

**SYLLABI****Bachelor of Technology (B.Tech.)****Branch – Civil Engineering****Year/Sem: Ist Year/I Sem****Mathematics-I (Credits: 4)**

Partial differentiation, Taylor's series, Maxima and Minima, Jacobians, Double integrals Equations to a line, plane, curve and surfaces, Line and surface integrals, Gradient, divergence and curl, Normal and tangent to a surface, Gauss and Stokes theorems, Differential Equations with constants coefficients, Laplace transforms, Algebra of matrices, Determinants, Gauss elimination method, Rank, Eigen values and vectors, Quadratic forms.

**Physics-I (Credits: 4)**

Analytical treatment of interference, Intensity distribution of fringe system, Fresnel's biprism, Newton's rings, Diffraction from Single slit, double slit and Diffraction grating, Polarization, Phenomenological understanding of Birefringence, Principles of use of uniaxial crystals in practical polarizers, compensators and wave plates, Optical activity, Relativity: Michelson-Morley experiment, Lorentz transformations, Addition of velocities, Mass variation with velocity, Mass-energy relation. Radiation: Black body radiation, Wein's law, Rayleigh Jean's law, Planck's law of radiation, Compton scattering. Atomic Structure: Origin of spectral lines, spin and orbital angular momentum, Quantum numbers, Atoms in magnetic field, Zeeman Effect. Statistical Distributions: Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions and their applications. Lasers: Principle and working of laser, Different types of lasers (He-Ne Laser, Ruby Laser, Semiconductor Laser), Holography.

**Software Development Fundamental (Credit: 4)**

Introduction to Programs, Processing programs, Types of Programming Languages, Programming Design tools (Pseudo code and Flowcharts), Program Design, Structured Programming, Problem solving and programming, Quality aspects of structured programs, Testing and Debugging Techniques, Self Learning of Pascal. Introduction to Programs, Processing programs, Types of Programming Languages, Programming Design tools (Pseudo code and Flowcharts), Program Design, Structured Programming, Problem solving and programming, Quality aspects of structured programs, Testing and Debugging Techniques, Loop Control and Case Control Structures, Arrays and Strings, Functions and Pointers, Structures and Union, Recursion, Dynamic Memory Allocation, linked-lists, File I/O, C Library.

**English (Credits: 3)**

Definition of Communication, Process & Stages of Communication, Barriers to Communication, Channels of Communication, The listening process, Importance of listening, Purpose and types of listening, Hearing and listening, Listening with a purpose, Barriers to listening. Importance of acquiring oral skills, Visual aids, Body Language, Delivery, Pronunciation, Use of connectives Organization of matter: Meta-discourse features, Textual organization, 7 C'S of effective communication, Reading comprehension, Some important synonyms and antonyms, Etiquettes & grooming, Skimming and Scanning, Intensive and extensive reading, SQ3R Technique, Business letters, Memo, Circulars, Notices, Report writing, resume writing, Agenda & Minutes writing, Technology based communication tools, Committee types, Advantages, Conferences, Audio-video

conferencing, Barriers and overcoming negative impact, Speech Preparation, Tips for successful job interview, Do's and don't's while appearing for interview, Mock interview, Some interview questions, Telephonic interview tips, Resume writing.

### **Physics Lab-I (Credits: 1)**

#### **Experiments List-**

1. To study the variation of magnetic field along the axis of Helmholtz Galvanometer and to determine its reduction factor. [set-up no.1 & 11]
2. To determine the specific rotation of cane sugar solution using Biquartz polarimeter. [set-up no.2 & 12]
3. To observe Newton's rings and to determine the wavelength of sodium light [Set-up no. 3 & 13]
4. To determine the wavelengths of spectral lines Red, Green and Violet of mercury using plane transmission grating. [set-up no.4 & 14]
5. To study the presence of energy levels in an atom by Franck-Hertz Experiment.[set-up no. 5 & 15]
6. To determine the resistance per unit length of a Carey Foster's bridge and to obtain the specific resistance of a given wire. [set-up no.6 & 16]
7. To determine the Planck's constant using solar cell. [set-up no. 7 & 17]
8. To determine the wavelength of sodium light with the help of Fresnel's biprism.[set-up no. 8 & 18]
9. To draw hysteresis loop of a ferromagnetic material & calculate its retentivity and coercivity.[set-up no.9 & 19]
10. To study ultrasonic waves in aluminium and to obtain Young's modulus for it. [set-up no. 10 & 20]

