis. - Impact on environmental health- Elements of Solid Waste Management.

**UNIT - II**

Collection, Segregation and Transport Management of Municipal Solid Wastes: Handling and segregation, Collection and storage of municipal solid wastes; Analysis of Collection systems. Transfer stations – labeling and handling of hazardous wastes. Stationary container system, hanked container system-routing for collection of solid waste, Transfer stations.

**UNIT - III**

Solid waste processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery: composting - types, vermicomposting, termigradation, fermentation. Incineration of solid wastes. Design principles.

**UNIT - IV**

Disposal in landfills: site selection, design, and operation of sanitary landfills; Leachate and landfill gas management; landfill closure and post-closure environmental monitoring; landfill remediation. Regulatory aspects of municipal solid waste management, Leachate management.

**UNIT - V**

Hazardous Waste and Management: Hazardous waste definition. Physical and biological routes of transport of hazardous substances – sources and characterization. Sampling and analysis of hazardous wastes –proximate analysis – survey analysis – directed analysis handling, collection, storage and transport. Hazardous waste treatment technologies TSDF

concept - Physical, chemical and thermal treatment of hazardous waste: solidification, chemical fixation, encapsulation, pyrolysis and incineration. Hazardous waste landfills - Site selections, design and operation. HW reduction, recycling and reuse, Regulatory aspects of HWM/HWM rules- Bio Medical Waste Management. E Waste Management

**TEXT BOOKS:**

1. Hazardous waste management Charles A. Wentz. Second edition 1995. McGraw Hill International.
2. Integrated solid waste management George Tchobanoglous, Hilary Theisen & Samuel A. Vigil.

**REFERENCES:**

1. Solid waste Engineering by William A. Worrel, and P. Aarne Vesilind Cengage Learning 2012.
2. Criteria for hazardous waste landfills – CPCB guidelines 2000.
3. Standard handbook of Hazardous waste treatment and disposal by Harry M. Freeman, McGraw Hill 1997.
4. Management of Solid waste in developing countries by Frank Flintoff, WHO regional publications 1976.

# GROUND WATER DEVELOPMENT AND MANAGEMENT
## (Professional Elective - III)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code**: **CN732PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Water Resources Engineering

**Course Objectives:** The objective of the course is to study the moment, occurrence of ground water and its development and management

**Course Outcomes:** At the end of the course, the student will be able to Understand Ground Water occurrence, Ground Water Movement Well constructional etc..

**UNIT – I**

Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

**UNIT – II**

Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water flow contours their applications.

**UNIT – III**

Steady groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well Well interface and well tests – Recuperation Test.

Unsteady flow towards a well – Non equilibrium equations – Theis' solution – Jocob and Chow's simplifications, Leaky aquifers – Well Interference.

**UNIT – IV**

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Ground Water: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies.

**UNIT – V**

Well Construction – Drilling Equipment used for Well Construction – Bore log – Interpretation of Log Data.

Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunction use, Case studies.

**TEXT BOOKS:**

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
2. Groundwater by H. M. Raghunath, Wiley Eastern Ltd.
3. Ground Water Hydrology by D.K. Todd and L.R Mays John Willey.

**REFERENCES:**

1. Groundwater Hydrology by Bower, John Wiley & sons.
2. Groundwater System Planning & Management – R. Willes & W. W. G. Yeh, Prentice Hall.
3. Applied Hydrogeology by C. W. Fetta, CBS Publishers & Distributers.

# INDUSTRIAL WASTE WATER TREATMENT
## (Professional Elective - III)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code**: **CN733PE** | **3** | **0/0/0** | **3** |

**Prerequisite**: Environmental Engineering

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

- 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:**

1. Wastewater Treatment – Concepts and Design Approach, by G L Karia and R A Christian, Prentice Hall of India, 2006
2. Environmental Engineering by Gerard Kiely, McGraw Hill Education (India) Pvt Ltd, 2013
3. Environmental Engineering – A Design Approach by A. P. Sincero and G A Sincero, Prentice Hall of India, 2014

**REFERENCES:**

1. Wastewater Engineering - Collection, Treatment, Disposal and Reuse by Metcalf and Eddy, , McGraw Hill Education (India) Pvt Ltd, 2013
2. Industrial Waste Treatment by Nelson Leonard Nemerow, Butterworth-Heinemann, 2007.
3. Biological Process Designs for Wastewater Treatment by Benefield L.D. and Randall C.D. Prentice Hall Pub. Co., 1980

# ECOLOGY AND MICROBIOLOGY
## (Professional Elective - III)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code**: **CN734PE** | **3** | **0/0/0** | **3** |

**Course Objectives:** To understand about ecology, biodiversity and the growth of microorganism

**Course Outcomes:** At the end of the course, the student should be able to understand about ecosystem, biodiversity microorganisms and sources of energy.

**UNIT - I**

**Ecosystems:** Definition, Concept of ecosystem; Biotic, a biotic and ecological systems. Structure, functions and classification of ecosystems. Ecological pyramids.

Ecological energetic: Flow of energy through food chains and food webs; Laws of thermodynamics; entropy, ecological efficiency; bio concentration and biomagnifications Biogeochemical cycles or Nutrient Cycles: sedimentary cycles; Causes and consequences of disruption of nutrient cycles with reference to Greenhouse gases and $SO_x$. Hydrological cycle.

**UNIT - II**

**Population ecology, biodiversity and its conservation:** Concept of a species and definition of a population. Biological and group attributes of populations. Density, natality, mortality, migrations and growth of populations. Natural regulation of populations. Human population explosion and its consequences. Food, fodder, fibre, fuel, timber and medicines. Forests and the ecological implication of depletion of forests, conservation of biodiversity.

**UNIT - III**

**Natural resources:** Classification of natural resources, biotic resources; Renewable and non-renewable resources: mutable and immutable resources; Different types of resources and their natural sources. Demographic quotient; rate of consumption and depletion. Value system, equitable resource use.

Distribution and exploitation; environmental implications of mining; strategies for conservation of mineral resources, land evaluation and suitability, land use/land cover mapping, LU/LC for Environmental Planning.

Renewable and non-renewable resources energy; Alternate and additional sources of energy; depletion of energy resources; Conservation of energy resource; Energy use efficiency. Solar radiation and its technological ways of harvesting; Solar collectors, photovoltaic, solar ponds; Hydroelectric power, Tidal, Ocean Thermal Energy Conversion, Wind, Geothermal Energy, Nuclear energy-fission and fusion, Hydrogen & Fuel cells.

**UNIT - IV**

**Diversity of micro organisms:** Prokaryotes and eukaryotes, eukaryotic and prokaryotic cell structure. General characters, beneficial and harmful effects of major groups of microorganisms, protozoa, algae, fungi, bacteria and viruses.

**UNIT - V**

**Microbial Growth And Nutrition:** Microbial nutrition, Nutritional requirements, major elements, minor elements trace metals and growth factors, Nutrient media (selective, differential, enriched, enrichment and special purpose media) and growth conditions. Nutritional types based on energy source, principal carbon source, electron donor. Proto and auxotrophs, copio and oligotrophs, phago and osmotrophs. Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, methods for determining growth (bacterial numbers, mass and cell constituents). Physiology of growth, bacterial growth curve, Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat), synchronous growth.

**REFERENCES:**


1. Fundamentals of Ecology by EP odum, WB Saurders & Co., 5th edition.
2. Environment and Natural Resources conservation by Trivedi R.K, 2002.
3. Remote sensing in Geology to Seigal, John wiely 1999.
4. Environmental Microbiology – Maier, R.M; Pepper, L; Gerba, C.P.-2009-2nd edition Academic Press.
5. Microbiology – Pelczar, K.J; Chan, E.C.S; Kreig, N.R.-2008-5th edition – Tata Mc Graw-Hill Publishing Biotechnology: the science & the business-Moses, V; Springham, D.G; cape, R.E-1999-2nd edition-
6. Microbial Biotechnology – Glazer, A.N; Nikaido, H-2007-2nd edition.
7. Microbiology Prescott, L., Joahnne M.Willey, Linda M. Sherwood, Christopher J. Woolverton-2010, 8th Edition, Mc Graw-Hill publishing company.

# CONSTRUCTION TECHNOLOGY AND MANAGEMENT
## (Professional Elective - IV)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code**: **CE722PE/CN741PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Building Materials & Building Construction

**Course Objectives:**

- This subject deals with overall planning, coordination and control of projects.
- This course gives the students scientific principles involved in construction, an understanding of the behavior of construction materials and fundamentals of structural mechanics.

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

- Understand the roles and responsibilities of a project manager
- Prepare schedule of activities in a construction project
- Identify the equipment used in construction
- Understand safety practices in construction industry
- Prepare tender and contract document for a construction project

**UNIT - I**

Management -Fundamentals of construction project management: Introduction, Project Initiation and Planning.

**UNIT - II**

Planning of construction facilities - Earthwork construction - Equipment for construction, Construction Finances – decision making, Cement concrete construction- Construction of Piles - Construction of Cofferdams - Construction of Tunnels.

**UNIT - III**

Development of project activity networks, Precedence Diagram Method, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Line Balance Methods in scheduling, Time Value of Money, Investment Analysis, Cost-Benefit Analysis.

**UNIT - IV**

Introduction to Building Information Modelling (BIM), Lean construction, and Integrated Project Delivery in construction, Crashing of project, Cost Optimization, Invoicing, Preparation of RA bill, Safety in construction, Estimation.

**UNIT - V**

Contracts: Contracts in construction, fundamentals of delay analysis and claims; Advances in construction management, tender and tender document - Deposits by the contractor - Arbitration. Negotiation - M. Book - Muster roll –stores.

**REFERENCES:**

1. Bennett, F. Lawrence., The management of construction: a project life cycle approach. Rutledge, 2003.
2. Oberlender, Garold D., Project management for engineering and construction. Vol. 2. New York: McGraw-Hill, 1993.
3. Peurifoy, Robert Leroy, Cliff J. Schexnayder and Shapira A. Construction planning, equipment, and methods. No. 696 pp. McGraw-Hill, 2010.
4. Chitkara, K. K. Construction Project Management. Tata McGraw-Hill Education, 2014.

# BRIDGE ENGINEERING
## (Professional Elective - IV)

| B.Tech. IV Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| **Course Code**: **CE742PE** | **3** | **0/0/0** | **3** |

**Pre-requisites**: Structural Engineering, Soil Mechanics & Foundation Engineering and Water Resources Engineering

**Course Objectives:** To study different types of bridges, forces that act on bridges, Design of bridge

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

- Design the T beam bridge and substructures
- Design the Bridge bearings
- Design the steel bridge

**UNIT- I**

**Introduction:** Definition, components of bridge, classification of bridges, selection of site, economical span, aesthetics consideration, necessary investigations and essential design data.
**Standard Specifications for Roads and Railways Bridges:** General, Indian Road Congress Bridge Code, width of carriage way, clearance, various loads to be considered for the design of roads and railway bridges, detailed explanation of IRC standard live loads.

**UNIT- II**

**Design Consideration for R. C. C. Bridges:** Various types of R.C.C. bridges (brief description of each type) , design of R.C.C. culvert and T-beam bridges.

**UNIT- III**

**Design Consideration for Steel Bridges:** Various types of steel bridges (brief description of each), design of truss and plate girder bridges.

**UNIT- IV**

**Hydraulic & Structural Design:** Piers, abutments, wing-wall and approaches.
**Brief Description:** Bearings, joints, articulation and other details.

**UNIT - V**

**Bridge Foundation:** Various types, necessary investigations and design criteria of well foundation.

**TEXT BOOKS:**

1. Essentials of Bridge Engineering, D.J.Victor, Oxford & IBH Pub, N. Delhi.
2. Design of Bridges, N. Krishna Raju, Oxford & IBH, N. Delhi.

3. Bridge Deck Analysis, R. P. Pama & A. R. Cusens, John Wiley & Sons.
4. Design of Bridge Structures, T. R. Jagadish & M.A.Jairam, Prentice Hall of India, N. Delhi.

# WATER QUALITY MANAGEMENT
## (Professional Elective - IV)

| B.Tech. IV Year I Sem. | L | T/P/D | C |
|---|---|---|---|
| **Course Code**: **CN743PE** | 3 | 0/0/0 | 3 |

**Course Objectives:**

- Introduce the concepts of water quality management and monitoring
- To understand the physical, chemical and biological characteristics of water and their significance
- To learn ways to improve water quality through treatment and management of chemically and biologically polluted waters
- Recognize the role of water quality guidelines and legislation in water quality management
- Provide a practical understanding of the significance of water quality management to society and the role of water practitioners in the management process

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

- Knowledge of surface water methods of data collection and analysis
- Knowledge of groundwater methods of data collection and analysis
- Knowledge of water quality methods of data collection and analysis
- Knowledge of water policies and risk assessment, integrated problem solving and systems analysis

**UNIT - I**

Introduction – Water Quantity purification – Water sampling Analysis – Monitoring in rivers. Pollution of Surface water: Sources – Effects on receiving waters- Control of NPS Pollution – Approaches.

**UNIT – II**

Modeling Pollutants – Self purification of rivers DO models, Critical deficit and time required to reach the critical deficit. Lake Water Quality Management: Effect of pollutants – Stratification of lakes – Problem in Urban Lakes – Eutrophication – Restoration Techniques.

**UNIT - III**

Groundwater pollution and management- Sources of ground water pollution and their effects-municipal, industrial, agricultural and miscellaneous, ground water basin investigations. Groundwater modeling techniques.

**UNIT – IV**

Introduction to Urban storm water quality management – Estimation of runoff – Pollutants in urban run off – storm water treatment facilities. Rain Water harvesting – Ground water re-

change – Estimation –Roof top water collection systems – re-change techniques – soak points.

**UNIT - V**

Watershed Management- concept of watershed – objectives, Runoff estimation – rainwater harvesting Methods – check dams, artificial re-change, form ponds, percolation tanks.

**TEXT BOOKS:**

1. Water Quality by Vladimar Novotny- John Wiley & Sons, Inc.
2. Water Supply and Sanitary Engineering by G.S. Birde- Dhanpath Rai Publishing Company Plt, Ltd., New Delhi.
3. Ground Water Hydrology by David Keith Todd - John Wiley & Sons.
4. Watershed Management by N.D. Mani – Dominant Publishers and Distributors

# GROUND WATER HYDROLOGY
## (Professional Elective - IV)

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN744PE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

Objective of this course is to introduce the students to the fundamentals of ground water flow, distribution of ground water, concept of aquifers, flow in confined and unconfined aquifers, interference among wells, well hydraulics, ground water development, ground water exploration by different techniques.

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

- Explain the types and different parameters of aquifers, and permeability of aquifers
- Compute flow in aquifers and explain the salient features of various types of wells including the losses.
- Derive the unsteady flow equation by various methods and obtain the solutions
- Explain the types and construction of wells, pumping tests in wells, working principles, and estimate power requirements of pumps and yield of wells.
- Explain the different techniques of ground water exploration.
- Explain ground water recharge, ground water runoff, ground water budget, and harvesting techniques.

**UNIT – I**

**Ground Water Occurrence and Movement:** Ground water hydrologic cycle, origin of ground Water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention. Permeability, Darcy's law, storage coefficient, Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinates system, ground water flow contours their applications.

**UNIT – II**

**Analysis of Pumping Test data-I: S**teady flow ground water flow towards a well in confined and unconfined aquifers-Dupit's and Theism's equations, Assumptions, Formation constants, yield of an open well interface and well tests. Unsteady flow towards a well – Non equilibrium equations-Thesis solution-Jacob and Chow's simplifications, Leak aquifers.

**UNIT – III**

**Surface and Subsurface Investigation:** Surface methods of exploration-Electrical resistivity and Seismic refraction methods. Subsurface methods-geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

**UNIT – IV**

**Artificial Recharge of Ground Water:** Concept of artificial recharge-recharge methods, relative merits. Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies.

**UNIT – V**

**Saline Water Intrusion In aquifers:** Occurrence of saline water intrusions, Ghyben-Herzberg relation, Shape of interface, control of seawater intrusion.

**TEXT BOOKS:**

1. Ground Water Hydrology by H. M. Raghunath, Wiley Eastern Ltd
2. Introduction to Hydraulics & Hydrology: With Applications for Storm water Management, 4th Edition, Cengage Learning

**REFERENCES:**

1. Ground water Hydrology by David Keith Todd, John Wiley &sons. New York..
2. Ground water by Bawver, john Wiley &sons.
3. Hydrology by Subramanya K

## TRANSPORTATION ENGINEERING LAB

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year I Sem.** | | | |
| **Course Code: CE703PC** | **0** | **0/3/0** | **2** |

**Pre-Requisites:** Transportation Engineering Theory

**Course Objectives:** To gain the practical knowledge of properties of Highway materials and surveys

**Course Outcomes:** At the end of the course, the student will be able to Asses for Highway construction properties of highway materials

### I. ROAD AGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test
5. Flakiness and elongation Indices of coarse Aggregates.

### II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Marshal stability Test

### III. TRAFFIC STUDIES

1. Traffic volume counts-Mid Blocks
2. Traffic volume counts-Junctions
3. Spot speed studies.
4. Parking Studies

### TEXT BOOK:

1. Laboratory Manual in Highway Engineering by Ajay K. Duggal and Vijay P. Puri - New age Publishers.
2. Highway Material Testing by Khanna S.K., Justo C.E.G, Nem Chand & Bros.
3. Principles and practice of Highway Engineering, L.R Kadiyali & N.B.Lal, Khanna, 2007.
4. Traffic Engineering and Transportation planning, L.R Kadiyali, Khanna publications, 2007.

# GEOTECHNICAL ENGINEERING LAB

| **B.Tech. IV Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN704PC** | **0** | **0/3/0** | **2** |

**Pre-Requisites:** Soil Mechanics (Co-requisite)

**Course Objectives:** To obtain index and engineering properties of locally available soils, and to understand the behavior of these soil under various loads.

**Course Outcomes:** At the end of the course, the student will be able to classify and evaluate the behavior of the soils subjected to various loads.

## LIST OF EXPERIMENTS

1. Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
2. a) Field density by core cutter method and
   b) Field density by sand replacement method
3. Determination of Specific gravity of soil Grain size distribution by sieve analysis
4. Permeability of soil by constant and variable head test methods
5. Standard Proctor's Compaction Test
6. Determination of Coefficient of consolidation (square root time fitting method)
7. Unconfined compression test
8. Direct shear test
9. Vane shear test
10. Differential free swell index (DFSI) test

## REFERENCE:

1. Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International

# ESTIMATING AND COSTING
## (Professional Elective - V)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | |
| **Course Code**: **CN851PE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

This subject covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works. This also covers the rate analysis, valuation of properties and preparation of reports for estimation of various items. At the end of this course the student shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents. Student should also be able to prepare value estimates.

**Course Outcomes:**

- Able to understand detailed estimates of buildings
- Able to analyse various works and contingent charges
- design head and cross regulator structures
- identify various types of reservoir and their design aspects
- design different types of buildings

**UNIT – I**

General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.
Detailed Estimates of Buildings.

**UNIT – II:** Earthwork for roads and canals

**UNIT – III:** Rate Analysis – Working out data for various items of work over head and contingent charges.

**UNIT – IV:** Reinforcement bar bending and bar requirement schedules. Contracts – Types of contracts – Contract Documents – Conditions of contract.

**UNIT – V:** Valuation of buildings. Standard specifications for different items of building construction.

**TEXT BOOKS:**

1. Estimating and Costing by B.N. Dutta, UBS publishers, 2000.
2. Estimating and Costing by G.S. Birdie

**REFERENCES:**

1. Standard Schedule of rates and standard data book by public works department.
I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)
2. Estimation, Costing and Specifications by M. Chakraborthi; Laxmi publications.
3. National Building Code

# FINITE ELEMENT METHODS FOR CIVIL ENGINEERING
## (Professional Elective - V)

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN852PE/CE861PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: SA – I & SA – II

**Course Objectives:**

- To equip the students with the finite element analysis fundamentals.
- To enable the students to formulate the design problems into FEA.
- To introduce basic aspects of finite elements technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, ad solution of the resulting algebraic systems.

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

- Develop shape functions and stiffness matrices for bar and beam elements
- To understand isoparametric formulation, static condensation etc.
- Understand the background of mathematical equations used for development of modeling software modules to develop the various structural related applications
- Identify mathematical model for solution of common engineering problems.

**UNIT – I**

Introduction to Finite Element Method – Basic Equations in Elasticity Stress – Strain equation – concept of plane stress – plane strain advantages and disadvantages of FEM. Element shapes – nodes – nodal degree of freedom Displacement function – Natural Coordinates – strain displacement relations.

**UNIT – II**

Lagrangian – Serendipity elements – Hermite polynomials – regular, Irregular 2 D & 3D – Element –shape functions upto quadratic formulation.

Finite Element Analysis (FEA) of – one dimensional problems – Bar element – Shape functions stiffness matrix – stress – strain relation

**UNIT – III**

FEA Beam elements – stiffness matrix - shape function– Analysis of continuous beams.

**UNIT – IV**

FEA Two dimessional problem – CST – LST element – shape function – stress – strain.

Isoparametric formulation – Concepts of, isoparametric elements for 2D analysis - formulation of CST element.