### **Workshop Lab (Credits: 1.5)**

#### **List of Experiments**

1. To study about various tools and equipments used in carpentry shop.
2. To make a cross lap joint as per given specification
3. To study about various tools used in foundry shop.
4. To prepare a green sand mould with the help of a given pattern.
5. To perform permeability test on sand mould.
6. To study various machine tools such as lathe, milling, shaper, drilling, grinding, EDM drill and cutting tools used by them.
7. To perform straight turning, step turning and taper turning operations on lathe machine
8. To perform threading operation on the lathe machine
9. To study about various tools used in fitting shop.
10. To make a fitting job as per given drawing.
11. To study various types of welding processes available in the workshop such as arc welding, gas welding and resistance welding.
12. To prepare a welded joint by using arc welding.
13. To prepare a welded joint by using Resistance Spot welding
14. To prepare a welded joint by using gas welding.

### **Software Development Fundamental Lab (Credit: 2)**

Initial exercises on MS office, Familiarity with Microsoft word, Familiarity with Microsoft power point, Familiarity with Microsoft excels, Pattern generating problems, Loop Control and Case Control Structures, Arrays and Strings, Functions and Pointers, Structures and Union, Recursion, Dynamic Memory Allocation, linked-lists, File I/O, C Library.

### **Year/Sem: Ist Year/II Sem**

#### **Mathematics-II (Credits: 4)**

Second order linear differential equations, Convergence of series, convergence tests, solution in series, Bessel's and Legendre functions, Chebyshev polynomials and orthogonality, Second order partial differential equations and classification, one dimensional, Wave and diffusion equations with their applications, Functions of complex variable, analytical functions and Cauchy-Riemann, Equations. Conformal mapping, Poles and singularities, complex integration, Taylor's and Laurent's series, Cauchy residue theorem, contour integration and their application.

#### **Chemistry (Credits: 4)**

Atomic Structure and Chemical Bonding: ionic bond, covalent bond, ionic crystals, covalent compound, diamond, graphite, VBT, VSEPR, MOT. Thermodynamics: 1<sup>st</sup> law, 2<sup>nd</sup> law, 3<sup>rd</sup> law, entropy, enthalpy. Electrochemistry: Electrochemical cell, Galvanic cell and concentration cells, equilibrium potential, corrosion and protection of corrosion. Solid State: types and properties, Bravais lattices, common crystal structures, atomic packing factor and density, Miller indices, XRD, defects. Liquid: properties, viscosity, surface tension. Gaseous State: gas law, ideal gas, real gas, Van der Waals equation. Fuel: classification, HCV, LCV, Bomb Calorimeter, renewable and non-renewable fuels. Metal and alloys: properties, metallurgy, other alloy, steels and its applications. Ceramics and Polymer: clays, silica, feldspars, method for fabrication of ceramic ware, bio-degradable polymers and their utility. Coordination Chemistry: Werner's theory, CFT, Chemical Kinetics: 1<sup>st</sup>, 2<sup>nd</sup> and zero Order, molecularity. Environmental Chemistry: water and its treatment, MSW. Green Chemistry: biogas, biomass, bio-ethanol, energy crops, waste to wealth. Organic Chemistry: Alkane, Alkene, Alkyne.

#### **Applied Mechanics (Credits: 4)**

Introduction and application of Equivalent force system and equations of equilibrium. Basic concept of force - couple system, planar force system, parallel force system, general force system Analysis of pin jointed frames, method of joints, sections and tension coefficient, Graphical method, Friction and its application. Kinematics of particle and rigid body, Dynamics of particle and rigid body, Virtual work, Impulse and Momentum, Centroid & center of gravity, Moment of inertia Mechanical Vibrations: Introduction, Equations of motion for single degree of freedom system, free and forced vibrations and damped vibrations. Compound springs with linear motion

#### **Electrical Circuit Analysis (Credits: 4)**

Introduction to circuit elements R, L, C and their characteristics, Different types of sources (like AC and DC, current and voltage, dependent and independent), KCL and KVL, Node and Loop analysis, Star and Delta conversion, Thevenin's and Norton's theorem, Superposition, Reciprocity, Maximum Power Transfer, Graph Theory, Tree and links, planar networks, Ideal opamp as a circuit element, AC waveform analysis frequency, phase, amplitude, peak, RMS and average value of ac waveform.

Single phase ac circuit analysis containing R, L and C, and their combinations, Concepts of impedance, power, active, reactive and apparent power and power factor, Series and parallel resonance, bandwidth and quality factor, Concept of 3-phase ac circuits, star and delta connections, Frequency domain analysis – Laplace transform solution of Integral differential equations, Forced and natural responses, Transient analysis, Concept of two-port Network, Z, Y, transmission (ABCD) and Hybrid parameter, Introduction to electrical filters and transmission line.

### **Chemistry Lab (Credits: 1)**

#### **List of Experiment in Chemistry:**

1. To prepare the standard solution of N/10 HCl by double titration method.
2. To determine the relative viscosity of given unknown liquid.
3. To determine the relative surface tension of given unknown liquid.
4. To determine the temporary, permanent and total hardness of given water samples.
5. Identify the element (N, S, Cl, Br, and I) in given organic compound.
6. To determine the pH and conductivity of given water samples.
7. To determine the chloride content in given water sample by argentometric titration method.
8. To determine the DO in given water sample by Winkler method.
9. To determine the HCV and LCV of given fuel by Bomb calorimeter.
10. To determine the function group of given organic compound.
11. To determine the flash point of given fuel.
12. To determine the inversion of sugar by polarimeter.

### **Applied Mechanics Lab (Credits: 1)**

#### **List of Experiments:**

1. To find the Law of triangular of forces by gravensand's Apparatus.
2. To find the law of parallelogram of forces by gravensand's Apparatus
3. To verify the law of polygon of forces by gravensand's Apparatus
4. To verify Lami's theorem by Jib crane apparatus.
5. To find the forces in Jib crane apparatus.
6. To find coefficient of friction between two surfaces on a horizontal surface.
7. To find coefficient of friction between two surfaces on a inclined plane.
8. To verify support reaction by parallelogram force apparatus.
9. To find the forces in a member of a triangular truss.
10. To find the resultant of forces graphically.

### **Electrical Circuit Analysis Lab (Credits: 1)**

#### **List of experiments-**

1. Simplify complex network using Thevenin theorem and verify it.
2. State Superposition Theorem and verify.
3. Perform and verify Maximum Power Transfer Theorem.
4. Perform Clipper Circuit.
5. Design Clamper Circuit.
6. Half wave rectifier with and without filter circuit.
7. Full wave rectifier with and without filter circuit.

8. Transistor as an Amplifier.
9. Implementation of logic gates
10. K-map and Boolean function simplification for efficient implementation of digital systems
11. Implementation of Binary Adders and Subtractor
12. Implementation of code converters (Gray-to-Binary & Binary-to-Gray)

### **Engineering Drawing & Design (Credits: 1.5)**

1. Study and construction of lines, lettering, dimensioning, plane scales and diagonal scales.
2. Study and construction of different methods used for the construction of conic curves.
3. Study and construction of geometrical construction.
4. Study and construction of cycloidal curves and involute helix etc.
5. Orthogonal projection of point in all possible position.
6. Study and construction of projection of line and its applications (inclined to both planes).
7. Study and construction of projection of planes (inclined to both planes).
8. Study and construction of projection of solids (right circular cone, prism, pyramid and cylinders).
9. Study and construction of true shape of sections.
10. Study and construction of oblique projection and development of surface.
11. Study and construction of isometric view using orthogonal projection on isometric scales.
12. Introduction to basic and editing command.
13. Introduction 2-D drafting.
14. Introduction surface modelling.
15. Introduction 3-D geometrical model.

### **Year/Sem: IInd Year/III Sem**

#### **Managerial Economics (Credits: 3)**

Introduction to Managerial Economics & Macro-economic Concepts: Definition of Economics, Meaning & Scope of Managerial Economics, Micro & Macro Economics, Concept of economic profit, (Opportunity Cost), Concept of Presentvalue. Demand Analysis: Law of demand, Individual & market demand, Determinants of market demand, Marginal Utility theory, Elasticity of demand– Price, Income, Cross, Advertising Theory of Consumer choice using Indifference Curve analysis, Demand forecasting techniques, Delphi, Survey, Time series analysis. Production Theory and Analysis: Production with one variable, optimal employment of a factor of production, Cobb Douglas production function, Production with two variable inputs, Production Isoquants, Production Isocosts, Optimal employment of two inputs, the expansion path, Basics of Supply, Market Equilibrium. Cost Theory and Analysis: Cost concepts – Opportunity, Explicit, Marginal, Incremental and Sunk, Relation between Production & Cost, Short run cost function, Long run cost function, Special topics -Profit contribution analysis, - Break Even analysis, Operating Leverage. Pricing under Different Market Structures: Perfect Competition - Determination of Price output relationship in short run, long run, Monopoly Determination of Price output relationship in short run & long run, Price discrimination, Monopolistic Competition-Determination of Price output relationship in short run & long run, Product Differentiation, Oligopoly- Types, Determination of Price output relationship, Kinky demand curve {Stickiness of Price}, Price leadership model