**UNIT - V**

Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

**TEXT BOOK:**

1. A first course in Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.
2. Introduction to finite Elements in Engineering by Tirupathi R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall of India

**REFERENCES:**

1. Finite Element Analysis by P. Seshu, PHI Learning Private Limited
2. Concepts and applications of Finite Element Analysis by Robert D. Cook *et al.*, Wiley India Pvt. Ltd.
3. Applied Finite Element Analysis by G. Ramamurty, I. K. International Publishing House Pvt. Ltd.

# GEOENVIRONMENTAL ENGINEERING
## (Professional Elective - V)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | |
| **Course Code**: **CN853PE/ CE862PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Soil Mechanics & Environmental Engineering

**Course Objectives:** To understand various sources of contamination of ground and to characterize contaminated ground and to find extent of contamination and to get familiarize with various remediation methods.

**Course Outcomes:** At the end of the course, the student will be able to:
Identify sources of contamination, characterize the contaminated ground, and identify the most appropriate remediation technique.

**UNIT - I**
**Sources and Site Characterization:** Scope of Geoenvironmental Engineering, Various Sources of Contaminations, Need for contaminated site characterization; and Characterisation methods.

**UNIT - II**
**Solid and Hazardous Waste Management**: Classification of waste, Characterisation solid wastes, Environmental Concerns with waste, waste management strategies.

**UNIT - III**
**Contaminant Transport:** Transport process, Mass-transfer process, Modeling, Bioremediation, Phytoremediation.

**UNIT - IV**
**Remediation Techniques:** Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies.

**UNIT - V**
**Landfills:** Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.

**TEXT BOOKS:**

1 Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)
2 Bedient, P.B.H.S. Refai, & C.J. Newell, - Ground Water Contamination, Prentice Hall Publications, 4th Edition, 2008.

**REFERENCES:**

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001.
2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering: Principles and Applications, Marcel Dekker, Inc., New York (2000)

3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill Publishers, 2001.

## FOUNDATION ENGINEERING
## (Professional Elective - V)

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN854PE** | **3** | **0/0/0** | **3** |

**Pre-Requisites:** Soil Mechanics

**Course Objectives:** To impart the knowledge on various soil exploration techniques, and analyse and design of various substructures, such as slopes, retaining walls, shallow foundations, and pile foundations.

**Course Outcomes:** At the end of the course, the student will be able to:
Check the stability of slopes, analyze, and design the shallow and pile foundations, and earth retaining structures.

**UNIT – I**
**Soil Exploration**: Need – methods of soil exploration – boring and sampling methods – penetration tests – plate load test – pressure meter – planning of soil exploration programme and preparation of soil investigation report.

**UNIT – II**
**Slope Stability**: Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish slip circle method, method of slices, Bishop's Simplified method of slices – Taylor's Stability Number- stability of slopes of earth dams under different conditions.

**UNIT – III**
**Earth Pressure Theories**: At-rest earth pressures, Rankine's theory of earth pressure – earth pressures in layered soils – Coulomb's earth pressure theory – Culmann's graphical method, effect of pore water, earth pressure due to surcharge loads.
**Retaining Walls**: Types of retaining walls – stability of gravity and cantilever retaining walls against overturning, sliding and, bearing capacity modes of failure, Drainage from backfill, introduction to reinforced earth walls.

**UNIT – IV**
**Shallow Foundations** - Types - choice of foundation – location and depth - safe bearing capacity – shear criteria – Terzaghi's, and IS code methods - settlement criteria – allowable bearing pressure based on SPT N value and plate load test – allowable settlements of structures.

**UNIT - V**
**Pile Foundation**: Types of piles – load carrying capacity of piles based on static pile formulae – dynamic pile formulae – Pile Capacity through SPT and CPT results - pile load tests - load carrying capacity of pile groups in sands and clays – Settlement of pile groups – negative skin friction

**Well Foundations**: Types – different shapes of wells – forces on wells - components of wells – Grip length – sinking of wells – tilts and shifts.

**TEXT BOOKS:**

1. Das, B.M., - (2011) Principles of Foundation Engineering –7th edition, Cengage Publishing.
2. Foundation Design Principles and Practices, Donald P. Coduto, 2nd Edition, Pearson Publishers.
3. Bowles, J.E., (2012) Foundation Analysis, and Design – 5th Edition, McGraw-Hill Publishing company, Newyork.

**REFERENCES:**

1. Geotechnical Engineering by S. K. Gulhati & Manoj Datta – Tata Mc Graw Hill Publishers New Delhi. 2005.
2. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers, and Distributors.
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt. Ltd, New Delhi
4. Analysis and Design of Substructures – Swami Saran, Oxford, and IBH Publishing company Pvt Ltd (1998).
5. Soil Mechanics and Foundation Engineering by B. N. D. Narasinga Rao, Wiley (2015).
6. Geotechnical Engineering by Debsashis Mitra Universities Press (2016).

# STOCHASTIC HYDROLOGY
## (Professional Elective - VI)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | |
| **Course Code**: **CN861PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Water Resources Engineering

**Course Objectives:** Understanding probabilities interventions of dynamics characteristic of water

**Course Outcomes:** At the end of the course, the student will be able to understand methods of Hydrology, flood frequency modeling of hydrologic etc

**UNIT - I**
Deterministic and Stochastic Hydrology, Need for statistical methods in hydrology, Continuous, and Discrete distributions.

**UNIT - II**
Moments and expectations, Parameter estimation, Probability plotting, Regional flood frequency analysis.

**UNIT - III**
Hypothesis Testing, linear regression, Hydrologic Time Series Analysis - Modeling of Hydrology.

**UNIT - IV**
Time Series - Data generation techniques, Autoregressive processes.

**UNIT - V**
Models for operational hydrology.

**TEXTBOOKS:**

1. Charles T. Haan, Statistical Methods in Hydrology, East West Publishers, 1998.
2. Jaya Rami Reddy, Stochastic Hydrology, Laxmi Publications, 1997.
3. Stochastic Process in Hydrology Kottegoda Prentice Hall International

# TRAFFIC ENGINEERING
## (Professional Elective - VI)

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN862PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Transportation Engineering

**Course Objectives:** To provide engineering techniques to achieve the safe and efficient movement of people and goods on roadways.

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

- Understand basics principles of Traffic Engineering
- Analyze parking data and model accidents
- Determine capacity and LOS.
- To provide engineering techniques to achieve Safe and efficient movement of people and goods on roadways

**UNIT - I**

Traffic Studies (Part- I) : Basic principles of Traffic, Volume, Speed and Density; Definitions and their interrelationships; Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data; Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Head ways and Gap Studies - Headway and Gap acceptance, Origin and Destination Studies.

**UNIT - II**

Traffic Studies (Part-II) : Parking Studies: parameters of parking, definitions, Parking inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data; Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modeling;, Road Safety Auditing, Measures to increase Road safety.

**UNIT - III**

Capacity and LOS Analysis: Introduction to Traffic capacity, Analysis concepts, Level of Service, Basic definitions, Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments - Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

**UNIT - IV**

Signal Designing – Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

**UNIT - V**

Transportation System Management - Measures for Improving vehicular flow – one way Streets, Signal Improvement, Transit Stop Relocation, Parking Management, Reversible

lanes- Reducing Peak Period Traffic - Strategies for working hours, Congestion Pricing, Differential Toll Policies.

**REFERENCES:**


1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication
3. Fundamentals of Transportation Engineering - C. S. Papacostas, Prentice Hall India.
4. IRC Codes
5. Traffic Engineering - Theory & Practice - Louis J. Pignataro, Prentice Hall Publication.
6. Traffic Engineering by Roger P. Roess, William R. Mc. Shane, Elena S. Prassas , Prentice Hall, 1977.
7. Transportation Engineering - An Introduction - C. Jotin Khisty, Prentice Hall Publication
8. Fundamentals of Traffic Engineering – McShane & Rogers.
9. Highway Capacity Manual -2000.

## GROUND IMPROVEMENT TECHNIQUES
## (Professional Elective - VI)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | |
| **Course Code**: **CN863PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Soil Mechanics

**Course Objectives:** To understand the importance of ground improvement and know various ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.

**Course Outcomes:** At the end of the course, the student will be able to:
Identify suitable ground improvement technques for specific project and its implications.

**UNIT - I**
**Introduction to Engineering Ground Modification**: Need and objectives, Identification of soil types, In situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications.

**UNIT - II**
**Mechanical Modification** – Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting Vibrocompaction, Dynamic Tamping and Compaction piles.

**UNIT - III**
**Hydraulic Modification** – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geosynthetics, Preloading and vertical drains, Electro-kinetic dewatering.

**UNIT - IV**
**Physical and Chemical Modification** – Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

**UNIT - V**
**Modification by Inclusions and Confinement** - Soil reinforcement, reinforcement with strip, bar, mesh, sheet and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

**TEXT BOOKS:**

1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications
2. Patra, N.R. (2012)– Ground Improvement Techniques, Vikas Publications
3. Purushothama Raj (1995) – Ground Improvement Techniques, Laxmi Publications, India

**REFERENCES:**

1. M. P. Moseley and K. Krisch (2006) – Ground Improvement, 2nd Edition, Taylor and Francis.
2. K. Krisch & F. Krisch (2010) – Ground Control and Improvement, John Wiley & Sons 1994.
3. Nicholson, P.G. (2015). Soil Improvement and Ground Modification methods, Elsevier Publishers.

# ELEMENTS OF EARTHQUAKE ENGINEERING
## (Professional Elective - VI)

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE853PE/CN864PE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Structual Engineering –II & RC Design

**Course Objectives:** To understand the analysis of the behaviour of structures under dynamic loads and understand the principles of design for seismic and wind loads and relevant codal provisions

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

- Analyse the behaviour of structures under dynamic loads & design for seismic codal provisions.
- Apply seismic coefficient and response spectrum methods for analysis of multi storied buildings
- Apply concepts of ductility in the design of multi-storeyed structures
- Understand the concepts of base isolation

**UNIT - I**

**Engineering Seismology**: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-strong ground motions- Seismic zones of India.

**Theory of Vibrations**: Elements of a vibratory system- Degrees of Freedom-Continuous system-Lumped mass idealization-Oscillatory motion-Simple Harmonic Motion-Free vibration of single degree of freedom (SDOF) system- undamped and damped-critical damping-Logarithmic decrement-Forced vibrations-Harmonic excitation-Dynamic magnification factor-Excitation by rigid based translation for SDOF system-Earthquake ground motion.

**UNIT - II**

**Conceptual design**: Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel.

**Introduction to earthquake resistant design**: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method.

**UNIT - III**

**Reinforced Concrete Buildings**: Principles of earthquake resistant deign of RC members-Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods-IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities- Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces- Equivalent lateral force procedure- Lateral distribution of base shear.

**UNIT - IV**

**Masonry Buildings**: Introduction- Elastic properties of masonry assemblage- Categories of masonry buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- Seismic design requirements- Lateral load analysis of masonry buildings.

**UNIT - V**

**Structural Walls and Non-Structural Elements**: Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- Prevention of non-structural damage- Isolation of non-structures. Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beams, columns, and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes.

**TEXT BOOKS:**

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press 2nd Edition s
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

**REFERENCES:**

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
2. Earthquake Resistant Design of Building structures by Vinod Hosur, Wiley India Pvt. Ltd.
3. Elements of Mechanical Vibration by R. N. Iyengar, I. K. International Publishing House Pvt. Ltd.
4. Masory and Timber structures including earthquake Resistant Design –Anand S. Arya, Nem chand & Bros
5. Earthquake Tips – Learning Earthquake Design and Construction
6. C.V.R. Murthy

**REFERENCE CODES:**

1. IS: 1893 (Part-1) -2002. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.
2. IS:4326-1993, “ Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.
3. IS:13920-1993, “ Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.

**B.TECH. AERONAUTICAL ENGINEERING**
**INTRODUCTION TO SPACE TECHNOLOGY**
**(OPEN ELECTIVE - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: AE511OE** | **3** | **0** | **0** | **3** |

**UNIT - I**

**Fundamentals of Rocket Propulsion and Trajectories:** Space Mission- Types-Space environment-launch vehicle selection.; Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation, Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two multi-stage rockets-Trade-off ratios-Single stage to orbit- Sounding rocket-Aerospace plane-Gravity turn trajectories-Impact point calculation-Injection conditions-Flight dispersions

**UNIT- II**

**Atmospheric Re-entry:** Introduction-Steep ballistic re-entry-Ballistic orbital re-entry-Skip re-entry-"Double- Dip" re-entry - Aero-braking - Lifting body re-entry

**UNIT-III**

**Fundamentals of Orbital Mechanics, Orbital Manoeuvres:** Two-body motion-circular, elliptic, hyperbolic, and parabolic orbits-Basic orbital elements-Ground trace**.** In-Plane orbit changes-Hohmann transfer-Bi-elliptical transfer-Plane changes- Combined manoeuvres-Propulsion for manoeuvres

**UNIT - IV**

**Satellite Attitude Dynamics:** Torque free axisymmetric rigid body-Attitude control for spinning spacecraft - Attitude control for non-spinning spacecraft - The Yo-Yo mechanism – Gravity – Gradient satellite-Dual spin spacecraft-Attitude determination

**UNIT-V**

**Space mission Operations:** Supporting ground system architecture and team interfaces - Mission phases and core operations- Team responsibilities – Mission diversity – Standard operations practices

**TEXT BOOK:**

1. 'Spaceflight Dynamics', W.E. Wiesel, 3rd edition, McGraw-Hill, 2010

**REFERENCES**

1. 'Rocket Propulsion and Space flight dynamics', Cornelisse JW, Schoyer HFR, and Wakker KF, Pitman, 1984
2. 'Fundamentals of Space Systems', Vincet L. Pisacane, Oxford University Press, 2005.
3. 'Understanding Space: An Introduction to Astronautics', J. Sellers, 2nd edition, McGraw- Hill, 2004

4. ‘Introduction to Space Flight’, Francis J Hale, Prentice-Hall, 1994
5. ‘Spacecraft Mission Design’, Charles D. Brown, AIAA Education Series, 1998
6. ‘Elements of Space Technology for Aerospace Engineers’, Meyer Rudolph X, Academic Press, 1999

**B.TECH. AERONAUTICAL ENGINEERING**
**INTRODUCTION TO AEROSPACE ENGINEERING**
**(OPEN ELECTIVE - II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: AE621OE** | **3** | **0** | **0** | **3** |

**UNIT – I**

**History of Flight and Space Environment:** Balloons and dirigibles, heavier than air aircraft, commercial air transport; Introduction of jet aircraft, helicopters, missiles; Conquest of space, commercial use of space; Different types of flight vehicles, classifications exploring solar system and beyond, a permanent presence of humans in space; Earth's atmosphere, the standard atmosphere; The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity; Environmental impact on spacecraft, space debris; Planetary environments.

**UNIT – II**

**Introduction to Aerodynamics:** Anatomy of the airplane, helicopter; Understanding engineering models; Aerodynamic forces on a wing, force coefficients; Generating lift, moment coefficients; Aerodynamic forces on aircraft – classification of NACA airfoils, aspect ratio, wing loading, Mach number, centre of pressure and aerodynamic centre-aerofoil characteristics-lift, drag curves; Different types of drag.

**UNIT – III**

**Flight Vehicle Performance and Stability:** Performance parameters, performance in steady flight, cruise, climb, range, endurance, accelerated flight symmetric manoeuvres, turns, sideslips, takeoff and landing; Flight vehicle Stability, static stability, dynamic stability; Longitudinal and lateral stability; Handling qualities of the airplanes.

**UNIT – IV**

**Introduction to Airplane Structures and Materials, Power Plants:** General types of construction, monocoque, semi-monocoque; Typical wing and fuselage structure; Metallic & non-metallic materials, use of aluminium alloy, titanium, stainless steel and composite materials. Basic ideas about engines, use of propeller and jets for thrust production; Principles of operation of rocket, types of rockets.

**UNIT – V**

**Satellite Systems Engineering Human Space Exploration:** Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems; Satellite structures, mechanisms and materials; Power systems; Communication and telemetry; Propulsion and station keeping; Space missions, mission objectives. Goals of human space flight missions, historical background, The Soviet and US missions; The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle; International

Space Station, extravehicular activity; The space suit; The US and Russian designs; Life support systems, Flight safety; Indian effort in aviation, missile and space technology.

**TEXT BOOKS:**

1. Anderson J. D, “Introduction to Flight”, McGraw-Hill, 5th Edition, 1989.
2. Newman D, “Interactive Aerospace Engineering and Design”, McGraw-Hill, 1st Edition, 2002.
3. Barnard R.H and Philpot. D.R, “Aircraft Flight”, Pearson, 3rd Edition, 2004.

**REFERENCES**

1. Kermode, A. C, “Flight without Formulae”, McGraw Hill, 4th Edition, 1997.
2. Swatton P. J, “Flight Planning”, Blackwell Publisher, 6th Edition, 2002.

**B.TECH. AERONAUTICAL ENGINEERING**
**AIR TRANSPORTATION SYSTEMS**
**(OPEN ELECTIVE - III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: AE831OE** | **3** | **0** | **0** | **3** |

**UNIT- I**

**Aviation Industry & Its Regulatory Authorities:** Introduction, history of aviation-evolution, development, growth, challenges. Aerospace industry, air transportation industry-economic impact- types and causes. Airline Industry- structure and economic characteristics. The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA). Safety regulations- risk assessment- human factors and safety, security regulations, environmental regulations.

**UNIT-II**

**Airspace:** Categories of airspace- separation minima, airspace sectors- capacity, demand and delay. Evolution of air traffic control system- procedural ATC system, procedural ATC with radar assistance, first generation 'automated' ATC system, current generation radar and computer-based ATC systems. Aerodrome air traffic control equipment and operation - ICAO future air-navigation systems (FANS). Air-navigation service providers as businesses. Communication, navigation and surveillance systems (CNSS). Radio communications- VHF, HF, ACARS, SSR, ADS. Navigation- NDB, VOR, DME, area-navigation systems( R-Nav), ILS, MLS, GPS, INS.

**UNIT- III**

**Aircraft:** Costs- project cash-flow, aircraft price. Compatibility with the operational infrastructure. Direct and indirect operating costs. Balancing efficiency and effectiveness-payload-range, fuel efficiency, technical contribution to performance, operating speed and altitude, aircraft field length performance. typical operating costs. Effectiveness- wake-vortices, cabin dimensions, flight deck.

**UNIT- IV**

**Airports:** Setting up an airport- airport demand, airport siting, runway characteristics- length, declared distances, aerodrome areas, obstacle safeguarding. Runway capacity- evaluating runway capacity- sustainable runway capacity. Runway pavement length, Manoeuvring area-airfield lighting, aprons, Passenger terminals-terminal sizing and configuration. Airport demand, capacity and delay.

**UNIT - V**

**Airlines:** Setting up an airline- modern airline objectives. Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements. Indirect operating costs. Aircraft- buy or lease. Revenue generation, computerized reservation systems, yield management. Integrating service quality into the revenue-generation process.

Marketing the seats. Airline scheduling. Evaluating success- financial viability, regulatory compliance, efficient use of resources, effective service.

**TEXT BOOK:**

1. Hirst, M., *The Air Transport System*, Woodhead Publishing Ltd, Cambridge, England, 2008.

**REFERENCES:**

1. Wensven, J.G., *Air Transportation: A Management Perspective*, Eighth Edition, shgate, 2015.
2. Belobaba, P., Odoni, A. and Barnhart, C., *Global Airline Industry*, Second Edition, Wiley, 2015.
3. M. Bazargan, M., *Airline Operations and Scheduling*, Second Edition, Ashgate, 2010.
4. Nolan, M.S., *Fundamentals of Air Traffic Control*, 5th edn., Thomson Learning, 2011.
5. Wells, A. and Young, S., *Airport Planning and Management*, 6th edn., McGraw-Hill, 2011.

**B.TECH. AERONAUTICAL ENGINEERING**
**ROCKETS AND MISSILES**
**(OPEN ELECTIVE - III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: AE832OE** | **3** | **0** | **0** | **3** |

**UNIT- I**

**Introduction:** Space launch vehicles and military missiles- function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements, performance measures, design, construction, operation- similarities and differences.

**UNIT – II**

**Solid and Liquid Propulsion Systems:** Solid propellant rocket motors, principal features, applications. Solid propellants- types, composition, properties, performance. Propellant grain-desirable properties, grain configurations, Liners, insulators and inhibitors-function, requirements, materials. Rocket motor casing-materials. Combustion system of solid rockets, igniters, types, construction. Nozzles-types, Liquid propellants- types, composition, properties, performance. Propellant tanks feed systems- pressurisation, turbo-pumps- valves and feed lines, injectors, starting and ignition. Engine cooling, support structure, control of engine starting and thrust build-up, liquid rocket combustion chamber

**UNIT – III**

**Aerodynamics of Rockets and Missiles:** Classification of missiles. Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, method of describing aerodynamic forces and moments, lateral aerodynamic moment, lateral damping moment, longitudinal moment of a rocket, lift and drag forces, drag estimation, body upwash and downwash in missiles. Rocket dispersion, re-entry body design considerations

**UNIT - IV**

**Dynamics and Control of Rockets and Missiles:** Tsiolskovsky's rocket equation- range in the absence of gravity, vertical motion in the earth's gravitational field, inclined motion, flight path at constant pitch angle, motion in the atmosphere, the gravity turn- the culmination altitude. Multi-staging. Earth launch trajectories- vertical segment, the gravity turn, constant pitch trajectory, orbital injection; Rocket thrust vector control-methods of thrust vector control for solid and liquid propulsion systems, thrust magnitude control, thrust termination

**UNIT - V**

**Rocket Testing:** Ground testing and flight testing- types of tests, test facilities and safeguards, monitoring and control of toxic materials, instrumentation and data management. Ground testing, flight testing, trajectory monitoring, post accident procedures, Description of a typical space vehicle launch procedure.