#### **Mechanics of Solids (Credits: 4)**

Simple stresses and strains: Stress-strain relationships, elastic constants and their relationships, temperature stresses. Analysis of axially loaded members: Bars of uniform, varying and tapering cross sections, composite bars. Complex Stresses: Stresses on inclined planes, principal stresses and strains, Mohr's circle of stresses, theories of elastic failure. Simple theory of bending, bending and shear stress distributions in beams Bending moment and shear force diagrams, relationships between loads, shear force and bending moment. Slope and deflection of beams: Differential equation of the deflection curve, double integration method, Macaulay's method, moment area method and conjugate beam method.

### **Mechanics of Fluid (Credits: 3)**

Introduction; Definition, Types of fluid, Properties of fluid, Fluid pressure on curved & plane surfaces, Pressure measurement, Stability of floating bodies. Kinematics of fluid flow; steady & unsteady, uniform & non-uniform, rotational & irrotational, Laminar & turbulent flow, Continuity equations for 1-D & 2-D flows, Flow-nets. Dynamics of fluid flow; Euler's equation, Bernoulli's equation; Venturi-meter, Pitot-tube, Orifice-meter, Notches & Weirs, Mouthpieces, Impulse-momentum equation, Dimensional analysis & modeling criteria. Boundary Layer Theory; Elements of boundary layer theory, Drag & lift Airfoil theory. Analysis of pipe flow; Laminar & Turbulent flow through pipes & velocity distribution, Darcy Weisbach's equation, Losses in pipe sections, branching of pipes

### **Geotechnical Engineering (Credits: 3)**

Introduction to Geo-technical problems in Civil Engineering, complexity of soil nature, Soil types and formation, regional soil deposit of India; Solids-water-air relationships and index properties of soils, Soil identification and B.I.S. classification; Flow through soils, permeability, capillarity, design of protective filters, and principle of effective stresses; Soil compaction and field control, Stress distribution in soil due to applied surface loads; Compressibility and one dimensional consolidation characteristics of soils; Shear strength of soil; Earth pressure theories for retaining walls, Stability of Slopes.

### **Surveying (Credits: 3)**

Basic surveying types, Compass surveying, Leveling, Differential leveling, Reciprocal leveling, Contouring, Theodolite; Measurement of horizontal & vertical angles. Traverse Surveying. Plane Table Surveying; Tachometric Surveying, Curves: Simple circular, Compound, Reverse & Transition curves, setting out of the curves.

Photographic Surveying: Principles, Aerial photography. Aerial Camera, Scale of Vertical Photograph, Computation of Length of Line Between Points of Different Elevations, Relief Displacement, Flight Planning for Aerial Photography,

Introduction to Remote Sensing, Idealized Remote Sensing, Basic Principles of Remote Sensing,

Special instruments: Telemeter, Altimeter, Electronic Theodolites, The Geodimeter, The Tellurometer, Total Station. Introduction to Drone Survey.

### **Building Materials & Construction (Credits: 3)**

Conventional Building Materials: Building Materials: Bricks, stones, timber, cement, concrete, steel, glass, plastics, P.V.C., paint, Varnish, Adhesive material, Material from industrial wastes,

Modern Building Materials: Composite Material, Ceramics, Phosphogypsum panels, bamboo mat board, Red mud polymer jute composites, Dry Wall Panel System.