**TEXT BOOKS:**

1. Sutton, G.P., and Biblarz, O., *Rocket Propulsion Elements*, 8th edition, Wiley-Interscience, 2010.
2. Cornelisse, J.W., Schoyer H.F.R. and Wakker, K.F., *Rocket Propulsion and Space-flight Dynamics*, Pitman, 1979.
3. Turner, M.J.L., *Rocket and Spacecraft Propulsion*, 3rd edition, Springer, 2009.

**REFERENCES**

1. Chin, S.S., *Missile Configuration Design*, McGraw Hill, 1961
2. Ball, K.J., Osborne, G.F., *Space Vehicle Dynamics*, Oxford University Press, 1967.

**B.TECH. AUTOMOBILE ENGINEERING**
**DISASTER MANAGEMENT**
**(Open Elective - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: CE511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** The subject provides different disasters, tools and methods for disaster management.

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

- 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:**

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

**REFERENCES:**

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

**B.TECH. AUTOMOBILE ENGINEERING**
**INTELLECTUAL PROPERTY RIGHTS**
**(Open Elective - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: MT512OE** | **3** | **0** | **0** | **3** |

**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 & REFERENCES:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

**B.TECH. AUTOMOBILE ENGINEERING**
**DATA STRUCTURES**
**(Open Elective – II)**

| **B.Tech. III Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Course Code: EM614PE/MT621OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the basic concepts such as Abstract Data Types, Linear, and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose the appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

**Course Outcomes:**

- Learn how to use data structure concepts for realistic problems.
- Ability to identify appropriate data structure for solving computing problems in respective language.
- Ability to solve problems independently and think critically.

**UNIT- I**

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists-Operations- Insertion, Deletion.

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

**UNIT- II**

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

**UNIT- III**

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, Threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.
Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.

**UNIT- IV**

Searching- Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling.
Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

**UNIT- V**

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree ,B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees(Elementary treatment-only Definitions and Examples), Comparison of Search Trees.
Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

**TEXT BOOKS:**

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.

**REFERENCE BOOKS:**

1. Data structures: A Pseudocode Approach with C, 2nd edition, R. F. Gilberg And B.A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
3. Data Structures using C, A. M. Tanenbaum, Y. Langsam, M.J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, and Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipscutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson..
9. Data Structures using C &C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

**B.TECH. AUTOMOBILE ENGINEERING**
**ARTIFICIAL NEURAL NETWORKS**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: MT622OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

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

- Create different neural networks of various architectures both feed forward and feed backward.
- Perform the training of neural networks using various learning rules.
- Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

**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 Perceptron**: 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, Computer Experiment

**TEXT BOOKS:**

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

**REFERENCE BOOKS:**

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

**B.TECH. AUTOMOBILE ENGINEERING**
**INTRODUCTION TO MECHATRONICS**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: AM831OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Basic Electronics Engineering

**Course Objectives:**

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Course Outcomes:** At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

**UNIT – I**

**Introduction**: Definition – Trends - Control Methods: Standalone , PC Based ( Real Time Operating Systems, Graphical User Interface , Simulation ) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

**Signal Conditioning : I**ntroduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

**UNIT – II**

**Precision Mechanical Systems :** Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

**Electronic Interface Subsystems :** TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

**UNIT – III**

**Electromechanical Drives :** Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

**Microcontrollers Overview** : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C ( LED Blinking , Voltage measurement using ADC).

**UNIT – IV**

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

**UNIT – V**

**Programmable Motion Controllers** : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

**TEXT BOOKS:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

**REFERENCE BOOKS:**

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

**B.TECH. AUTOMOBILE ENGINEERING**
**MICROPROCESSORS AND MICROCONTROLLERS**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: AM832OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

**Course Outcomes:**

- Understands the internal architecture and organization of 8086, 8051 and ARM processors/controllers.
- Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.

**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:**

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.
3. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

**REFERENCE BOOKS:**

1. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
2. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
3. The 8051Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

**B.TECH. BIOMEDICAL ENGINEERING**
**RELIABILITY ENGINEERING**
**(Open Elective – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: BM511OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Mathematics III

**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:** After completion of this course, the student will be able to

- 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 irrepairable 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 method- tie 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:**

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

**REFERENCE BOOK:**

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993**.**

# B.TECH. BIOMEDICAL ENGINEERING
# MEDICAL ELECTRONICS
## (Open Elective – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: BM621OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Nil.

**UNIT - I**

**Action Potential and Transducers:** Electrical activity in cells, tissues, muscles and nervous systems -transducers-types and characteristics

Physiological transducers – pressure transducers-transducers for body temperature measurement – Pulse sensors-respiratory sensors.

**UNIT - II**

**Biosignal Acquisition:** Physiological signal amplifiers-isolation amplifiers-medical pre-amplifier design-bridge amplifiers-line driving amplifier-current amplifier – chopper amplifier-biosignal analysis - signal recovery and data acquisition-drift compensation in operational amplifiers-pattern recognition-physiological assist devices.

**UNIT - III**

**Biopotential Recorders:** Characteristics of recoding system - electrocardiography (ECG) – electro encephalography (EEG) - electromyography (EMG) - electroretinography (ERG) - electrooculography (EOG) – recorders with high accuracy –recorders for OFF line analysis.

**UNIT - IV**

**Specialized Medical Equipment:** Digital thermometer-audio meter –X-ray machines-radiography and fluoroscopy - angiography – elements of bio-telemetry system-design of bio-telemetry system-radio telemetry system-pace makers-Heart lung machine-Dialysis machine.

**UNIT - V**

**Advanced Biomedical Instrumentation:** Computers in medicine - lasers in medicine – basic principles of endoscopes- nuclear imaging techniques - computer tomography (CT) Scanning –Ultrasonic imaging system-construction propagation and delay – magnetic resonance imaging (MRI).

**TEXT BOOKS:**

1. Biomedical Instrumentation and Measurements-L. Cromwell, F.J. Weibel land E. A. Pfeiffer.
2. Biomedical Instrumentation- M. Arumugam - Anuradha Publications.
3. Handbook of Biomedical Instruments- R.S. Khandpur.

# B.TECH. BIOMEDICAL ENGINEERING
# TELEMETRY AND TELECONTROL
# (Open Elective – III)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: BM831OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Nil.

**Course Objective:** To make students understand the application of telemetry techniques to Instrumentation.

**Course Outcome:** Upon completion of this course students will appreciate t he application of different telemetry systems and control to any process.

**UNIT – I**

**Telemetry Principles:** Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non Electrical, Electrical, Pneumatic, Frequency.

**Symbols and Codes:** Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes. Inter symbol Interference.

**UNIT – II**

**Frequency& Time Division Multiplexed Systems:** FDM, IRIG Standard, FM and PM Circuits, Receiving end, PLL.

TDM - PAM, PAM /PM and TDM – PCM Systems. PCM reception. Differential PCM Introduction, QAM, Protocols.

**UNIT – III**

**Satellite Telemetry:** General considerations, TT & C Service, Digital Transmission systems, TT & C Subsystems, Telemetry, and Communications.

**Modern Telemetry:** Zigbee, Ethernet.

**UNIT – IV**

**Optical Telemetry:** Optical fibers Cable – Sources and detectors – Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System.

**UNIT – V**

**Telecontrol Methods:** Analog and Digital techniques in Telecontrol, Telecontrol apparatus – Remote adjustment, Guidance, and regulation – Telecontrol using information theory – Example of a Telecontrol System.

**TEXT BOOKS:**

1. Telemetry Principles – D. Patranabis, TMH

2. Telecontrol Methods and Applications of Telemetry and Remote Control – by Swoboda G., Reinhold Publishing Corp., London, 1991

**REFERENCE BOOKS:**

1. Handbook of Telemetry and Remote Control – by Gruenberg L., McGraw Hill, New York, 1987.
2. Telemetry Engineering – by Young R.E., Little Books Ltd., London, 1988.
3. Data Communication and Teleprocessing System – by Housley T., PH Intl., Englewood Cliffs, New Jersey, 1987.

**B.TECH. BIOMEDICAL ENGINEERING**
**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: BM832OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To introduce important system concepts such as Electromagnetic interference and Electromagnetic compatibility (EMI & EMC).
- To familiarize with unavoidable and naturally happening sources of EMI and problems to ensure EMC.
- To study various techniques to reduce EMI from systems and to improve EMC of electronic systems.

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

- Gain basic knowledge of problems associated with EMI and EMC from electronic circuits and systems.
- Analyze various sources of EMI and various possibilities to provide EMC.
- Understand and analyze possible EMI prevention techniques such as grounding, shielding, filtering, and use of proper coupling mechanisms to improve compatibility of electronic circuits and systems in a given electromagnetic environment.

**UNIT – I**

**Sources of EMI:** Definition of EMI and EMC, Classification, Natural and Man-Made EMI Sources, Switching Transients, Electrostatic Discharge, Nuclear Electromagnetic Pulse and High Power Electromagnetics.

**EMI/EMC Standards:** Introduction, Standards for EMI/EMC – MIL –STD 461/462 – IEEE/ANSI Standards – CISPR/IEC, Standards – FCC Regulations.

**UNIT - II**

**EMI Coupling Modes:** Penetration: Introduction, Shielding Theory - Shielding Effectiveness, The Circuit Approach, The Wave Approach, Aperture Theory, Calculation of Effectiveness of a Conducting Box with an Aperture, Introduction to Propagation and Cross Talk – Introduction, Basic Principles, Determination of EM Field from Transmission Lines.

**UNIT - III**

**EMI Controlling Techniques - I:** Grounding, Principles and Practice of Earthing, Precautions in Earthing, Measurements of Ground Resistance, System Grounding for EMC, Cable Shielding Grounding.

Shielding, Theory and Effectiveness, Materials, Integrity at Discontinuities, Conductive Coatings, Cable Shielding, Effectiveness Measurements, Electrical Bonding.

**UNIT – IV**

**EMI Controlling Techniques - II:** Characteristics and Types of Filters – Impedance Mismatch, Lumped Element Low-Pass, High- Pass, Band-Pass and Band-Reject Filters, Power Line Filter Design - Common Mode, Differential Mode, Combined CM and DM Filters, Design Example.

EMC Gaskets – Knitted Wire-Mesh Gaskets, Wire-Screen Gaskets, Oriented Wire Mesh, Conductive Elastomer, Transparent Conductive Windows, Conductive Adhesive, Conductive Grease, Conductive Coatings, Isolation Transformers, Opto-Isolators.

**UNIT - V**

**EMI Measurements:** Introduction to Open Area Test Site Measurements – Measurement Precautions – Open Area Test Site – Terrain Roughness – NSA – Measurement of Test Site Imperfections – Antenna Factor Measurement – Measurement Errors.

Radiated Interference Measurements – Anechoic Chamber – TEM Cell – Reverberating Chamber – Ghz TEM Cell – Comparison of Test Facilities – Measurement Uncertainties

Conducted Interference Measurements – Characterization – Conducted EM Noise on Power Supply Lines – Conducted EMI from Equipment – Immunity – Detectors and Measurement – Pulsed EMI Immunity – Electrostatic Discharge.

**TEXT BOOKS:**

1. Engineering Electromagnetic Compatibility – V. Prasad Kodali – 2/e – IEEE Press – Wiley India Pvt. Ltd – 2001.

**REFERENCES:**

1. Introduction to Electromagnetic Compatibility – Clayton R. Paul – John Wiley & Sons, 1992.
2. Electromagnetic Compatibility of Integrated Circuits – Techniques for Low Emission and Susceptibility – Edited by Sonia Ben Dhia, Mohamed Ramdani and Etienne Sicard – Springer, 2006.
3. EMI reduction in Electronic Systems – Mills – J.P – Prentice Hall Inc.
4. Noise Reduction in Electronic Systems – Henry W. Ott, 2nd Edition, Wiley Interscience, 1988.

**B.TECH. CIVIL ENGINEERING**
**DISASTER MANAGEMENT**
**(Open Elective - I)**

| **B.Tech. III Year I Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE511OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** The subject provide different disasters, tools and methods for disaster management

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

- 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:**

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

**REFERENCES:**

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

**B.TECH. CIVIL ENGINEERING**
**REMOTE SENSING AND GIS**
**(Open Elective - II)**

| **B.Tech.IV Year II Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE621OE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Surveying

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

- 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 surface features (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 Based Vector 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:**

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

**REFERENCES:**

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

# B.TECH CIVIL ENGINEERING
# GEOINFORMATICS
## (Open Elective - II)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. III Year II Sem** | | | |
| **Course Code**: **CE622OE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To introduce the concepts of remote sensing, satellite image characteristics and its components.
- To expose the various remote sensing platforms and sensors and to introduce the concepts of GIS, GPS and GNSS.

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

- The characteristics of Aerial photographic images ,Remote sensing satellites and Applications of remote sensing.
- The GIS and its Data models.
- The Global Navigation Satellite System.

**UNIT – I**

Aerial Photographs- Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation, Introduction to Digital Photogrammetry.

**UNIT - II**

Remote Sensing: Physics of remote sensing, Remote sensing satellites, and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

**UNIT – III**

Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

**UNIT - IV**

Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications

**UNIT - V**

Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications

**TEXT BOOKS:**

1. Remote Sensing & GIS , BS Publications
2. Higher Surveying by A M Chandra New Age International Publisher
3. Remote Sensing & GIS by B. Bhatta Oxford University Press
4. Introduction to GPS by A. E Rabbany Library of congress cataloging in Publication data

**REFERENCES:**

1. T M Lillesand et al: Remote Sensing & Image Interpretation
2. Higher Surveying by B C Punmia Ashok kr. Jain Laxmi Publications
3. N K Agarwal : Essentials of GPS , Spatial Networks: Hyderabad

**B.TECH. CIVIL ENGINEERING**
**INTELLECTUAL PROPERTY RIGHTS**
**(Open Elective - II)**

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. III Year II Sem** | | | |
| **Course Code**: **CE623OE** | **3** | **0/0/0** | **3** |

**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 & REFERENCES:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.,

**B.TECH CIVIL ENGINEERING**
**ENVIRONMENTAL IMPACT ASSESSMENT**
**(Open Elective - III)**

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem** | | | |
| **Course Code: CE831OE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Environmental Engineering

**Course Objectives:** This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

**Course Outcomes:**

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the suitable methodology and prepare Rapid EIA.
- Indentify and incorporate mitigation measures.

**UNIT – I**

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

**UNIT- II**

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

**UNIT- III**

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

**UNIT – IV**

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

**UNIT - V**

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

**TEXT BOOKS:**

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

**REFERENCES:**

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

**B.TECH. CIVIL ENGINEERING**
**OPTIMIZATION TECHNIQUES IN ENGINEERING**
**(Open Elective - III)**

| **B.Tech. IV Year II Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE832OE** | **3** | **0/0/0** | **3** |

**Prerequisites:** Operations Research

**Course Objectives:** After doing this subject student should know

- The various optimization techniques for single variable optimization problem
- Direct search methods and Gradient methods for multi variable un constraint Optimization problems
- Formulate a Geometric Programming model and solve it by using Arithmetic Geometric in equality theorem
- Simulate the system
- Thorough of state of art optimization techniques like Genetic Algorithms, simulated Annealing

**Course Outcomes:** For a given system, as per customer requirement it is required to

- Formulate optimization problem.
- Solve the problem by using a appropriate optimization techniques.

**UNIT - I**

**Single Variable Non-Linear Unconstrained Optimization:** Elimination methods: Uni-Model function-its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

**UNIT - II**

**Multi variable non-linear unconstrained optimization:** Direct search methods – Univariant method, Pattern search methods – Powell's, Hook - Jeeves, Rosen brock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

**UNIT - III**

**Linear Programming** – Formulation, Simplex method, & artificial variable optimization techniques: Big M & Two phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition and deletion of variables, constraints.

Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

**UNIT - IV**

**Integer Programming**- Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method

**Stochastic Programming**: Basic concepts of probability theory, random variables-distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

**UNIT - V**

**Geometric Programming:** Polynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤ type only)

**Non Traditional Optimization Algorithms:** Genetics Algorithm-Working Principles, Similarities, and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO)(very brief)

**TEXT BOOKS:**

1. Optimization theory & Applications / S. S. Rao / New Age International.
2. Optimization for Engineering Design, Kalyanmoy Deb, PHI

**REFERENCES:**

1. Operations Research by S. D. Sharma Kedarnath & Ramnath Publisher
2. Operation Research by Hamdy A Taha Pearson Educations
3. Optimization in operations research by Ronald L. Rardin Pearson Publisher
4. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
5. Optimization Techniques theory and practice by M. C. Joshi, K. M. Moudgalya Narosa Publications

**B.TECH. CIVIL ENGINEERING**
**ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES**
**(Open Elective - III)**

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year III Sem** | | | |
| **Course Code: CE833OE** | **3** | **0/0/0** | **3** |

**Course Objective:** The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

**Course Outcome:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

**Unit – 1: Entrepreneurial Perspectives:**
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

**Unit – 2: New Venture Creation:**
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**Unit – 3: Management of MSMEs and Sick Enterprises**
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

**Units – 4: Managing Marketing and Growth of Enterprises:**
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**Units – 5: Strategic perspectives in Entrepreneurship:**
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

**Text Books:**
1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V.Rao, 3e, Cengage, 2012.

**REFERENCES:**

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

**B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING**
**DISASTER MANAGEMENT**
**(Open Elective - I)**

| **B.Tech. III Year I Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE511OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** The subject provide different disasters, tools and methods for disaster management

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

- 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:**

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

**REFERENCES:**

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

**B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING**
**ENVIRONMENTAL IMPACT ASSESSMENT**
**(Open Elective - II)**

| **B.Tech.III Year II Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code: CN621OE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Environmental Engineering

**Course Objectives:** This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

**Course Outcomes:**

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the suitable methodology and prepare Rapid EIA.
- Indentify and incorporate mitigation measures.

**UNIT – I**

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

**UNIT- II**

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

**UNIT- III**

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

**UNIT – IV**

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

**UNIT - V**

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

**TEXT BOOKS:**

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

**REFERENCES:**

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

# B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
# INTELLECTUAL PROPERTY RIGHTS
## (Open Elective - II)

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech.III Year II Sem** | | | |
| **Course Code**: **CE623OE** | **3** | **0/0/0** | **3** |

**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 & REFERENCES:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.,

**B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING**
**REMOTE SENSING & GIS**
**(Open Elective - III)**

| **B.Tech. IV Year II Sem** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CN831OE** | **3** | **0/0/0** | **3** |

**Pre Requisites**: Surveying

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

- 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 surface features (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 Based Vector 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:**

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

**REFERENCES:**

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

**B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING**
**ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES**
**(Open Elective – III)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **CE833OE** | **3** | **0/0/0** | **3** |

**Course Objective:** The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

**Course Outcome:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

**Unit – 1: Entrepreneurial Perspectives:**
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

**Unit – 2: New Venture Creation:**
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**Unit – 3: Management of MSMEs and Sick Enterprises**
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

**Units – 4: Managing Marketing and Growth of Enterprises:**
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**Units – 5: Strategic perspectives in Entrepreneurship:**
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

**TEXT BOOKS:**

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V. Rao, 3e, Cengage, 2012.

**REFERENCES:**

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**OPERATING SYSTEMS**
**(OPEN ELECTIVE – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: CS511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the OS role in the overall computer system
- To study the operations performed by OS as a resource manager
- To understand the scheduling policies of OS
- To understand the different memory management techniques
- To understand process concurrency and synchronization
- To understand the concepts of input/output, storage and file management
- To understand the goals and principles of protection
- Introduce system call interface for file and process management
- To study different OS and compare their features.

**Course Outcomes:**

- Apply optimization techniques for the improvement of system performance.
- Ability to design and solve synchronization problems.
- Learn about minimization of turnaround time, waiting time and response time and also maximization of throughput by keeping CPU as busy as possible.
- Ability to change access controls to protect files.
- Ability to compare the different operating systems.

**UNIT - I**

Overview-Introduction-Operating system objectives, User view, System view, Operating system definition ,Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments.

Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

**UNIT - II**

Process and CPU Scheduling - Process concepts-The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(),exec(),wait(),exit(), Interprocess communication-ordinary pipes and named pipes in Unix.

Process Scheduling-Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread scheduling, Linux scheduling and Windows scheduling.

Process Synchronization, Background, The Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization in Linux and Windows.

**UNIT - III**

Memory Management and Virtual Memory – Memory Management Strategies- Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table, IA-32 Segmentation, IA-32 Paging.

Virtual Memory Management-Background, Demand Paging, Copy-on-Write, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, Virtual memory in Windows..

**UNIT - IV**

Storage Management-File System- Concept of a File, System calls for file operations - open (), read (), write (), close (), seek (), unlink (), Access methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection.

File System Implementation - File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance.

Mass Storage Structure – Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap space Management

**UNIT - V**

Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection.

**TEXT BOOKS:**

1. Operating System Concepts , Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 9th Edition, Wiley, 2016 India Edition
2. Operating Systems – Internals and Design Principles, W. Stallings, 7th Edition, Pearson.

**REFERENCE BOOKS:**

1. Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI
2. Operating Systems A concept-based Approach, 2nd Edition, D.M. Dhamdhere, TMH.
3. Principles of Operating Systems, B. L. Stuart, Cengage learning, India Edition.
4. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
5. Principles of Operating systems, Naresh Chauhan, Oxford University Press.

# B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY
# DATABASE MANAGEMENT SYSTEMS
# (OPEN ELECTIVE – I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: CS512OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques.

**Course Outcomes:**

- Demonstrate the basic elements of a relational database management system.
- Ability to identify the data models for relevant problems.
- Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
- Apply normalization for the development of application software.

**UNIT - I**

**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.

**Introduction to Data base design:** Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.

**Relational Model:** Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

**UNIT - II**

**Relational Algebra and Calculus**: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.

**SQL:** Queries, Constraints, Triggers: Form of Basic SQL Query, UNION,INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases..

**UNIT - III**

**Schema Refinement and Normal Forms**: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

**UNIT - IV**

**Transaction Management:** Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

**Concurrency Control:** Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

**UNIT - V**

**Storage and Indexing:** Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

**Hash- Based Indexing:** Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

**TEXT BOOKS:**

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition. **(Part of UNIT-I, UNIT-II, UNIT-III, UNIT-V)**
2. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education(India) Private Limited l, 6th edition.**( Part of UNIT-I, UNIT-IV)**

**REFERENCE BOOKS:**

1. Database Systems, 6th edition, R Elmasri, Shamkant B.Navathe, Pearson Education.
2. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning.
3. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition.
4. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
5. Introduction to Database Systems, C. J. Date, Pearson Education.

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**JAVA PROGRAMMING**
**(OPEN ELECTIVE – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: CS621OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand object oriented programming concepts, and apply them in problem solving.
- To learn the basics of java Console and GUI based programming.

**Course Outcomes:**

- Understanding of OOP concepts and basics of java programming (Console and GUI based).
- The skills to apply OOP and Java programming in problem solving.
- Should have the ability to extend his/her knowledge of Java programming further on his/her own.

**UNIT- I**

**OOP concepts** – Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms

**Java programming** - History of Java, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow - block scope, conditional statements, loops, break and continue statements, simple java stand alone programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, building strings, exploring string class.

**UNIT- II**

**Inheritance -** Inheritance hierarchies, super and sub classes, Member access rules, super keyword, preventing inheritance: final classes and methods, the Object class and its methods

**Polymorphism-** dynamic binding, method overriding, abstract classes and methods.

**Interfaces** – Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface.

**Inner classes** – Uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

**Packages**-Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

**UNIT- III**

**Exception handling** – Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, creating own exception sub classes.

**Multithreading -** Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer pattern.

**UNIT- IV**

**Collection Framework in Java –** Introduction to Java Collections, Overview of Java Collection frame work, Generics, Commonly used Collection classes– Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calendar and Properties

**Files** – streams- byte streams, character streams, text Input/output, binary input/output, random access file operations, File management using File class.

**Connecting to Database** - JDBC Type 1 to 4 drivers, connecting to a database, querying a database and processing the results, updating data with JDBC.

**UNIT- V**

**GUI Programming with Java** - The AWT class hierarchy, Introduction to Swing, Swing vs. AWT, Hierarchy for Swing components, Containers – JFrame, JApplet, JDialog, JPanel, Overview of some swing components- Jbutton, JLabel, JTextField, JTextArea, simple swing applications, Layout management - Layout manager types – border, grid and flow

**Event** h**andling -** Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

**Applets** – Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets, applet security issues.

**TEXT BOOK:**

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

**REFERENCE BOOKS:**

1. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI.
2. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Pearson Education
4. Programming in Java, S.Malhotra and S.Choudhary, Oxford Univ. Press.

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**SOFTWARE TESTING METHODOLOGIES**
**(OPEN ELECTIVE – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: CS622OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**
To understand the software testing methodologies such as flow graphs and path testing, transaction flows testing, data flow testing, domain testing and logic base testing.

**Course Outcomes:**
- Ability to apply the process of testing and various methodologies in testing for developed software.
- Ability to write test cases for given software to test it before delivery to the customer.

**UNIT - I**
Introduction:- Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.
Flow graphs and Path testing:- Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

**UNIT - II**
Transaction Flow Testing:-transaction flows, transaction flow testing techniques.
Dataflow testing:- Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

**UNIT - III**
Domain Testing:-domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

**UNIT-IV**
Paths, Path products and Regular expressions:- path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
Logic Based Testing:- overview, decision tables, path expressions, kv charts, specifications.

**UNIT - V**
State, State Graphs and Transition testing:- state graphs, good & bad state graphs, state testing, Testability tips.
Graph Matrices and Application:-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

**TEXT BOOKS:**

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

**REFERENCE BOOKS:**

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing,3rd edition,P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann&J.Offutt, Cambridge Univ.Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press.
7. Software Testing, M.G.Limaye, TMH.
8. Software Testing, S.Desikan, G.Ramesh, Pearson.
9. Foundations of Software Testing, D.Graham & Others, Cengage Learning.
10. Foundations of Software Testing, A.P.Mathur, Pearson.

**B.TECH COMPUTER SCIENCE AND ENGINEERING / B.TECH INFORMATION TECHNOLOGY**
**CYBER SECURITY**
**(OPEN ELECTIVE – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: CS623OE** | **3** | **0** | **0** | **3** |

**UNIT- I**

**Introduction to Cybercrime:** Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT - II**

**Cyber Offenses: How Criminals Plan Them:** Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

**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 an Measures in Mobile Computing Era, Laptops.

**UNIT IV**

**Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

**UNIT V**

**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.

**TEXT BOOK:**

1. **Cyber Security:** *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Nina Godbole and Sunil Belapure, Wiley INDIA.

**REFERENCE BOOK:**

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

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**LINUX PROGRAMMING**
**(OPEN ELECTIVE – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: CS831OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand and make effective use of Linux utilities and Shell scripting language (bash) to solve Problems.
- To implement in C some standard Linux utilities such as ls, mv, cp etc. using system calls.
- To develop the skills necessary for systems programming including file system programming, process and signal management, and interprocess communication.
- To develop the basic skills required to write network programs using Sockets.

**Course Outcomes:**

- Work confidently in Linux environment.
- Work with shell script to automate different tasks as Linux administration.

**UNIT- I**

**Linux Utilities** - File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities.
Sed-Scripts, Operation, Addresses, Commands, Applications, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications.
**Shell programming with Bourne again shell (bash)** - Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

**UNIT- II**

**Files and Directories** - File Concept, File types, File System Structure, file metadata-Inodes, kernel support for files, system calls for file I/O operations- open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink. **Directories** - Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

**UNIT- III**

**Process** – Process concept, Layout of a C program image in main memory, Process environment-environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control - process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process, system call interface for process management-fork, vfork, exit, wait, waitpid, exec family, Process Groups, Sessions and Controlling Terminal, Differences between threads and processes.

**Signals** – Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.

**UNIT- IV**

**Interprocess Communication** - Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes-creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs (Named pipes), differences between unnamed and named pipes, popen and pclose library functions. **Message Queues** - Kernel support for messages, APIs for message queues, client/server example. **Semaphores** - Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

**UNIT- V**

**Shared Memory** - Kernel support for shared memory, APIs for shared memory, shared memory example. **Sockets** - Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (Unix domain and Internet domain),Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs-Single Server-Client connection, Multiple simultaneous clients, Socket options-setsockopt and fcntl system calls, Comparison of IPC mechanisms.

**TEXT BOOKS:**

1. Unix System Programming using C++, T. Chan, PHI.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Unix Network Programming, W. R. Stevens, PHI.

**REFERENCE BOOKS:**

1. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, Wiley India Edition.
2. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
3. System Programming with C and Unix, A. Hoover, Pearson.
4. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.
5. Unix shell Programming, S. G. Kochan and P. Wood, 3rd edition, Pearson Education.
6. Shell Scripting, S. Parker, Wiley India Pvt. Ltd.

7. Advanced Programming in the Unix Environment, 2nd edition, W. R. Stevens and S. A. Rago, Pearson Education.
8. Unix and Shell programming, B. A. Forouzan and R. F. Gilberg, Cengage Learning.
9. Linux System Programming, Robert Love, O'Reilly, SPD.
10. C Programming Language, Kernighan and Ritchie, PHI

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**R PROGRAMMING**
**(OPEN ELECTIVE – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: CS832OE** | **3** | **0** | **0** | **3** |

**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 approach

**Course Outcomes:**

- 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:**

1. R Programming for Data Science by Roger D. Peng
2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India**.**

**B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY**
**PHP PROGRAMMING**
**(OPEN ELECTIVE – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: CS833OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Gain the PHP programming skills needed to successfully build interactive, data-driven sites
- Use the MVC pattern to organize code
- Test and debug a PHP application
- Work with form data
- Use cookies and sessions
- Work with regular expressions, handle exceptions, and validate data

**Course Outcomes:**

- Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script.
- Understand basic PHP syntax for variable use and standard language constructs, such as conditionals and loops.
- Understand the syntax and use of PHP object-oriented classes.
- Understand the syntax and functions available to deal with file processing for files on the server as well as processing web URLs.
- Understand the paradigm for dealing with form-based data, both from the syntax of HTML forms, and how they are accessed inside a PHP-based script.

**Unit - I:**

**INTRODUCTION TO PHP:** History of PHP, Apache Web Server, MySQL and Open Source, Relationship between Apache, MySQL and PHP (AMP Module), PHP configuration in IIS, Apache Web server

**BASICS OF PHP:** PHP structure and syntax, Creating the PHP pages, Rules of PHP syntax, Integrating HTML with PHP, Constants, Variables : static and global variable, Conditional Structure & Looping, PHP Operators, Arrays, for each constructs, User defined function, argument function, Variable function, Return Function, default argument, variable length argument.

**Unit - II:**

**WORKING WITH FUNCTIONS:** Variable Function, String Function, Math Function, Date Function, Array Function, and File Function. User defined function, Systems defined function, Parameterized function, Non parameterized function, Dynamic parameter in function, Variable scope, Passing Argument in function, Static function.

**Unit - III:**

**WORKING WITH DATA:** FORM element, INPUT elements, Processing the form, User Input, Adding items, Validating the user input, Passing variables between pages. Files, Creating and deleting file, Reading and writing file, Working with file, Creating and deleting folder, Working with regular Expression Basic regular expression, Matching patterns, Finding match, Replace match,

**Unit - IV:**

**ERROR HANDLING:** Error types in PHP, Generating PHP errors, Exceptions, Parse errors, State Management: - Cookies Session, Destroying cookies and session Http management, Sent mail

**Images with PHP:** Working with GD Library, File types with GD and PHP, Compiling PHP with GD, Creating the image table, uploading the image.

**Unit - V:**

**INTRODUCTION TO MYSQL:** MySQL structure and syntax, Types of MySQL tables and storages engines, MySQL commands, Integration of PHP with MySQL, Connection to the MySQL server, Working with PHP and arrays of data, Referencing two tables, Joining two tables.

**WORKING WITH DATABASE:** Creating a table, manipulating the table, editing the database, inserting a record, deleting a record, editing data

**Understand process of executing a PHP-based script on a webserver.**

**TEXT BOOKS:**

1. **Beginning PHP, Apache, MySQL Web Development -** Elizabeth Naramore, Jason Gerner, Yann Le, Scouarnec, Jeremy Stolz, Michael K. Glass, Gary Mailer - By Wrox Publication.
2. **PHP, MySQL and Apache -** Julie C. Melone By Pearson Education

**REFERENCE BOOKS:**

1. **Beginning PHP 5.3,** by Matt Doyle - By Wrox Publication
2. **PHP and MySQL Bible** – Tim Converse and Joyce Park with Clark Morgam By Wiley INDIA

# B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
# PRINCIPLES OF ELECTRONIC COMMUNICATIONS
# (OPEN ELECTIVE - I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EC511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** The objective of this subject is to:

- Introduce the students to modulation and various analog and digital modulation schemes.
- They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

**Course Outcomes:** By completing this subject, the student can

- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

**UNIT - I**

**Introduction:** Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

**UNIT - II**

**Simple description on Modulation:** Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

**UNIT - III**

**Telecommunication Systems:** Telephones Telephone system, Paging systems, Internet Telephony.

**Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

**UNIT - IV**

**Satellite Communication:** Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

**Optical Communication:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

**UNIT - V**

**Cellular and Mobile Communications:** Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

**Wireless Technologies:** Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

**Text Books:**

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999

**Reference Books:**

1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

# B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
# PRINCIPLES OF COMPUTER COMMUNICATIONS AND NETWORKS
# (OPEN ELECTIVE - II)

| **B.Tech. III Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Course Code: EC621OE** | **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.
2. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition MC GRAW HILL EDUCATION, 2006.

**REFERENCE BOOK**S:

1. 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.

# B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
# ELECTRONIC MEASURING INSTRUMENTS
# (OPEN ELECTIVE - III)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EC831OE** | **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:**

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

**REFERENCES:**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

**B.TECH. ELECTRONICS AND COMPUTER ENGINEERING**
**SCRIPTING LANGUAGES**
**(Open Elective – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EM511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** The goal of the course is to study:

- The principles of scripting languages.
- Motivation for and applications of scripting.
- Difference between scripting languages and non- scripting languages.
- Types of scripting languages.
- Scripting languages such as PERL, TCL/TK, python and BASH.
- Creation of programs in the Linux environment.
- Usage of scripting languages in IC design flow.

**Course Outcomes:**

Upon learning the course, the student will have the:

- Ability to create and run scripts using PERL/TCl/Python in IC design flow.
- Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow.

**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**:

1. Python Tutorial by Guido Van Rossum, Fred L. Drake Jr. editor , Release 2.6.4
2. Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk 4.0.
3. Teach Yorself Perl in 21 days by David Till.
4. Red Hat Enterprise Linux 4 : System Administration Guide Copyright, 2005 Red Hat Inc.

**REFERENCE BOOKS**:

1. Learning Python – 2nd Ed., Mark Lutz and David Ascher, 2003, O'Reilly.
2. Perl in 24 Hours – 3rd Ed., Clinton Pierce, 2005, Sams Publishing.
3. Learning Perl – 4th Ed. Randal Schwartz, Tom Phoenix and Brain d foy. 2005.
4. Jython Essentials – Samuele Pedroni and Noel Pappin.2002. O'Reilly.
5. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN 0596000278)

**B.TECH. ELECTRONICS AND COMPUTER ENGINEERING**
**SOFT COMPUTING TECHNIQUES**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EM621OE** | **3** | **0** | **0** | **3** |

**Prerequisite**: Nil.

**Course Objectives:** This course makes the students to Understand

- Fundamentals of Neural Networks & Feed Forward Networks.
- Associative Memories & ART Neural Networks.
- Fuzzy Logic & Systems.
- Genetic Algorithms and Hybrid Systems.

**Course Outcomes:** On completion of this course the students will be able to

- Identify and employ suitable soft computing techniques in classification and optimization problems.
- Design hybrid systems to suit a given real – life problem.

**UNIT –I:**

**Fundamentals of Neural Networks & Feed Forward Networks:**

Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network :The Perceptron Model, Multilayer Feed Forward Neural Network :Architecture of a Back Propagation Network (BPN), The Solution, Back propagation Learning, Selection of various Parameters in BPN. Application of Back propagation Networks in Pattern Recognition & Image Processing.

**UNIT –II:**

**Associative Memories & ART Neural Networks:**

Basic concepts of Linear Associator, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hop field Networks(HPF), Mathematical Foundation of Gradient-Type Hopfield Networks, Transient response of Continuous Time Networks, Applications of HPF in Solution of Optimization Problem: Minimization of the Traveling salesman tour length, Summing networks with digital outputs, Solving Simultaneous Linear Equations, Bidirectional Associative Memory Networks; Cluster Structure, Vector Quantization, Classical ART Networks, Simplified ART Architecture.

**UNIT –III:**

**Fuzzy Logic & Systems:**

Fuzzy sets, Crisp Relations, Fuzzy Relations, Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based system, Defuzzification Methods, Applications: Greg Viot's Fuzzy Cruise Controller, Air Conditioner Controller.

**UNIT –IV:**

**Genetic Algorithms:**

Basic Concepts of Genetic Algorithms (GA), Biological background, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators used in GA, Generational Cycle, Convergence of Genetic Algorithm.

**UNIT –V:**

**Hybrid Systems:**

Types of Hybrid Systems, Neural Networks, Fuzzy Logic, and Genetic Algorithms Hybrid, Genetic Algorithm based BPN: GA Based weight Determination, Fuzzy Back Propagation Dept. of ECE, JNTUHCEH M.Tech. (SSP) (FT) w.e.f. 2015-16 56 Networks: LR-type fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BPN, Inference by fuzzy BPN.

**TEXT BOOKS:**

1. Introduction to Artificial Neural Systems - J.M.Zurada, Jaico Publishers
2. Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications - S.Rajasekaran, G.A. Vijayalakshmi Pai, July 2011, PHI, New Delhi.
3. Genetic Algorithms by David E. Gold Berg, Pearson Education India, 2006.
4. Neural Networks & Fuzzy Sytems- Kosko.B., PHI, Delhi,1994.

**REFERENCE BOOKS:**

1. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
2. An introduction to Genetic Algorithms - Mitchell Melanie, MIT Press, 1998
3. Fuzzy Sets, Uncertainty and Information- Klir G.J. & Folger. T. A., PHI, Delhi, 1993

**B.TECH. ELECTRONICS AND COMPUTER ENGINEERING**
**DATA ANALYTICS**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EM831OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Nil

**Course Objectives**: The student should be made to :

- Be exposed to conceptual frame work of big data.
- Understand different techniques of Data Analysis.
- Be familiar with concepts of data streams.
- Be exposed to item sets, Clustering, frame works and Visualization.

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

- Understand Big data fundamentals.
- Learn various Data Analysis Techniques
- Implement various Data streams.
- Understand item sets, Clustering, frame works & Visualizations.

**UNIT – I**

**Introduction to Big Data:** Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability , analytic process and tools , Analysis vs Reporting – Modern data analytic tools, stastical concepts : Sampling distributions, resampling , statistical inference, prediction error.

**UNIT – II**

**Data Analysis:** Regression modeling , Multivariate analysis, Bayesian modeling , inference and Bayesian networks , Support vector and Kernel methods, Analysis of time series : Linear systems analysis , nonlinear dynamics – Rule induction – Neural networks : Learning and and Generalisation, competitive learning, Principal component analysis and neural networks ; Fuzzy Logic : extracting fuzzy models from data , fuzzy decision trees, Stochastic search methods.

**UNIT – III**

**Mining Data Streams:** Introduction to Streams Concepts – Stream data model and architecture – Stream Computing , Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform ( RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

**UNIT – IV**

**Frequent Itemsets and clustering:** Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

**UNIT – V**

**Frame Works and Visualization:** MapReduce – Hadoop, Hive , MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques : systems and Applications .

**TEXT BOOKS:**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

**REFERENCE BOOKS:**

1. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# NON-CONVENTIONAL POWER GENERATION
# (OPEN ELECTIVE – I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EE511OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Nil.

**Course Objectives:**

- To introduce various types of renewable energy technologies
- To understand the technologies of energy conversion from the resources and their quantitative analysis.

**Course Outcomes:** After completion of this course, the student will be able to

- Analyze solar thermal and photovoltaic systems and related technologies for energy conversion.
- Understand Wind energy conversion and devices available for it.
- Understand Biomass conversion technologies, Geo thermal resources and energy conversion principles and technologies.
- Realize Power from oceans (thermal, wave, tidal) and conversion devices.
- Understand fundamentals of fuel cells and commercial batteries.

**UNIT - I**

Fundamentals of Solar Energy-Solar spectrum- Solar Radiation on Earth's surface-Solar radiation geometry-Solar radiation measurements- Solar radiation data- Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion- Flat plate collectors- concentrated collectors- construction and thermal analysis- Solar applications- Solar ponds- Heliostat systems-water heater-air heater-solar still.

**UNIT - II**

Solar-Electric Power generation- Photovoltaic cells- Equivalent circuit- V-I Characteristics-Photovoltaic modules – constructional details- design considerations- Tracking- Maximum power point tracking - Solar Thermo electric conversion.

**UNIT - III**

Wind Energy- Fundamentals of wind energy-power available in wind- Betz Limit-Aerodynamics of wind turbine- Wind turbines- Horizontal and vertical axis turbines –their configurations- Wind Energy conversion systems.

**UNIT - IV**

Energy from Bio Mass- Various fuels- Sources-Conversion technologies-Wet Processes – Dry Processes- Bio Gas generation – Aerobic and anaerobic digestion - Factors affecting generation of bio gas - Classification of bio gas plants-Different Indian digesters- Digester design considerations - Gasification process - Gasifiers – Applications. Geothermal Energy - sources- Hydrothermal convective - Geo-pressure resources - Petro-thermal systems (HDR) - Magma Resources-Prime Movers.

**UNIT - V**

OTEC Systems- Principle of operation - Open and closed cycles, Energy from Tides - Principle of Tidal Power - Components of tidal Power plants - Operation Methods - Estimation of Energy in Single and double basin systems - Energy and Power from Waves- Wave energy conversion devices - Fuel Cells - Design and Principle of operation - Types of Fuel Cells - Advantages and disadvantages - Types of Electrodes – Applications - Basics of Batteries - Constructional details of Lead acid batteries - Ni-Cd Batteries.

**TEXT BOOKS:**

1. "John Twidell & Wier", "Renewable Energy Resources", CRC Press, 2009.
2. "G. D. Rai", "Non Conventional Energy sources", Khanna publishers, 2004

**REFERENCE BOOKS:**

1. "D. P .Kothari, Singal, Rakesh and Ranjan", "Renewable Energy sources and Emerging Technologies", PHI, 2009.
2. "F. C. Treble", Generating Electricity from Sun, Pergamon Press, 1st Edition 1991
3. "C. S. Solanki", "Solar Photovoltaics - Fundamentals- Principles and Applications", PHI, 2009
4. "S. P. Sukhatme", "Solar Energy Principles and Application", TMH, 2009.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# ELECTRICAL ENGINEERING MATERIALS
# (OPEN ELECTIVE – I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EE512OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Engineering chemistry and Engineering Physics - II

**Course Objective:**

- To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

**Course Outcomes:** After completion of this course, the student will be able to

- 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, curie point, 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, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating 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 oil as per ISI

**Text Books:**

1. "R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

**Reference Books:**

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

**B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING**
**NANOTECHNOLOGY**
**(OPEN ELECTIVE – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EE513OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness, and efficiency. The objective here is imparting the basic knowledge in Nano Science and Technology.

**Course Outcomes:** The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

**UNIT - I**

**Introduction:** History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

**UNIT - II**

**Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials**: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations,

**Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility.

**Magnetic Properties**: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

**UNIT- III**

**Synthesis Routes: Bottom up approaches:** Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self-assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

**UNIT - IV**

**Tools to Characterize nanomaterials:** X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope

(STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

**UNIT - V**

**Applications of Nanomaterials:** Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water-Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology.

**TEXT BOOKS:**

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

**REFERENCES BOOKS:**

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS
# (OPEN ELECTIVE – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EE621OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Power systems - I & Power Systems - II

**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:** After Completion of this course, student will be able to

- 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 four wire 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:**

1. "K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
2. "Er. V. K. Jain, Er. Amitabh Bajaj", "Design of Electrical Installations", University Science Press.

**Reference Books:**

1. 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.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
4. Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding 650 V), Indian Standard Institution, IS: 3106-1966.
5. Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.
8. "Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# ENERGY STORAGE SYSTEMS
# (OPEN ELECTIVE – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EE622OE** | **3** | **0** | **0** | **3** |

**Prerequisite:** Electro chemistry

**Course Objective:**

- To enable the student to understand the need for energy storage, devices and technologies available and their applications

**Course Outcomes:** After completion of this course, the student will be able to

- 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, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the 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:**

1. “James M. Eyer, Joseph J. Iannucci and Garth P. Corey “, “Energy Storage Benefits and Market Analysis”, Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

**Reference Book:**

1. “Jim Eyer, Garth Corey”, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# INTRODUCTION TO MECHATRONICS
# (OPEN ELECTIVE – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EE623OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Basic Electronics Engineering

**Course Objectives:**

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Course Outcomes:** At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

**UNIT – I**

**Introduction**: Definition – Trends - Control Methods: Standalone , PC Based ( Real Time Operating Systems, Graphical User Interface , Simulation ) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

**Signal Conditioning : I**ntroduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

**UNIT – II**

**Precision Mechanical Systems :** Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

**Electronic Interface Subsystems :** TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

**UNIT – III**

**Electromechanical Drives :** Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

**Microcontrollers Overview** : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

**UNIT – IV**

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

**UNIT – V**

**Programmable Motion Controllers** : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

**TEXT BOOKS:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

**REFERENCE BOOKS:**

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

**B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING**
**ENTREPRENEUR RESOURCE PLANNING**
**(OPEN ELECTIVE – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EE831OE** | **3** | **0** | **0** | **3** |

**(Students must read text book. Faculty is free to choose any other cases)**

**Course Objectives:** It enables the student to understand the foundations of Enterprise planning and ERP System Options.

**Course Outcome:** The student understands the challenges in implementation of ERP system, ERP System Implementation options, and functional modules of ERP.

1. Introduction to ERP- Foundation for Understanding ERP systems-Business benefits of ERP-The challenges of implementing ERP system-ERP modules and Historical Development.

Case: Response top RFP for ban ERP system (Mary Sumner).

2. ERP system options & Selection methods-Measurement of project Inpact-information Technology Selection-ERP proposal evaluation-Project Evaluation Technique.(David L. olson).

Case: Atlantic Manufacturing (Mary Sumner).

3. ERP system Installation Options- IS/IT Management results-Risk Identification analysis-System Projects- Demonstration of the system-Failure method-system Architecture & ERP (David L. Olson)

Case: Data Solutions & Technology Knowledge (Mary Sumner).

4. ERP - sales and Marketing- Management control process in sales and marketing - ERP customer relationship management - ERP systems- Accounting & Finance control processes. Financial modules in ERP systems.

Case: Atlantic manufacturing (Mary Sumner).

5. ERP – Production and Material Management-Control process on production and manufacturing - Production module in ERP- supply chain Management & e-market place-e-business & ERP-e supply chain & ERP- Future directions for ERP.

Case: HR in Atlantic manufacturing. (Mary Sumner).

**UNIT - I**

**ERP and Technology:** Introduction – Related Technologies – Business Intelligence – E-Commerce and E Business – Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM

**UNIT - II**

**ERP Implementation:** Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks –Requirements Definition – Methodologies – Package selection –

Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities.

**UNIT - III**

**ERP In Action & Business Modules:** Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance –Materials Management – Quality management – Marketing – Sales, Distribution and service.

**UNIT - IV**

**ERP Market:** Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc –SSA Global – Lawson Software – Epicor – Intutive.

**UNIT - V**

Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP.

**TEXT BOOKS:**

1. Alexis Leon, “ERP DEMYSTIFIED”, Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

**REFERENCE BOOKS:**

1. Jim Mazzullo, “SAP R/3 for Everyone”, Pearson, 2007.
2. Jose Antonio Fernandz, “The SAP R /3 Handbook”, Tata McGraw Hill, 1998.
3. Biao Fu, “SAP BW: A Step-by-Step Guide”, First Edition, Pearson Education, 2003.

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# MANAGEMENT INFORMATION SYSTEM (MIS)
# (OPEN ELECTIVE – III)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EE832OE** | **3** | **0** | **0** | **3** |

**Course Objective:**

- To provide the basic concepts of Enterprise Resource Planning and Management of Information System.
- Explain to students why information systems are so important today for business and management;
- Evaluate the role of the major types of information systems in a business
- Assess the impact of the Internet and Internet technology on business-electronic commerce and electronic business;
- Identify the major management challenges to building and using information systems and learn how to find appropriate solutions to those challenges

**Course Outcomes:** The completion of the subject, the student will be able to

- Understand the usage of MIS in organizations and the constituents of the MIS
- Understand the classifications of MIS, understanding of functional MIS and the different functionalities of these MIS. This would be followed by case study on Knowledge management.
- Assess the requirement and stage in which the organization is placed. Nolan model is expected to aid such decisions
- Learn the functions and issues at each stage of system development. Further different ways in which systems can be developed are also learnt.

**UNIT – I**

**Introduction to IS Models and Types of Information systems:** – Nolan Stage Hypothesis, IS Strategic Grid, Wards Model, Earl's Multiple Methodology, Critical Success Factors, Soft Systems Methodology, Socio-Technical Systems Approach (Mumford), System Develop Life Cycle, Prototype and End User Computing, Application Packages, Outsourcing, Deciding Combination of Methods. Types of Information Systems

**UNIT – II**

**IS Security, Control and Audit**– System Vulnerability and Abuse, business value of security and control, Need for Security, Methods of minimizing risks IS Audit, ensuring system quality.

**UNIT – III**

**Induction to ERP:** Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP, Business Modeling, Integrated Data Model, Foundations of IS in Business, Obstacles of applying IT, ERP Market- ERP Modules: Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, , Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System, ERP System Options and Selection, ERP proposal Evaluation.

**UNIT – IV**

**Benefits of ERP:** Reduction of Lead Time, On-Time Shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design Making Capabilities.

**UNIT – V**

**ERP Implementation and Maintenance**: Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success, User Training, Maintaining ERP & IS**.** Case Studies.

**TEXT BOOKS:**

1. Gordon B. Davis & Margrethe H. Olson: Management Information Systems, TMH, 2009.
2. C Laudon and Jane P. Laudon, et al: Management Information Systems, Pearson Education, 2009.
3. Alexis Leon: ERP (Demystified), 5/E, Tata McGraw-Hill, 2009.
4. C. S. V. Murthy: Management Information System, Himalaya, 2009
5. James A. Obrein: Management Information Systems, TMH, 2009
6. David L Olson: Managerial Issues of Enterprise Resource Planning Systems, McGraw Hill, International Edition-2009.
7. Rainer, Turban, Potter: Introduction to Information Systems, WILEY-India, 2009.
8. Vaman, ERP in Practice, TMH, 2009

**REFERENCE BOOKS:**

1. Dharminder and Sangeetha: Management Information Systems, Excel, 2009
2. Gerald V. Post, David L Anderson: Management Information Systems, Irvin McGraw Hill, 2009.
3. Monk: Concepts in ERP, Cengage, 2009
4. Olson: Managerial Issues of ERO, TMH, 2009
5. Motiwala: Enterprise Resource Planning, Pearson 2009
6. Miller: MIS—Cases, Pearson, 2009

# B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
# ORGANIZATIONAL BEHAVIOUR
# (OPEN ELECTIVE – III)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EE833OE** | **3** | **0** | **0** | **3** |

**Course Objective:**

- To provide the students with the conceptual framework and the theories underlying Organisational Behaviour.

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

- Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour.
- Assess the potential effects of organizational level factors (such as structure, culture and change) on organizational behaviour.
- Critically evaluate the potential effects of important developments in the external environment (such as globalization and advances in technology) on organizational behaviour.
- Analyse organizational behavioural issues in the context of organizational behaviour theories, models and concepts.

**UNIT – I**

Introduction to OB - Definition, Nature and Scope –Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organisational Behaviour. Cognitive Processes-I : Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization - Social perception – Attribution Theories – Locus of control –Attribution Errors –Impression Management.

**UNIT – II**

Cognitive Processes-II: Personality and Attitudes - Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction and organisational commitment-Motivational needs and processes- Work-Motivation Approaches Theories of Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotional intelligence – Self-Efficacy.

**UNIT – III**

Dynamics of OB-I: Communication – types - interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision making techniques – creativity and group decision making . Dynamics of OB –II Stress and Conflict: Meaning and types of stress –Meaning and types of

conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

**UNIT – IV**

Dynamics of OB –III Power and Politics: Meaning and types of power – empowerment - Groups Vs. Teams – Nature of groups –dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place.

**UNIT – V**

Leading High performance: Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High performance work practices - Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

**TEXT BOOKS:**

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
2. Mc Shane: Organizational Behaviour, 3e, TMH, 2008
3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008.
4. New strom W. John& Davis Keith, Organisational Behaviour-- Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.
5. Pierce and Gardner: Management and Organisational Behaviour: An Integrated perspective, Thomson, 2009.
6. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009.
7. Pareek Udai: Behavioural Process at Work:, Oxford & IBH, New Delhi, 2009.

**REFERENCE BOOKS:**

1. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008.
2. Hitt: Organizational Behaviour, Wiley, 2008
3. Aswathappa: Organisational Behaviour, Himalaya, 2009
4. Mullins: Management and Organisational Behaviour, Pearson, 2008.
5. McShane, Glinow: Organisational Behaviour--Essentials, TMH, 2009.
6. Ivancevich: Organisational Behaviour and Management, 7/e, TMH, 2008.

**B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING**
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**
**(Open Elective – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: EI511OE** | **3** | **0** | **0** | **3** |

**Prerequisite: Nil**

**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:** 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.

**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:**

1. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

**REFERENCE BOOKS:**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

**B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING**
**INDUSTRIAL ELECTRONICS**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EI621OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Basic Electrical and Electronics Engineering or Electronic Devices and Circuits.

**UNIT - I**

**DC Amplifiers:** Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

**UNIT - II**

**Regulated Power Supplies:** Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection.

**Switched Mode & IC Regulators:** Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators - Current boosting .

**UNIT - III**

**SCR and Thyristor:** Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR.

**UNIT - IV**

**Applications of SCR in Power Control:** Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave.

**DIAC, TRIAC and Thyristor Applications:** Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation.

**UNIT - V**

**Industrial Applications - I:** Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators.

Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

**Industrial Applications - II:** High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties,

Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications.

**TEXTBOOKS:**

1. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
2. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

**REFERENCE BOOKS:**

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Thyristors and applications – M. Rammurthy, East-West Press, 1977.3.
3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

**B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING**
**SENSORS AND TRANSDUCERS**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EI831OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Nil

**Course Objectives:** To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities and the following:

- Various types of Sensors & Transducers and their working principle
- Resistive, Capacitive and Inductive transducers
- Some of the miscellaneous transducers
- Characteristics of transducers

**Course Outcomes:** Upon completion of this course the student shall be able to understand the working of basic sensors and transducers used in any industries.

**UNIT – I**

**Measurements and Instrumentation of Transducers:** Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers.

**UNIT – II**

**Characteristics of Transducers:** Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs

**UNIT – III**

**Resistive Transducers:** Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer

**UNIT – IV**

**Inductive and Capacitive Transducer:** Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

**UNIT – V**

**Miscellaneous Transducers:** Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers

**TEXT BOOKS:**

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.

**REFERENCE BOOKS:**

1. Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.
2. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
3. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
4. Murthy. D. V. S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
5. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
6. Instrument Transducers – An Introduction to their Performance and design – by Herman K. P. Neubrat, Oxford University Press.

**B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING**
**PC BASED INSTRUMENTATION**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: EI832OE** | **3** | **0** | **0** | **3** |

**Course Objective:** To introduce interfacing data acquisition systems to PC and introducing PLCs with their classification, operation, and programming.

**UNIT – I**

**Introduction to Computer Instrument Communication:** Personal Computer, overview of operating System, I/O Ports, Plug-in-slots, PCI bus, Operators Interface. Computer Interfacing for Data Acquisition and Control – Interfacing Input Signals, Output system with continuous actuators. Data Acquisition and Control using Standard Cards: PC expansion systems, Plug-in Data Acquisition Boards; Transducer to Control room, Backplane bus – VXI.

**UNIT – II**

**Programmable logic controller (PLC) basics:** Definition, overview of PLC systems, input/output modules, power supplies, and isolators.

**Basic PLC programming:** Programming On-Off inputs/ outputs. Creating Ladder diagrams Basic PLC functions PLC Basic Functions, register basics, timer functions, counter functions.

**UNIT – III**

**PLC intermediate and advanced functions:** Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. Utilizing digital bits, sequencer functions, matrix functions. PLC Advanced functions: Analog PLC operation, networking of PLC.

**UNIT – IV**

**Application of PLC:** Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating

**UNIT – V**

**Related Topics:** Alternate programming languages. Auxiliary commands and functions. PLC installation, troubleshooting, and maintenance. Field bus: Introduction, concept. HART protocol: Method of operation, structure, and applications. Smart transmitters, smart valves, and smart actuators.

**TEXT BOOKS**

1. Programmable Logic Controllers – Principles and Applications, John. W .Webb Ronald A Reis , Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Computer Control of Processes – M.Chidambaram. Narosa 2003.

**REFERENCES**

1. PC Based Instrumentation and Control Third Edition by Mike Tooley ; Elsevier.
2. PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation, and Control. By Kevin James; Elsevier.
3. Practical Data Acquisition for Instrumentation and Control Systems by John Park and Steve Mackay.
4. Distributed Control Systems, Lukcas M.P, Van Nostrand Reinhold Co., New York, 1986.
5. 5. Programmable Logic Controllers, Second edition, Frank D. Petruzella, Mc Graw Hill, New York, 1997.
6. Programmable Logic Controllers Programming methods and applications-Prentice Hall by John R. Hackworth and Frederick D. Hackworth, Jr.

**B.TECH. MECHANICAL ENGINEERING**
**OPTIMIZATION TECHNIQUES**
**(Open Elective – I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME511OE** | **3** | **0/0/0** | **3** |

**Prerequisite:** Mathematics –I & Mathematics –II

**Course Objectives:**

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

**Course Outcomes:** After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

**UNIT – I**

**Introduction and Classical Optimization Techniques:** Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

**Classical Optimization Techniques:** Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

**UNIT – II**

**Linear Programming:** Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

**Transportation Problem:** Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

**UNIT – III**

**Unconstrained Nonlinear Programming:** One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

**Unconstrained Optimization Techniques:** Univariant method, Powell's method and steepest descent method.

U**NIT – IV**

**Constrained Nonlinear Programming:** Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

**UNIT – V**

**Dynamic Programming:** Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**TEXT BOOKS:**

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

**REFERENCE BOOKS:**

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

**B.TECH. MECHANICAL ENGINEERING**
**COMPUTER GRAPHICS**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME512OE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- To make students understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
- To make the student present the content graphically.

**Course Outcomes:**

- Students can animate scenes entertainment.
- Will be able work in computer aided design for content presentation..
- Better analogy data with pictorial representation.

**UNIT - I**

**Introduction:** Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices

**Output primitives:** Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

**UNIT - II**

**2-D Geometrical transforms:** Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

**2-D Viewing:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

**UNIT - III**

3-**D Object representation**: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, sweep representations, octrees BSP Trees,

**3-D Geometric transformations**: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

**UNIT - IV**

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods

**Illumination Models and Surface rendering Methods:** Basic illumination models, polygon rendering methods

**UNIT- V**

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

**TEXT BOOKS:**

1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson education.
2. "Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc Graw hill edition.

**REFERENCE BOOKS:**

1. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
2. "Procedural elements for Computer Graphics", David F Rogers, Tata Mc Graw hill, 2nd edition.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4. "Principles of Computer Graphics", Shalini, Govil-Pai, Springer.
5. "Computer Graphics", Steven Harrington, TMH
6. Computer Graphics, F. S. Hill, S. M. Kelley, PHI.
7. Computer Graphics, P. Shirley, Steve Marschner & Others, Cengage Learning.
8. Computer Graphics & Animation, M. C. Trivedi, Jaico Publishing House.
9. An Integrated Introduction to Computer Graphics and Geometric Modelling, R. Goldman, CRC Press, Taylor&Francis Group.
10. Computer Graphics, Rajesh K.Maurya, Wiley India.

**B.TECH. MECHANICAL ENGINEERING**
**INTRODUCTION TO MECHATRONICS**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME513OE** | **3** | **0/0/0** | **3** |

**Pre-requisites:** Basic Electronics Engineering

**Course Objectives:**

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Course Outcomes:** At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

**UNIT – I**

**Introduction**: Definition – Trends - Control Methods: Standalone , PC Based ( Real Time Operating Systems, Graphical User Interface , Simulation ) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

**Signal Conditioning : I**ntroduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

**UNIT – II**

**Precision Mechanical Systems :** Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

**Electronic Interface Subsystems :** TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

**UNIT – III**

**Electromechanical Drives :** Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

**Microcontrollers Overview** : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

**UNIT – IV**

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

**UNIT – V**

**Programmable Motion Controllers** : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

**TEXT BOOKS:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

**REFERENCE BOOKS:**

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

**B.TECH. MECHANICAL ENGINEERING**
**FUNDAMENTALS OF MECHANICAL ENGINEERING**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME514OE** | **3** | **0/0/0** | **3** |

**Pre-Requisites:** None
**Course Objectives:** Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

**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:**

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson
2. Introduction to Engineering Materials / B.K. Agrawal/ Mc Graw Hill

**REFERENCE BOOKS:**

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

**B.TECH. MECHANICAL ENGINEERING**
**WORLD CLASS MANUFACTURING**
**(Open Elective – II)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME621OE** | **3** | **0/0/0** | **3** |

**Pre-requisites:** None

**Course Objectives:** To understand the concept of world class manufacturing, dynamics of material flow, OPT and Lean manufacturing.

**Course Outcomes:** Students should be able to compare the existing industry with WCM companies.

**UNIT - I**

**Information Age and Global Competitiveness:** The Emergence of Information Age; Competition and Business Challenge; Operating Environment; Globalization and International Business; Global Competitiveness and Manufacturing Excellence; World Class Manufacturing and Information Age Competition; Manufacturing Challenges, Problems in Manufacturing Industry.

**UNIT - II**

**Cutting Edge Technology:** Value Added Engineer in - Hall's Framework; Schonberger's Framework of WCM; Gunn's Model; Maskell's Model.

**Philosophy of World Class Manufacturing:** Evolution of WCM; Ohno's View on WCM; Principles and Practices; Quality in WCM; Deming's & Shingo's Approach to Quality Management; Culmination of WCM.

**UNIT - III**

**System and Tools for World Class Manufacturing:** The Integration Imperative; Overview of Systems and Tools; Information Management Tools - Product and Process Design Tools, Bar Code Systems, Kanban: A Lean Production Tool, Statistical Quality Control (SQC), Material Processing, and Handling Tools; Assessment of Manufacturing Systems and Tools.

**Labor and HRD Practices in WCM:** Human Resource Dimensions in WCM; Morale and Teamwork; High Employee Involvement; Cross Functional Teams; Work Study Methods; Human Integration Management.

**UNIT - IV**

**Competitive Indian Manufacturing:** Manufacturing Performance and Competitiveness - Indian Firms: Manufacturing Objectives and Strategy; Usage of Management Tools and Technologies; Manufacturing Management Practices; IT Infrastructure and Practices; Strategic Intent Framework; Breadth and Integration of IT Infrastructure.

**Globalization and World Class Manufacturing:** Generic Manufacturing Strategies for Information Age; Planning Methodology and Issues in Strategic Planning of WCM; Performance Measurement - PO-P System, TOPP System and Ambite System.

**UNIT - V**

**The Future WCM:** Manufacturing Strategy: Futile Search for an Elusive Link, Manufacturing Strategic Intent Classification, Translating Intent into Action.

**Case Studies:** Accelerated Fermentation Process – Using World Class Enzymes; Birla Cellulosic Kharach.

**TEXT BOOKS:**

1. World Class Manufacturing- A Strategic Perspective / BS Sahay, KBS Saxena & Ashish Kumar / Macmillan
2. Making Common Sense Common Practice – Models for Manufacturing Excellence / Ron Moore / Butter Worth Heinemann

**REFERENCE BOOKS:**

1. Managing Technology and Innovation for Competitive Advantage / V. K. Narayanan/ Prentice Hall
2. World Class Manufacturing - The Lesson of Simplicity / Richard J Schonberger / Free Press

**B.TECH. MECHANICAL ENGINEERING**
**FUNDAMENTALS OF ROBOTICS**
**(Open Elective – II)**

| | | | |
|---|---|---|---|
| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
| **Course Code**: **ME622OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

**Course outcomes:** After this completion of this course, the student should be able to

- Understand the basic components of robots.
- Differentiate types of robots and robot grippers.
- Model forward and inverse kinematics of robot manipulators.
- Analyze forces in links and joints of a robot.
- Programme a robot to perform tasks in industrial applications.
- Design intelligent robots using sensors.

**UNIT - I**

Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator. Components of Industrial robotics-precession of movement-resolution, accuracy & repeatability-Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors,& Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

**UNIT - II**

Grippers - Mechanical Gripper-Grasping force-Engelberger-g-factors-mechanisms for actuation, Magnetic gripper , vaccume cup gripper-considerations in gripper selection & design . Industrial robots specifications. Selection based on the Application .

**UNIT - III**

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

**UNIT - IV**

Trajectory planning: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, bleding scheme. Introduction Cartesian space scheme.

Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

**UNIT - V**

Programming of Robots and Vision System-Lead through programming methods- Teach pendent- overview of various textual programming languages like VAL etc.

Machine (robot) vision:

**TEXT BOOKS:**

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Robotics / John J. Craig/ Pearson

**REFERENCE BOOKS:**

1. Theory of Applied Robotics /Jazar/Springer.
2. Robotics / Ghosal / Oxford

**B.TECH. MECHANICAL ENGINEERING**
**FABRICATION PROCESSES**
**(Open Elective –II)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME623OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** Understand the philosophies of various Manufacturing process.

**Course Outcomes:** 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, Thermit 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:**

1. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

**REFERENCE BOOKS:**

1. Metal Casting / T.V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

**B.TECH. MECHANICAL ENGINEERING**
**TOTAL QUALITY MANAGEMENT**
**(Open Elective - III)**

| | | | |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
| **Course Code**: **ME831OE** | **3** | **0/0/0** | **3** |

**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/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

**TEXT BOOK:**

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
2. Total Quality Management/P. N. Mukherjee/PHI

**REFERENCE BOOKS:**

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011

5. Total Engineering Quality Management/Sunil Sharma/Macmillan

**B.TECH. MECHANICAL ENGINEERING**

**INDUSTRIAL SAFETY, HEALTH, AND ENVIRONMENTAL ENGINEERING**

**(Open Elective - III)**

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code: ME832OE** | **3** | **0/0/0** | **3** |

**Pre-requisites:** None

**Course Objectives:**

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948.
- To familiarize students with powers of inspectorate of factories.
- To help students to learn about Environment act 1948 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.

**Course Outcomes:**

- To list out important legislations related to Health , Safety and Environment
- To list out requirements mentioned in factories act for the prevention of accidents. To understand the health and welfare provisions given in factories act.
- To understand the statutory requirements for an Industry on registration, license and its renewal.
- To prepare onsite and offsite emergency plan.

**UNIT - I**

**Factories Act – 1948 :** Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Telangana Factories Rules 1950 under Safety and health chapters of Factories Act 1948

**UNIT II**

**Environment Act – 1986:** General Powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

**UNIT - III**

**Manufacture, Storage and Import of Hazardous**

**Chemical Rules 1989 :** Definitions – duties of authorities – responsibilities of occupier – notification of major accidents –information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.

**UNIT - IV**

**Other Acts and Rules :** Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules – hazardous wastes (management7 and handling) rules, 1989, with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Gas cyclinder rules-Explosives Act 1983-Pesticides Act

**UNIT - V**

**International Acts and Standards:** Occupational Safety and Health act of USA (The Williames-Steiger Act of 1970) – Helath and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

**TEXT BOOKS:**

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., New Delhi.
3. Industrial Safety, Health and Environment Management Systems / R. K. Jain, Sunil S. Rao / Khanna Publishers.

**REFERENCE BOOKS:**

1. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt. Ltd., New Delhi.
2. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt. Ltd., New Delhi.
3. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.
4. The Mines Act 1952, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.
5. The manufacture, storage, and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.

**B.TECH. MECHANICAL ENGINEERING**
**BASICS OF THERMODYNAMICS**
**(Open Elective - III)**

| | L | T/P/D | C |
|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | |
| **Course Code**: **ME833OE** | **3** | **0/0/0** | **3** |

**Pre-requisite**: Engineering Chemistry and Physics

**Course Objective**: To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

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

- Understand and differentiate between different thermodynamic systems and processes
- Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes
- Understand and analyze the Thermodynamic cycles

**UNIT – I**

**Introduction: Basic Concepts:** System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle, Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility

**UNIT - II**

Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

**UNIT – III**

First and Second Laws of Thermodynamics: First Law: Cycle and Process, Specific Heats (cp and cv), Heat interactions in a Closed System for various processes, Limitations of First Law, Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator), Efficiency/COP, Second Law: Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, Statement of Clausius Inequality, Property of Entropy, T-S and P-V Diagrams

**UNIT - IV**

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const.

Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, , Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation ,Psychrometric chart.

**UNIT - V**

**Power Cycles:** Otto, Diesel cycles - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis

**Refrigeration Cycles:** Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

**TEXT BOOKS:**

1. Basic Engineering Thermodynamics / PK Nag / Mc Graw Hill
2. Engineering Thermodynamics / chattopadhyay/ Oxford

**REFERENCE BOOKS:**

1. Thermodynamics for Engineers / Kenneth A. Kroos , Merle C. Potter/ Cengage
2. Thermodynamics /G.C. Gupta /Pearson

**B.TECH. MECHANICAL ENGINEERING**
**RELIABILITY ENGINEERING**
**(Open Elective - III)**

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **ME834OE/AM852PE/EI862PE** | **3** | **0/0/0** | **3** |

**Prerequisite:** Mathematics III

**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:** After completion of this course, the student will be able to

- 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 irrepairable 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 method- tie 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:**

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

**REFERENCE BOOK:**

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993**.**

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**
**FABRICATION PROCESSES**
**(Open Elective - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: NT511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** Understand the philosophies of various Manufacturing process.

**Course Outcomes:** 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, Thermit 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:**

1. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

**REFERENCE BOOKS:**

1. Metal Casting / T. V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**
**NON DESTRUCTIVE TESTING METHODS**
**(Open Elective - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: NT512OE** | **3** | **0** | **0** | **3** |

**Course overview:** The aim is to introduce students the overview of the non destructive testing methods of materials. The course covers NDE, Ultrasonic, MPI testing of metal parts. It gives an idea about selection of the testing criteria. It briefly describe the thermo-graph and radio graph methods of testing and provide selection properties for different tests.

**Course Objectives:** This course has the basic idea of the properties of steal and ferrous metals. The objectives aim to:

1. Identify the basic methods of testing.
2. Understand the concept of non destructive testing.
3. Describe the various types of NDT tests carried out on components.
4. Describe ultrasonic method of testing the materials.
5. Analyze the different types of test carried out on components and surfaces.
6. Understand the properties of materials suitable for NDT test.
7. Understand the radiography uses in engineering.

**Course Outcomes:** At the end of the course the students are able to:

1. Identify the requirements of testing criteria as per material composition.
2. Understand the theory of non destructive testing methods is used.
3. Determine the type of requirement of non destructive test.
4. Distinguish between the various NDT test as Ultrasonic and Eddy current methods.
5. Understand the properties of radiation used in engineering.
6. Describe the various types of non destructive test used to determine the surface cracks.

**UNIT - I**

**Overview of NDT -** NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, various physical characteristics of materials and their applications in NDT, Visual inspection.

**UNIT - II**

**Surface NDE Methods:** Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

**UNIT - III**

**Thermography and Eddy Current Testing -** Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

**UNIT - IV**

**Ultrasonic Testing and Acoustic Emission -** Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique IV Principle, AE parameters, Applications

**UNIT - V**

**Radiography -** Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

**TEXT BOOKS:**

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu, Practical Non-Destructive Testing¡¨, Narosa Publishing House, 2009.
2. Ravi Prakash, Non-Destructive Testing Techniques¨, 1st revised edition, New Age International Publishers, 2010

**REFERENCES:**

1. ASM Metals Handbook, ¨Non-Destructive Evaluation and Quality Control¨, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier, Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**

**FUNDAMENTALS OF ENGINEERING MATERIALS**

**(Open Elective - I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: NT513OE** | **3** | **0** | **0** | **3** |

**Course Overview:**

The aim is to introduce students the overview of the properties of materials used in engineering manufacturing process. The course covers basic concept of ferrous, non-ferrous metals and its alloys. It emphasizes on transformation of iron at various temperatures. It briefly describes the heat treatment given to iron and its alloys. It gives the general overview idea of composite materials.

**Course Objectives:** This course has the basic idea of the properties of steal and ferrous metals. The objectives aim to:

- Identify the basic crystalline structure of steal.
- Understand the concept of TTT.
- Describe the various heat treatment methods to obtain the desired properties.
- Describe the composition of carbon contents in steel.
- Analyze the different forms of iron obtained during heating of steel.
- Understand the properties of non-ferrous alloys.
- Understand requirement.

**Course Outcomes:** At the end of the course the students are able to:

- This subject gives student a technical knowledge about behavior of metals.
- Identify the crystalline structure of steel.
- Understand the theory of time temperature and transformation.
- Determination of different uses of heat treatment in steel.
- Distinguish between the various forms of steel.
- Understand the properties of non-ferrous alloys.
- Describe the various uses of composite materials.

**UNIT – I**

**Structure of Metals**: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods. Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

**UNIT –II**

**Phase Diagrams**: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

**UNIT – III**

**Steels**: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

**UNIT – IV**

**Cast Irons**: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron. Engineering Materials-III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

**UNIT – V**

**Ceramics, Polymers and Composites**: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.

**TEXT BOOKS:**

1. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

**REFERENCE BOOKS:**

1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and callister.
3. Elements of Material science / V. Rahghavan

# B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)
# INTRODUCTION TO MATERIALS HANDLING
## (Open Elective – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: NT621OE** | **3** | **0** | **0** | **3** |

**Course Overview**

Course covers a systems approach to managing activities associated with traffic, transportation, inventory management, warehousing, packaging, order processing, and materials handling. This course is designed to give students a comprehensive understanding of the issues involved in the design of an industrial production system. It will cover the problems in plant location, product analysis, process design, equipment selection, materials handling, and plant layout.

**Course Objectives:**

- To develop competency for system visualization and design.
- To enable student to design cylinders and pressure vessels and to use IS code.
- To enable student select materials and to design internal engine components.
- To introduce student to optimum design and use optimization methods to design mechanical components.
- To enable student to design machine tool gearbox.
- To enable student to design material handling systems.
- Ability to apply the statistical considerations in design and analyze the defects and failure modes in

**Course Outcomes:**

- Demonstrate ability to successfully complete Fork Lift Certification to safely and effectively operate in the manufacturing environment.
- Demonstrate proficiency in supply chain operations, utilizing appropriate methods to plan and implement processes necessary for the purchase and conveyance of goods in a timely and cost-effective manner
- It explains about the different types of material handling, advantages and disadvantages. It also suggests the selection procedure for the material handling along with its specifications.
- Need for Material handling also explained with different techniques like Automated Material handling Design Program, Computerized material handling Planning will be dealt.
- The Material handling is explained with models, selection procedure of material handling is depending on different function oriented systems. This also related with plant layout by which the minimization of the handling charges will come down.
- The ergonomics related to material handling equipment about design and miscellaneous equipments.

**UNIT – I**

Types of intraplant transporting facility, principal groups of material handling equipments, choice of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

**UNIT – II**

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains hemp rope and steel wire rope, selection of ropes, fastening of hain sand ropes , different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems . Chain and rope sheaves and sprockets.

**UNIT – III**

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, electric lifting magnets, grabbing attachments for loose materials, crane attachments for handling liquid materials.

**UNIT – IV**

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes, shoe brakes, thermal calculations of shoe brakes and life of linings, safety handles, load operated constant force and variable force brakes general theory of band brakes, its types and construction.

**UNIT – V**

Different drives of hosting gears like individual and common motor drive for several mechanisms, traveling gear, traveling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyred and crawler cranes motor propelled trolley hoists and trolleys, rails and traveling wheels, slewing, jib and luffing gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, drive efficiency calculations, selecting the motor rating and determining braking torque for traveling mechanisms, slewing mechanisms, jib and luffing mechanisms. (Elementary treatment is expected)

**TEXT BOOKS:**

1. Materials Handling Equipment – N. Rudenko , Envee Publishers, New Delhi
2. Materials Handling Equipment – M.P. Alexandrov. Mie publications, Moscow

**REFERENCE BOOKS:**

1. Aspects of Material handling - Arora
2. Introduction to Material Handling- Ray
3. Plant Layout and Material Handling- Chowdary RB

# B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)
# NON-CONVENTIONAL ENERGY SOURCES
## (Open Elective – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: NT622OE** | **3** | **0** | **0** | **3** |

**Course Overview:**

Non Conventional resources include solar energy, wind, falling water, the heat of the earth (geothermal), plant materials (biomass), waves, ocean currents, temperature differences in the oceans and the energy of the tides. Non Conventional energy technologies produce power, heat or mechanical energy by converting those resources either to electricity orto motive power. The policy maker concerned with development of the national grid system will focus on those resources that have established themselves commercially and are cost effective for on grid applications. Such commercial technologies include hydroelectric power, solar energy, fuels derived from biomass, wind energy and geothermal energy. Wave, ocean current, ocean thermal and other technologies that are in the research or early commercial stage, as well as non-electric Non Conventional energy technologies, such as solar water heaters and geothermal heat pumps, are also based on Non Conventional resources, but outside the scope of this Manual.

**Course Objectives:**

- Graduates will demonstrate the ability to use basic knowledge in mathematics, science and engineering and apply them to solve problems specific to mechanical engineering (Fundamental engineering analysis skills).
- Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results (Information retrieval skills).
- Graduates should be capable of self-education and clearly understand the value of life-long learning (Continuing education awareness).
- Graduates will develop an open mind and have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues (Social awareness).
- Graduate will be able to design a system to meet desired needs within environmental, economic, political, ethical health and safety, manufacturability and management knowledge and techniques to estimate time, resources to complete project (Practical engineering analysis skills).

**Course Outcomes:**

- Introduction to Renewable Energy Sources, Principles of Solar Radiation, Different Methods of Solar Energy Storage and its Applications, Concepts of Solar Ponds, Solar Distillation and Photo Voltaic Energy Conversion

- Introduction to Flat Plate and Concentrating Collectors ,Classification of Concentrating Collectors
- Introduction to Wind Energy, Horizontal and Vertical Access Wind Mills, Bio-Conversion
- Types of Bio-Gas Digesters and Utilization for Cooking Geothermal Energy Resources
- Types of Wells and Methods of Harnessing the Energy, Ocean Energy and Setting of OTEC Plants
- Tidal and Wave Energy and Mini Hydel Power Plant, Need and Principles of Direct Energy Conversion
- Concepts of Thermo-Electric Generators and MHD Generators

**UNIT - I**

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. Classification of NCES - Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

**UNIT - II**

Solar Energy-Energy available form Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

**UNIT - II**

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion - Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors-Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

**UNIT - IV**

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features-Atmospheric exhaust and condensing, exhaust types of conventional steam turbines.

Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

**UNIT - V**

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power plants, Operational of small

cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

**TEXT BOOKS:**

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.

**REFERENCE BOOKS:**

1. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing House, New Delhi, 2004
2. Wakil MM, *Power Plant Technology*, Mc Graw Hill Book Co, New Delhi, 2004.
3. Non - Conventional Energy Sources. Rai

# B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)
# ROBOTICS
## (Open Elective – II)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: NT623OE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Basic principles of Kinematics and mechanics

**Course Objectives:** The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

**Course Outcomes:** At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.

**UNIT – I**

**Introduction:** Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.

**Components of the Industrial Robotics:** common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

**UNIT – II**

**Motion Analysis:** Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

**Manipulator Kinematics**-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

**UNIT – III**

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.

**UNIT IV**

**Robot actuators and Feedback components:**

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

**UNIT V**

**Robot Application in Manufacturing:**

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

**TEXT BOOKS:**

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

**REFERENCE BOOKS:**

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada , Slotine / Wiley Inter-Science

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**

**CONCEPTS OF NANO SCIENCE AND TECHNOLOGY**

(**Open Elective - III**)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: NT831OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Beginners will be able to acquaint themselves with the excited subject though they are novice, whereas advanced learners will equip themselves to solve the complicated issues further.
- To know the importance of the synthesis method addressed in the material properties and give practical experience of nanomaterials synthesis/properties and characterization; investigations into the various factors influence the properties of nanomaterials, optimizing the procedures, and implementations to the new designs
- To provide a sound understanding of the various concepts involved in fabrication of device architectures' and able to evaluate them in advance

**Course Outcome:** The intended course covers the whole spectrum of nanomaterials ranging from introduction, classification, synthesis, properties, and characterization tools of nanophase materials to application including some new developments in various aspects.

**UNIT - I**

**Introduction to Nano:** Importance, Definition and scope, Nano size, challenges, applications. Electrons**,** Other Materials**,** Nano magnetism as a case study; Fundamental terms (Physics & Chemistry) in nano-science and technology; Feynman's perspective; Scaling laws pertaining to mechanics, optics, electromagnetism; Importance of Quantum mechanics, statistical mechanics and chemical kinetics in nano-science and technology;

**UNIT - II**

**Classification of nano materials:** Scientific basis for top-down and bottom-up approaches to synthesize Nanomaterials; How to characterize Nanomaterials?

**UNIT - III**

**Tools for Nanoscience and Technology:** Tools for measuring properties of Nanostructures, Tools to Make Nanostructures. Nano scale Bio-structures, modelling

**UNIT - IV**

**Nano-Biotechnology**: Bio-molecules; Biosensors; Nanomaterials in drug delivery; Working in clean room environments; Safety and related aspects of Nanomaterials;

**UNIT – V**

**Carbon Nanomaterials and Applications:** Carbon Nano structures and types of Carbon Nano tubes, growth mechanisms of carbon nanotubes. Carbon clusters and Fullerenes, Lithium & Hydrogen adsorption & storages, Fuel cell applications and energy storage, Chemical Sensors applications of CNTs

**TEXT BOOKS AND REFERENCES:**

1. Textbook of Nanoscience and Nanotechnology – B. S. Murthy, P. Shankar, Baldev Raj, B. B. Rath and James Murday, University Press-IIM Series in Metallurgy and Materials Science.
2. A Textbook of Nanoscience and Nanotechnology – T. Pradeep, Tata McGraw Hill edition.
3. Nanotechnology Fundamentals and Applications- by Manasi Karkare I. K International
4. Nanoscience and Nanotechnology in engineering – by Vijay K Varadan A Sivathanu pillai Word scientific
5. Nanotechnology Applications To Telecommunications And Networking By Daniel Minoli, Wiley Interscience
6. Nanotechnology Principles and Applications by Sulabha Kulkarni

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**

**SYNTHESIS OF NANOMATERIALS**

(**Open Elective - III**)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: NT832OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To provide knowledge about top-down and bottom-up approaches for the synthesis of nanomaterials.
- To enhance the various nanosynthesis techniques and to identify and solve problems
- To design and conduct experiments relevant to nanochemistry, as well as to analyze the results.
- To improve usage of synthesis methods for modern technology

**Course Outcome:** To provide abundant knowledge on various synthesis methods of nanomaterials.

**UNIT - I**

Introduction, Bottom-up approach: Sol-gel method, emulsion and Top-down: ball milling approach with examples.

**UNIT - II**

Physical methods: Inert gas condensation, Arc discharge, plasma synthesis, electric explosion of wires, molecular beam epitaxy, Physical Vapour Deposition, thermal evaporation, lithography and sputtering.

**UNIT - III**

Chemical methods: Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, co-precipitation method. Semiconductor nanocrystals by arrested precipitation, sonochemical routes

**UNIT - IV**

Biological methods – use of bacteria, fungi, actinomycetes for nano-particle synthesis nano-particles Solvated metal atom dispersion, Template based synthesis of nanomaterials.

**UNIT - V**

Thermolysis route - spray pyrolysis, solvothermal and hydrothermal routes, solution combustion synthesis, Chemical vapor deposition

**TEXTBOOKS:**

1. Textbook of Nanoscience and Nanotechnology – B. S. Murthy, P. Shankar, Baldev Raj, B. B .Rath and James Murday, University Press-IIM Series in Metallurgy and Materials Science.
2. A Textbook of Nanoscience and Nanotechnology – T. Pradeep, Tata McGraw Hill edition.
3. Nanostructures and Nanomaterials by Guozhong Cao
4. Inorganic Materials Synthesis and Fabrication by J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, John Wiley & Sons Inc.
5. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
6. The Chemistry of nanomaterials: Synthesis, Properties and Applications, Vol-I by C.N.R. Rao, A. Muller and A.K. Cheetham
7. The Physics of Micro/Nano- Fabrication by Ivor Brodie and Julius J.Muray

**REFERENCE BOOKS:**

1. Encyclopedia of Nanotechnology by M. Balakrishna Rao and K. Krishna Reddy, Vol I to X, Campus books.
2. Encyclopedia of Nanotechnology by H.S. Nalwa
3. Nano: The Essentials – Understanding Nano Science and Nanotechnology – by T. Pradeep, Tata McGraw Hill

**B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)**

**CHARACTERIZATION OF NANOMATERIALS**

(**Open Elective - III**)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: NT833OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To develop ability to understand modern characterization techniques especially utilized to probe in nanoscopic regime
- To elucidate on application of standard spectroscopy, microscopy techniques for element analysis, structure analysis, depth profiling, topography imaging, as well as surface and interface analysis
- To provide overview of principles underlying the characterization methods and basic theory for analysis of the data obtained from the instrument
- The objective of this course is to make the students understand the principles underlying various spectroscopies and instrumentations specific to nanomaterials

**UNIT - I**

**Fundamentals of Electron Microscopy:** Advantages of Electron Microscope over Optical Microscope (Magnification, Resolution, Depth of field). Theory and principle of Electron Microscope, Electron sources, Electron lenses (Electrostatic and Electromagnetic).

**UNIT - II**

**Scanning Electron Microscopy: SEM**: Theory of operation, Specimen-Beam interactions Importance of beam spot size, Machine variables, Scanning Electron Microscope (SEM). **Specimen Preparation in SEM**: Special methods for various sample types – Biological sample preparation, Applications of SEM

**UNIT - III**

**Transmission Electron Microscopy: TEM**: Theory of operation, Modes of operation, Transmission Electron Microscope (TEM),Bright field Imaging, Electron diffraction, Dark field imaging, High Resolution TEM (HRTEM), Applications of TEM.

**UNIT - IV**

**Atomic Force Microscopy:** AFM: Basic concepts – Interactive forces, Principle and instrumentation, Force curves and force measurements, Modes of imaging: Tapping, contact and non-contact, Probes, Tip functionalization,

**UNIT - V**

**X-Ray Diffraction and Spectroscopic methods:**

X-ray diffraction–Powder method, Single crystal diffraction technique -Determination of crystal strucures – Nanostructural analysis – Profile analysis (peak broadening and micro strain) – Crystallite size analysis using Scherer formula and Williamson – Hall equation. UV Spectroscopy, IR Spectroscopy and Raman Spectroscopy

**TEXT BOOKS:**

1. Nanotechnology: Principles and Practices – Sulabha K. Kulkarni – Capital Publishing Company
2. 2. Nano: The Essentials – Understanding Nanoscience and Nanotechnology by T. Pradeep. Tata McGraw Hill
3. 3. Introduction to Nano Technology by Charles. P. Poole Jr and Frank J. Owens, Wiley India Pvt Ltd.
4. A practical approach to X-Ray diffraction analysis by C. Suryanarayana

**REFERENCES:**

1. Haynes. R, Woodruff. D. P. and Talchar, T.A., optical Microscopy of Materials Cambridge University press, 1986.
2. Flegler, S.L., Heckman, J.W. and Klomparens, K.L., scanning and Transmission Electron Microscopy: A Introduction WH Freeman & Co, 1993.
3. Paul E. West, introduction to Atomic Force Microscopy Theory Practice Applications
4. Julian Chen N, C., introduction to Scanning Tunneling Microscopy, Oxford University Press, Inc., 1993.
5. Magonov, S.M., and Whangbo, M-H., surface Analysis with STM and AFM: Experimental and Theoretical Aspects of Image Analysis VCH Publishers, Inc., New York 1996.
6. Goldstein, J., Newbury, D.E., Joy, D.C., and Lym, C.E., scanning Electron Microscopy and X-ray Microanalysis, 2003.

# B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
# ANALOG AND DIGITAL IC APPLICATIONS
# (OPEN ELECTIVE – I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: MT511OE** | **3** | **0** | **0** | **3** |

**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.

**OP-AMP Applications**: Basic application 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.

**UNIT - II**

Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723.

**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, saw tooth, square wave and VCO.

**UNIT - III**

**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.

**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 and dual slope ADC. DAC and ADC specifications.

**UNIT - IV**

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 tristate outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

Design using TTL-74XX & CMOS 40XX series, code converters, decoders, Demultiplexers, decoders, & drives for LED & LCD display. Encoder, priority Encoder, multiplexers, & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2’s, Complement system. Digital comparator circuits.

**UNIT - V**

**Sequential Circuits:** Flip-flops & their conversions. Design of synchronous counters. Decade counter, shift registers, & applications, familiarities with commonly available 74XX & CMOS 40XX series of IC counters.

**Memories:** ROM architecture, types, & applications, RAM architecture, Static & Dynamic RAMs, synchronous DRAMs.

**TEXT BOOKS:**

1. Linear Integrated Circuits –D. Roy Choudhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.

**REFERENCES:**

1. Operational Amplifiers & Linear Integrated Circuits – R.F. Coughlin & Fredrick F. Driscoll, PHI, 1977.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications –Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits-Sergio Franco, McGraw Hill, 3rd Ed., 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**INTELLECTUAL PROPERTY RIGHTS**
**(Open Elective – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: MT512OE** | **3** | **0** | **0** | **3** |

**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 & REFERENCES:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing company ltd.,

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**COMPUTER ORGANIZATION**
**(Open Elective – I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: MT513OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand basic components of computers.
- To understand the architecture of 8086 processor.
- To understand the instruction sets, instruction formats and various addressing modes of 8086.
- To understand the representation of data at the machine level and how computations are performed at machine level.
- To understand the memory organization and I/O organization.
- To understand the parallelism both in terms of single and multiple processors.

**Course Outcomes:**

- Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit.
- Ability to understand memory hierarchy and its impact on computer cost/performance.
- Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design.
- Ability to understand the instruction set, instruction formats and addressing modes of 8086.
- Ability to write assembly language programs to solve problems.

**UNIT - I**

**Digital Computers:** Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

**Basic Computer Organization and Design:** Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

**Micro Programmed Control:** Control memory, Address sequencing, micro program example, design of control unit.

**UNIT - II**

**Central Processing Unit:** The 8086 Processor Architecture, Register organization, Physical memory organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum and Maximum mode system and timings.

8086 Instruction Set and Assembler Directives-Machine language instruction formats, Addressing modes, Instruction set of 8086, Assembler directives and operators.

**UNIT - III**

Assembly Language Programming with 8086- Machine level programs, Machine coding the programs, Programming with an assembler, Assembly Language example programs.

Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Interrupt programming, Passing parameters to procedures, Macros, Timings and Delays.

**UNIT - IV**

**Computer Arithmetic:** Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating - point Arithmetic operations.

**Input-Output Organization:** Peripheral Devices**,** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input –Output Processor (IOP),Intel 8089 IOP.

**UNIT - V**

**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

**Pipeline and Vector Processing:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

**Multi Processors:** Characteristics of Multiprocessors, Interconnection Structures, Inter processor arbitration, Inter processor communication, and synchronization.

**TEXT BOOKS:**

1. Computer System Architecture, M. Moris Mano, Third Edition, Pearson. **(UNITS- I , IV , V)**
2. Advanced Microprocessors and Peripherals, K M Bhurchandi, A.K Ray ,3rd edition, McGraw Hill India Education Private Ltd. **(UNITS - II, III).**

**REFERENCES:**

1. Microprocessors and Interfacing, D V Hall, SSSP Rao, 3rd edition, McGraw Hill India Education Private Ltd.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002
3. Computer Organization and Architecture, William Stallings, 9th Edition, Pearson.
4. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**DATA STRUCTURES**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: EM614PE/MT621OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the basic concepts such as Abstract Data Types, Linear, and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose the appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

**Course Outcomes:**

- Learn how to use data structure concepts for realistic problems.
- Ability to identify appropriate data structure for solving computing problems in respective language.
- Ability to solve problems independently and think critically.

**UNIT - I**

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega, and Theta notations, Introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations-Insertion, Deletion.

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

**UNIT - II**

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

**UNIT - III**

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals - DFS and BFS.

**UNIT - IV**

Searching - Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling. Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

**UNIT - V**

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree ,B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees(Elementary treatment-only Definitions and Examples), Comparison of Search Trees.

Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

**TEXT BOOKS:**

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D. S. Kushwaha and A.K. Misra, PHI.

**REFERENCE BOOKS:**

1. Data structures: A Pseudo code Approach with C, 2nd edition, R. F. Gilberg And B. A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M. A. Weiss, Pearson.
3. Data Structures using C, A.M. Tanenbaum, Y. Langsam, M. J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipscutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson..
9. Data Structures using C & C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**ARTIFICIAL NEURAL NETWORKS**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: MT622OE** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

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

- Create different neural networks of various architectures both feed forward and feed backward.
- Perform the training of neural networks using various learning rules.
- Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

**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 Perceptron**: 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, Computer Experiment

**TEXT BOOKS:**

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

**REFERENCE BOOKS:**

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**INDUSTRIAL MANAGEMENT**
**(Open Elective – II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: MT623OE** | **3** | **0** | **0** | **3** |

**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:** Departmentation 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- $\overline{X}$ 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:**

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers
2. Industrial Engineering and Management Science/T.R. Banga and S. C. Sarma/Khanna Publishers

**REFERENCE BOOKS:**

1. Motion and Time Study by Ralph M Barnes/ John Willey & Sons Work Study by ILO
2. Human factors in Engineering & Design/Ernest J McCormick / TMH
3. Production & Operation Management /Paneer Selvam /PHI
4. Industrial Engineering Management/NVS Raju/Cengage Learning
5. Industrial Engineering Hand Book /Maynard
6. Industrial Engineering Management / Ravi Shankar/ Galgotia

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**RENEWABLE ENERGY SOURCES**
**(Open Elective – III)**

| **B.Tech. IV Year II Sem.** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Course Code: MT831OE/ME853PE** | **3** | **0** | **0** | **3** |

**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, $CO_2$ 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. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. 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.

1. **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.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

**REFERENCE BOOKS:**

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**PRODUCTION PLANNING AND CONTROL**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: MT832OE/ME854PE** | **3** | **0** | **0** | **3** |

**Pre-requisites:** Management Science & Productivity.

**Course Objectives**: Understand the importance of Production planning & control. Learning way of carrying out various functions it so as to produce right product, right quantity at right time with minimum cost.

**Course Outcomes:** At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

**UNIT – I**

**Introduction**: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

**Forecasting** – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

**UNIT – II**

**Inventory management** – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only. **Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

**UNIT – III**

**Line Balancing**: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

**UNIT – IV**

**Scheduling** –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

**UNIT – V**

**Dispatching**: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

**Follow up**: definition – types of follow up – expediting – definition – expediting procedures- Applications of computers in planning and control.

**TEXT BOOKS:**

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

**REFERENCE BOOKS:**

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control- Jain & Jain – Khanna publications

**B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)**
**ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES**
**(Open Elective – III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: CE833OE** | **3** | **0** | **0** | **3** |

**Course Objective:** The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

**Course Outcome:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

**Unit – 1: Entrepreneurial Perspectives:**
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

**Unit – 2: New Venture Creation:**
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**Unit – 3: Management of MSMEs and Sick Enterprises**
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

**Units – 4: Managing Marketing and Growth of Enterprises:**
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**Units – 5: Strategic perspectives in Entrepreneurship:**
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

**TEXT BOOKS:**

1. Entrepreneurship Development and Small Business Enterprises, Poornima M.Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D.F.Kuratko and T.V.Rao, 3e, Cengage, 2012.

**REFERENCES:**

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

# B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
# MATERIAL CHARACTERIZATION TECHNIQUES
# (OPEN ELECTIVE –I)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year I Sem.** | | | | |
| **Course Code: MM511OE** | **3** | **0** | **0** | **3** |

**Course Objective:** This course is intended to give an exposure to evaluation of special characteristics of materials (Structural, Mechanical & Thermal etc.) in order to understand their suitability in Engineering Applications

**Course Outcome:** At the end of the course the student will be able to characterize, identify, and apply the material to the concerned application.

**UNIT-I**

**X-Ray Diffraction:** Introduction, Production and properties of x-rays, Bragg's law of diffraction. Experimental Methods of Diffraction, Intensity of Diffracted beams - Scattering by an electron by an atom, by a unit cell, structure-factor calculations; factors affecting Diffraction Intensities.

**Application of XRD:** Orientation of single crystals, Effect of plastic deformation, the structure of polycrystalline Aggregates, Determination of crystal structure, Precise lattice parameter measurements, Phase - diagram determination, Order-disorder transformation, Chemical analysis by Diffraction, Stress measurement

**UNIT-II**

**Elements of Quantitative Metallography and Image Processing.**

**Scanning Electron Microscopy:** Principle, Interaction of electron beams with matter, Construction and Working principle Scanning Electron Microscopy, Working Distance, Depth of field, Depth of focus and Spot Size, Specimen preparation for Scanning Electron Microscopy, Different types of modes used in Scanning Electron Microscopy (Secondary Electron and Backscatter Electron) and their applications, Advantages, limitations and applications of Scanning Electron Microscopy, Electron Backscattered Diffraction.

**UNIT-III**

**Transmission Electron Microscopy:** Principle, Construction and Working principle of Transmission Electron Microscopy, Resolving power and Magnification, Depth of field and Depth of focus, Bright and dark field, Specimen preparation for the Transmission Electron Microscopy: Selected Area Diffraction, Applications of Transmission Electron Microscopy, Advantage and Limitations of Transmission Electron Microscopy.

**UNIT-IV**

**Spectroscopy – Energy Dispersive Spectroscopy, Wavelength Dispersive Spectroscopy,** Electron Probe Microanalyzer**,**

**UNIT-V**

Principles, Instrumentation, operation and application of thermal analysis, Thermogravimetric Analysis, TGA, Differential Scanning Calorimetry, Differential thermal analysis**,** Dynamic Mechanical Analysis, Dialatometry.

**TEXT BOOKS:**

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

**REFERENCES:**

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall , 2001 – Science

**B.TECH. METALLURGICAL AND MATERIALS ENGINEERING**
**SCIENCE AND TECHNOLOGY OF NANO MATERIALS**
**(OPEN ELECTIVE - II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: MM621OE** | **3** | **0** | **0** | **3** |

**Course Objective:** This course is intended to expose the students to the most exciting area of nano materials. This would emphasize the classification, synthesis and applications of these materials.

**Course Outcome:** The student will be able to design a component/material that would provide us a 'better tomorrow' via nanotechnology.

**UNIT-I**

Introduction: History and Scopy, classification of nanostructural materials, Applications, Challenges and future prospects

**UNIT-II**

Unique properties of nano-materials, microstrucutre and defects in nano-crystalline materials, effect of nano-dimension on material behaviours

**UNIT-III**

Synthesis Routes: Bottom up approaches, top down approaches, consolidation of nano-powders.

**UNIT-IV**

Application of nano-materials: Nano-electronics, Micro and Nano-electromechanical systems, nano-sensors, Nano-catalyst, Structure and engineering, Automotive, Nano-medical, water and environment treatment, energy, defence and space, textile and paints**.**

**UNIT-V**

Nanostructured materials with high application potential: Quantum dots, Carbon nanotubes, GaN Nanowires, Nanocrystalline Zno, Nanocrystalline $Tio_2$, Multilayered films

**TEXT BOOKS:**

1. Text book of Nano Science and Technology: B S Murthy, Universities press-IIM series in Metallurgy and Material Sciene
2. Nano Essentials: T Pradeep / TMH

**REFERENCES:**

1. Springer Handbook of Nanotechnology
2. Nano Materials Synthersis, Properties and applications, 1996 Edlstein and Cammarate.
3. Nano Materials A.K. Bandyopadyay/ New age Publications

**B.TECH. METALLURGICAL AND MATERIALS ENGINEERING**
**METALLURGY FOR NON METALLURGISTS**
**(OPEN ELECTIVE - II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem.** | | | | |
| **Course Code: MM622OE** | **3** | **0** | **0** | **3** |

**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.
- 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

- 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

**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:**

1. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL ,1997
3. Mechanical Metallurgy – G. E. Dieter

**REFERENCES:**

1. Engineering Physical Metallurgy and Heat treatment – Y Lakhtin
2. C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, John Wiley, NJ, USA, 2006
3. Foundations of Materials Science and Engineering – WF Smith

# B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
# DESIGN AND SELECTION OF ENGINEERING MATERIALS
# (OPEN ELECTIVE - III)

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem.** | | | | |
| **Course Code: MM831OE** | **3** | **0** | **0** | **3** |

**Course Objective:** This course aims at making student to understand and design a material for a given application considering the composition, manufacturing process and properties that are required in service.

**Course Outcome:** Understand the Relationship between materials selection, processing and applications.

**UNIT-I**

**Materials selection process:** Criteria for selection of materials

**UNIT-II**

**Effect of composition, processing and structure on materials properties:** Concepts in the design of industrial components

**UNIT-III**

**Properties vs Performance materials:** Aerospace and defense applications: design and alloy based on LCF, TMF, Creep fatigue interaction, hot corrosion resistance, role of DBTT for Naval applications, Intermetallics, Aluminides

**UNIT-IV**

**Nuclear Material: Manufacturing aspects of design**

Nuclear application: radiation damage, effect of radiation damage on YS, UTS, DBTT, design of alloy for fission and fusion reactors

**UNIT-V**

**Special Materials: Manufacturing aspects of design**

Selection and design of ceramics composites and polymers for specific applications,

**TEXT BOOKS**

1. M.F. Ashby, Materials Selection in Mechanical Design, Pergamon Press, 1992
2. G.E. Dieter, Engineering Design, A Materials and Processing Approach, 2nd ed., McGraw-Hill, 1991

**REFERENCES**

1. T.H. Courtney, *Mechanical Behavior of Materials*, McGraw-Hill, 1990
2. J.R. Dixon and C. Poli, *Engineering Design and Design for Manufacturing*, Field Stone Publishers, 1995

**B.TECH. MINING ENGINEERING**
**INTRODUCTION TO MINING TECHNOLOGY**
**(Open Elective - I)**

| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Course Code: MN511OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** The student is expected to learn the fundamentals of mining engineering so as to encourage multi-disciplinary research and application of other branches of engineering to mining technology.

**Course Outcomes:** Upon completion of the course, the student shall be able to understand various stages in the life of the mine, drilling , blasting and shaft sinking**.**

**UNIT-I**
Introduction: Distribution of mineral deposits in India and other countries, mining contributions to civilization, mining terminology,

**UNIT-II**
Stages in the life of the mine - prospecting, exploration, development, exploitation, and reclamation. Access to mineral deposit- selection, location, size and shape (incline, shaft and adit), brief overview of underground and surface mining methods.

**UNIT-III**
Drilling: Types of drills, drilling methods, electric, pneumatic and hydraulic drills, drill steels and bits, drilling rigs, and jumbos.

**UNIT-IV**
Explosives: Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives.; Rock blasting: Mechanism of rock blasting, blasting procedure, and pattern of shot holes.

**UNIT-V**
Shaft sinking: Ordinary and special methods, problems, and precautions, shaft supports and lining.

**TEXT BOOKS:**
1. R. P. Pal, Rock blasting effect and operation, A. A. Balkema, 1st Ed, 2005.
2. D. J. Deshmukh, Elements of mining technology, Vol. 1, Central techno, 7th Ed, 2001

**REFERENCE BOOKS:**
1. C. P. Chugh, Drilling technology handbook, Oxford and IBH, 1st Ed, 1977.
2. R. D. Singh, Principles and practices of modern coal mining, New age international, 1st Ed, 1997.

**B.TECH. MINING ENGINEERING**
**COAL GASIFICATION, COAL BED METHANE AND SHALE GAS**
**(Open Elective - II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. III Year II Sem** | | | | |
| **Course Code: MN621OE** | **3** | **0** | **0** | **3** |

**Course Objectives**: To specialize the students with additional knowledge on geological and technological factors of coal gasification industry mining methods of underground coal gasification, linkage techniques etc.

**Course Outcomes**; Student can get specialized in the underground coal gasification concepts, application and future scope in various geomining conditions.

**UNIT-I**
Underground Coal Gasification (UCG) Concept; Chemistry, conditions suitable for UCG, Principles of UCG., Merits and Demerits.

**UNIT-II**
UCG Process Component factors: Technology of UCG, opening up of coal seam for UCG.

**UNIT-III**
Mining methods of UCG: Chamber method, Stream method, Borehole procedure method, Blind bore hole method.

**UNIT-IV**
Non-Mining methods of UCG: Level seams, Inclined seams.

**UNIT-V**
Linkage Techniques: Pekcolation linkage, Electro linkage, Boring linkage, compressed-air-linkage, Hydraulic fracture linkage. Future Scope and Development: Innovations.

**TEXT BOOKS:**
1. Underground Coal Mining Methods – J.G. SINGH
2. Winning and Working Coal in India Vol.II- R. T. Deshmukh and D.J.Deshmukh.

**REFERENCE BOOK:**
1. Principles and Practices of Modern Coal Mining – R.D. SINGH

**B.TECH. MINING ENGINEERING**
**SOLID FUEL TECHNOLOGY**
**(Open Elective - III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech. IV Year II Sem** | | | | |
| **Course Code: MN831OE** | **3** | **0** | **0** | **3** |

**Pre-requisites**: Under graduate Physics and Chemistry

**Course Objectives**: Understand coal formation, properties, and their evaluation along with various issues of coal washing

**Course Outcomes:** Students can understand the fundamentals of
Processes of formation of coal, properties and evaluation and coal preparation and washability characteristics of coal

**UNIT-I**
Introduction: Processes of formation of coal, Theories of origin of coal, Eras of coal formation, Indian Coalfields and its subsidiaries: Occurrence and distribution, coal bearing formations, coal type and rank variation, Characteristics of major coalfields, Coal production from different sectors.

**UNIT-II**
Coal petrography: Macro and micro lithotypes, Composition of macerals, application of coal petrography, Mineral matter in coal: Origin and chemical composition, Impact of mineral matter in coal process industry.

**UNIT-III**
Coal properties and their evaluation: proximate and ultimate analysis, calorific value, crossing and ignition point temperature, plastic properties (free swelling index, Caking index, Gray King Low Temperature Assay, Roga index, plastometry, dilatometry).

**UNIT-IV**
Physical properties like specific gravity, hard groove grindability index, heat of wetting, crossing point temperature of coal, Behavior of coal at elevated temperatures and products of thermal decomposition, Classification of coal - International and Indian classification, grading of Indian coals.

**UNIT-V**
Coal Washing: Principles, objectives, coal preparation, washability characteristics; Selection, testing, storage and utilization of coking and non-coking coal, Use of coal by different industries.

**TEXT BOOKS:**

1. S. Sarkar, Fuels and Combustion, Orient Longman Private Ltd., 2nd edition, 1990
2. O. P. Gupta, Elements of Fuels, Furnaces and Refractories, Khanna Publication, 3rd Edition, 1996.

**REFERENCE BOOKS:**

1. M. A. Elliot, Chemistry of Coal Utilization, Wiley, 1981.
2. D. Chandra, R. M. Singh, and M. P. Singh, Text Book of Coal, Tara Book Agency, 2000.

**B.TECH. MINING ENGINEERING**
**HEALTH AND SAFETY IN MINES**
**(Open Elective - III)**

| **B.Tech. IV Year II Sem** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| **Course Code: MN832OE** | **3** | **0** | **0** | **3** |

**Course Objectives:** To brief mining students in health and safety engineering concepts, causes of accident, training, human behavioral approach in safety etc.

**Course Outcomes:** student will gain knowledge and able to understand the importance of health and safety including the role of safety risk assessment in mining industry

**UNIT-I**

Introduction to accidents, prevention, health and safety in industry : Terminology, reason for preventing accidents – moral and legal.

Safety scenario in Indian mines, Accidents in Indian mines, Measurement of safety performance. Classification of accidents as per Mining legislation/law and general classification of accidents.

**UNIT-II**

Causes and preventive measures of accidents in underground and opencast mines i.e., due to fall of roof and sides, transportation of machinery, haulage and winding, drilling and blasting, movement of machinery in opencast mines and electricity etc., ; accident analysis and report, cost of accidents, statistical analysis of accidents and their importance for promotion of safety.

**UNIT-III**

System engineering approach to safety, techniques used in safety analysis, generic approach to loss control within mining operations. Concept of ZAP and MAP.

**UNIT-IV**

Risk management, Risk identification, Risk estimation and evaluation, Risk minimization techniques in mines. Risk analysis using FTA, HAZOP, ETA etc; health risk assessment and occupational diseases in mining.

**UNIT-V**

Development of safety consciousness, publicity and propaganda for safety; training of workmen, Human Behavioral approach in safety, safety polices and audio-visual aids, safety drives campaigns, safety audit. Safety management and organization; Internal safety organization

**TEXT BOOKS:**

1. Occupational Safety and Health in Industries and Mines by C.P. Singh
2. S.K. Das, Mine Safety and Legislation. Lovely Prakashan, Dhanbad, 2002

**REFERENCE BOOKS:**

1. N.J. Bahr, System Safety Engineering, and Risk Assessment: A Practical Approach, Taylor and Francis, NY, 1997.
2. Indian Mining Legislation – A Critical Appraisal by Rakesh & Prasad

**B.TECH. PETROLEUM ENGINEERING**
**MATERIALS SCIENCE AND ENGINEERING**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE511OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** This subject is intended to:

- Provide all the technical/engineering inputs to the learner to choose or select suitable materials of construction of chemical/petrochemical process equipment, piping and internals.
- Import expertise to the material so that it meets the specific life expectancy, by reducing the shutdown frequency.
- Learn the techniques in minimizing equipment breakdown and increasing the on-stream factor.
- To gain knowledge in choosing/selecting the material such that it withstands the severe process operating conditions such as cryogenic, high temperature, high pressure, acidic, basic, stress induced chemical/petrochemical environments keeping view the reliability and safety of the process equipment.

**Course Outcome:** After the course, the students will be to

- Equipped with knowledge to prepare material selection diagram, evaluation of equipment life and prediction of life of the equipment.
- Acquiring the abilities to carryout reliability studies.
- Ready to carryout equipment failure analysis and propose the remedial measures.

**UNIT - I**

Classification of engineering materials, Levels of Structure, Structure-Property relationships in materials, Crystal Geometry and non-crystalline(amorphous) states. Lattice –Bravais lattices, crystal systems with examples. Lattice co-ordinates, Miller and Miller- Bravais Indices for directions and places: ionic, covalent and metallic solids; packing factors and packing efficiency, ligancy and coordination number. Structure determination by Brag's X-ray diffraction method.

**UNIT - II**

Crystal Imperfections-classification-point defects-estimation of point defects-Dislocations-classification(edge and screw)-surface defects -dislocation motion and its relevance to mechanical and chemical properties –stress-strain relationship and diagrams for different materials(metals, non-metals, rubbers and plastics and polymers)-elastic and plastic deformation-slip -stress required to move a dislocation. Multiplication of dislocations –dislocation reactions, effect on mechanical behavior of materials. Strain hardening/work hardening –dynamic recovery and recrystallization.

**UNIT - III**

Fracture and failure of materials: ductile fracture analysis-brittle fracture analysis-fracture toughness-ductile-brittle transition-fatigue fracture-theory, creep and mechanism –methods to postpone the failure and fracture of materials and increase the life of the engineering components /structures.

**UNIT - IV**

Solid –liquid and solid-solid Equilibria for metals and alloys. Phase rule-phase diagram for pure metals (single component system),alloys(binary systems)-micro structural changes during cooling-Lever rule and its applications-typical phase diagrams-homogeneous and heterogeneous systems, formation of Eutectic, Eutectoid mixtures- non-equilibrium cooling. Binary Systems(phase diagrams) for study: Cu-Ni/Bi-Cd/Pb-Sn/ Fe-C /Al-Cu

Materials for chemical and petrochemical industrial process equipment- Effect of alloying on mechanical and chemical behavior of materials, applications of heat treatment methods for strengthening of engineering materials.

**UNIT - V**

Composite structures and their advantages over conventional materials–Matrix-reinforcement properties and evaluation of strength properties with different orientation of reinforcement-applications –Nano materials –synthesis and characterization.

Stability criteria of materials in chemical/petrochemical industrial environments. Corrosion and Oxidation of materials –basic mechanisms-types of corrosion, Corrosion testing and evaluation Prevailing methods to combat corrosion. Coatings –metallic non-metallic, passivity, cathodic protection.

**TEXT BOOKS:**

1. Materials Science and Engineering, Raghavan, V., 5th Edition, PHI, New Delhi, 2009.
2. Material Science and Engineering, Ravi Prakash, William F. Smith, and Javed Hashemi, 4th Edition, Tata-McGraw Hill, 2008.

**REFERENCE BOOKS:**

1 Elements of Material Science and Engineering, Lawrence H. Van Vlack, 6th Edition, Pearson, 2002.
2 Materials Science and Engineering, Balasubramaniam, R., Callister's, Wiley, 2010.
3. Corrosion Engineering, Mars G. Fontana, Tata-McGraw Hill, 2005.

**B.TECH. PETROLEUM ENGINEERING**
**RENEWABLE ENERGY SOURCES**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE512OE** | **3** | **0/0/0** | **3** |

**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, $CO_2$ 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. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. 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.

1. **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.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

**REFERENCE BOOKS:**

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

**B.TECH. PETROLEUM ENGINEERING**
**ENVIRONMENTAL ENGINEERING**
**(Open Elective - I)**

| **B.Tech. III Year I Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE513OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** This subject provides the knowledge of water sources, water treatment, design of distribution system waste water treatment, and safe disposal methods. The topics of characteristics of waste water, sludge digestion are also included.

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

- Analyze characteristics of water and wastewater
- Estimate the quantity of drinking water and domestic wastewater generated
- Design components of water supply systems Design sewerage system

**UNIT – I**

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

**UNIT – II**

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices- Miscellaneous treatment methods.

**UNIT – III**

Distribution systems requirement –method and layouts -Design procedures- Hardy Cross and equivalent pipe methods pipe – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house - Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow

**UNIT - IV**

characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – components requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing **–** ultimate disposal of sewage – sewage farming – dilution.

**UNIT – V**

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – standard and high rate – Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

**TEXT BOOKS:**

1. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanog lous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Water Supply & Environmental Engineering by A.K. Chatterjee.
4. Water Supply and sanitary Engineering by G.S. Bindi, Dhanpat Rai & Sons Publishers.

**REFERENCES:**

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.

**B.TECH. PETROLEUM ENGINEERING**
**ENERGY MANAGEMENT AND CONSERVATION**
**(Open Elective - II)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE621OE** | **3** | **0/0/0** | **3** |

**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**
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:**

1. Energy Management by Murfy
2. General Aspects of Energy Management and Audit, National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management)

**REFERENCE BOOKS:**

1. Energy Management Handbook, W.C. Turner, 5$^{th}$ Edition, Marcel Dekker, Inc, New York, 2005.
2. Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.
3. Energy Management by O.P. Collagan

**B.TECH. PETROLEUM ENGINEERING**
**OPTIMIZATION TECHNIQUES**
**(Open Elective - II)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE622OE** | **3** | **0/0/0** | **3** |

**Prerequisite:** Mathematics –I & Mathematics –II

**Course Objectives:**

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

**Course Outcomes:** After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

**UNIT – I**

**Introduction and Classical Optimization Techniques:** Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

**Classical Optimization Techniques:** Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

**UNIT – II**

**Linear Programming:** Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

**Transportation Problem:** Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

**UNIT – III**

**Unconstrained Nonlinear Programming:** One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

**Unconstrained Optimization Techniques:** Univariant method, Powell's method and steepest descent method.

U**NIT – IV**

**Constrained Nonlinear Programming:** Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

**UNIT – V**

**Dynamic Programming:** Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**TEXT BOOKS:**

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

**REFERENCE BOOKS:**

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

**B.TECH. PETROLEUM ENGINEERING**
**ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES**
**(Open Elective – II)**

| **B.Tech. III Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE623OE** | **3** | **0/0/0** | **3** |

**Course Objective:** The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

**Course Outcome:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

**Unit – 1: Entrepreneurial Perspectives:**
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

**Unit – 2: New Venture Creation:**
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**Unit – 3: Management of MSMEs and Sick Enterprises**
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

**Units – 4: Managing Marketing and Growth of Enterprises:**
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**Units – 5: Strategic perspectives in Entrepreneurship:**
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

**TEXT BOOKS:**

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V. Rao, 3e, Cengage, 2012.

**REFERENCES:**

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

**B.TECH. PETROLEUM ENGINEERING**
**DISASTER MANAGEMENT**
**(Open Elective – III)**

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE831OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** The subject provides different disasters, tools, and methods for disaster management.

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

- 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:**

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

**REFERENCES:**

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

**B.TECH. PETROLEUM ENGINEERING**
**FUNDAMENTALS OF LIQUEFIED NATURAL GAS**
**(Open Elective – III)**

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE832OE** | **3** | **0/0/0** | **3** |

**Course Objectives:** The students will be able to:

- Gain basic knowledge of LNG and its prospective.
- Learn different liquefaction technologies of LNG.
- Have knowledge on different functional units on receiving terminals
- Analyze transportation of LNG and regasification.
- Understand HSE of LNG industry.

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

- Have good knowledge on LNG process.
- Classify different liquefaction techniques.
- Understand different units in LNG processing and transportation.
- Have knowledge associated with safety aspects of LNG.

**UNIT-I**

**Introduction:** Overview of LNG industry: History of LNG industry – Base load LNG – Developing an LNG Project – World and Indian Scenario – Properties of LNG.

**UNIT-II**

**Liquefaction Technologies:** Propane precooled mixed refrigerant process – Description of Air products $C_3$MR LNG process – Liquefaction – LNG flash and storage.

**Cascade process:** Description of ConocoPhillips optimized cascade (copoc) process – Liquefaction – LNG flash and storage.

**Other Liquefaction Processes:** Description of Linde MFC LNG process- Precooling and Liquefied Petroleum Gas (LPG) recovery – Liquefaction and subcooling- Trends in LNG train capacity – strategy for grassroots plant- offshore LNG production.

**UNIT-III**

**Supporting Functional Units in LNG Plants:** Gas pretreatment: Slug catcher – NGL stabilization column – Acid gas removal unit – Molecular sieve dehydrating unit – Mercury and sulphur removal unit – NGL recovery – Nitrogen rejection – Helium recovery.

**UNIT-IV**

**Receiving Terminals:** Receiving terminals in India – Main components and description of marine facilities – storage capacity – Process descriptions.

Integration with adjacent facilities – Gas inter changeability – Nitrogen injection – Extraction of $C_2^+$ components.

**LNG Shipping Industry & Major Equipment in LNG Industry:** LNG Shipping Industry: LNG fleet – Types of LNG ships – Moss – Membrane – prismatic; Cargo measurement and calculations

**UNIT-V**

**Major equipment in LNG industry:** Cryogenic heat exchangers: Spiral – Wound heat exchangers – Plate-fin heat exchangers – Cold boxes; Centrifugal compressors – Axial compressors – Reciprocating compressors. LNG pumps and liquid expanders – Loading Arms and gas turbines.

**Vaporizers:** Submerged combustion vaporizers- Open rack vaporizers – Shell and tube vaporizers: direct heating with seawater, and indirect heating with seawater. Ambient air vaporizers: Direct heating with ambient air – Indirect heating with ambient air.; LNG tanks.

**Safety, Security and Environmental Issues:** Safety design of LNG facilities – Security issues for the LNG industry – Environmental issues – Risk based analysis of an LNG plant.

**TEXT BOOK:**

1. LNG: Basics of Liquefied Natural Gas, I st Edition, Stanley Huang, Hwa Chiu and Doug Elliot, PETEX, 2007.

(https://ceonline.austin.utexas.edu/petexonline/file.php/1/ebook_demos/lng/HTML/index.html.)

**REFERENCE BOOKS:**

1. Marine Transportation of LNG (Liquefied) and related products, Richard G. Wooler, Gornell Marine Press, 1975.
2. Marine Transportation of Liquefied Natural Gas, Robert P Curt, Timothy D. Delaney, National Maritime Research Centre, 1973.
3. Natural Gas: Production, Processing and Transport, Alexandre Rojey, Editions OPHRYS, 1997.

**B.TECH. PETROLEUM ENGINEERING**
**HEALTH, SAFETY AND ENVIRONMENT IN PETROLEUM INDUSTRY**
**(Open Elective - III)**

| **B.Tech. IV Year II Sem.** | **L** | **T/P/D** | **C** |
|---|---|---|---|
| **Course Code**: **PE833OE** | **3** | **0/0/0** | **3** |

**Course Objectives:**

- Knowledge of environment issues and all related Acts.
- Knowledge of drilling fluids and its toxic effects with environment.
- Proper disposal of drilling cutting after appropriate treatment.
- Treatment of produced water and makeup water and its disposal as per state pollution control board norms.
- Knowledge of oil mines regulations and proper implementation in drilling & production mines as per Act.
- Knowledge of Hazop in drilling rigs & production installations.
- Knowledge of disaster management to fight any fire accident at drilling rig/ production installation/production platform.

**Course Outcomes:**

- The student can have the knowledge of various Acts related to safety, Health and environment in petroleum industry.
- The student can have the knowledge of various drilling fluids handling and safe disposal such toxic products.
- Knowledge of disaster management to fight any crisis.
- Knowledge of Hazard studies and occupational health hazards in the industry.

**UNIT - I**

**Introduction to environmental control in the petroleum industry:** Overview of environmental issues- A new attitude.

**Drilling and production operations:** Drilling- Production- Air emissions.

**UNIT - II**

**The impact of drilling and production operations:** Measuring toxicity- Hydrocarbons- Salt- Heavy metals- Production chemicals- Drilling fluids- Produced water- Nuclear radiation- Air pollution- Acoustic impacts- Effects of offshore platforms- Risk assessment.

**Environmental transport of petroleum wastes:** Surface paths- Subsurface paths- Atmospheric paths. Planning for Environmental protection.

**Waste treatment methods:** Treatment of water- Treatment of solids- Treatment of air emissions-Waste water disposal: surface disposal.

**UNIT - III**

**Oil mines regulations:** Introduction-Returns, Notices and plans- Inspector, management and duties- Drilling and workover- Production- Transport by pipelines- Protection against gases and fires- Machinery, plants and equipment- General safety provisions- Miscellaneous-Remediation of contaminated sites- Site assessment-Remediation process.

**UNIT- IV**

Toxicity, physiological, asphyxiation, respiratory, skin effect of petroleum hydrocarbons and their mixture- Sour gases with their threshold limits- Guidelines for occupational health monitoring in oil and gas industry. Corrosion in petroleum industry- Additives during acidizing, sand control and fracturing.

**UNIT - V**

Hazard identification- Hazard evaluation- Hazop and what if reviews- Developing a safe process and safety management- Personal protection systems and measures.

Guidelines on internal safety audits (procedures and checklist)- Inspection & safe practices during electrical installations- Safety instrumentation for process system in hydrocarbon industry- Safety aspects in functional training-Work permit systems.

Classification of fires- The fire triangle- Distinction between fires and explosions- Flammability characteristics of liquids and vapors- Well blowout fires and their control- Fire fight equipment- Suppression of hydrocarbons fires.

**TEXT BOOKS:**

1. Environmental Control in Petroleum Engineering, John C. Reis, Gulf Publishing Company, 1996.
2. Application of HAZOP and What if Reviews to the Petroleum, Petrochemical and Chemical Process Industries, Dennis P. Nolan, Noyes Publications, 1994.
3. Oil Industry Safety Directorate (OISD) Guidelines, Ministry of Petroleum & Natural Gas, Government of India and Oil Mines Regulations-1984, Directorate General of Mines Safety, Ministry of Labor and Employment, Government of India.

**REFERENCE BOOKS:**

1. Guidelines for Process Safety Fundamentals in General Plant Operations Centre for Chemical Process Safety, American Institute of Chemical Engineers, 1995.
2. Guidelines for Fire Protection in Chemical, Petrochemical and Hydrocarbon Processing Facilities, Centre for Chemical Process Safety, American Institute of Chemical Engineers, 2003.
3. Guidelines for Hazard Evaluation Procedures Centre for Chemical Safety, Wiley-AIChE, 3rd Edition, 2008.
4. Guideline for Process Safety Fundamentals in General Plant Operations, Centre for Chemical Process Safety, AIChE, 1995.
5. Chemical Process Industry Safety, K S N Raju, McGraw Hill, 2014.