Building Construction: Classification of buildings, Brick masonry, stone masonry, Types of walls, partition and cavity walls Pre-fabricated construction. Plastering and pointing. Types of roofs and roof covering, treatment for water proofing, Types of floors, foundations. Damp proofing materials and techniques, Doors and windows: sizes and locations, proportions, Stair and staircases, Shuttering, scaffolding and centering, Recommendation of NBC and Building by laws Concrete repair, Formwork designing. Modern curing techniques, Introduction to Building Information Model (BIM), Detailing of electrical and plumbing facilities. GRAHA Rating

Construction methods: Precast Flat Panel System, 3d Volumetric Construction, Precast Foundations .Fabrication Of Pre Cast Components,

### **Building Material Lab (Credits: 1)**

#### **List of Experiments:**

1. Determination of water absorption and efflorescence of brick.
2. Determination of compressive strength of brick.
3. To determine the quantity of water for cement paste for normal consistency, initial and final setting time of cement
4. To determine the fineness, specific gravity and unit weight of cement
5. To determine fineness modulus of fine and coarse aggregate
6. To determine the percentage bulking of fine aggregate
7. To determine compressive strength of nominal mix concrete of a given grade
8. To determine the workability of concrete by various methods
9. To determine the split tensile strength of concrete of given mix proportions
10. To determine soundness of given cement by Le-Chatelier method
11. Effect of water cement ratio on strength of concrete
12. Concrete mix design

### **Surveying Lab (Credits: 1)**

#### **List of Experiments:**

1. Chain survey
2. Compass survey
3. Plane table survey
4. Simple leveling
5. Profile leveling
6. Longitudinal& Cross section
7. Contouring
8. Theodolite
9. Tachometry
10. Areas & Volumes
11. Traversing
12. Trigonometric leveling.
13. Total station

### **Mechanics of Fluid Lab (Credits: 1)**

#### **List of Experiments**

1. Determination of meta-centric height
2. Calibration of a Venturi-meter
3. Determination of frictional losses in pipes of different diameters.
4. Determination of minor losses in pipes
5. Calibration of Pitot tube
6. Calibration of a, V - notch and rectangular notch

7. Reynolds dye experiment for flow characterization
8. Determination of  $C_c$ ,  $C_v$  and  $C_d$  of an orifice
9. Verification of Bernoulli's theorem
10. Calibration of orifice meter
11. Verify the impulse moment equation (impact of jet)
12. Performance characteristics of a centrifugal pump
13. Valve characteristic

### **Geotechnical Engineering Lab (Credits: 1)**

#### **List of Experiments:**

1. Soil Identification Test
2. Moisture content determination by oven drying method, pycnometer method, and rapid moisture meter
3. Specific Gravity of soil particles by Pycnometer method and Density Bottle method
4. Particle size distribution of soils (Grain size analysis) by Sieve analysis and Hydrometer analysis.
5. Atterberg's limits tests
6. Field density tests of soils by Core cutter method and sand replacement method
7. Permeability tests of soils by Variable head method and Constant head method
8. Soil compaction test (Density moisture relations)
9. Moisture Content variation with drying duration

### **Year/Sem: IInd Year/IV Sem**

#### **Financial Management (Credits: 3)**

Introduction, Scope and Objectives, Basic Financial Concept, Time value of money, Capital budgeting techniques, Cash flows, Long term sources of finances. Concept and measurement of cost of capital, Leverages, EBIT-EPS analysis, Working capital management- Inventory Management, Financial Statement analysis

#### **Numerical Methods (Credits: 4)**

Solution of linear system of equations- Direct and iterative methods. Eigen values and Eigen vectors, Jacobi and Householder methods. Interpolation. Approximation. Numerical differentiation, Numerical Integration, Gauss quadrature, Solution of a system of non-linear equations; Initial and boundary value problems in ODE Numerical solution of PDE by finite difference method. Method of weighted residuals (MWR).

#### **Water Supply Engineering (Credits: 4)**

Introduction: Importance of planned water supplies; financing, planning and execution of modern water supply schemes. Water demands: Various types of demands; the per capita demand: variations in demand; design periods; population forecasting by various methods. Sources of water: Kinds of water sources and their characteristics; factors governing the selection of a source of water supply; storage capacity of impounded reservoir. Collection and Distribution of water: Intakes and their design for lakes, streams and rivers; methods of distribution; concept of service and balancing reservoirs; capacity of distribution reservoirs; Design of water distribution systems; analysis of pipe networks by Hardy Cross method, equivalent pipe method, method of sections and Newton-Raphson method; Layout of distribution system; the house water connection; construction and maintenance of distribution systems. Pipes-Joints-Fittings: various types of conduits; testing and inspection; joints in pipes; valves in pipe line. Pumps and pumping stations: Types of pumps and their choice; pumping stations; economical diameter of



rising main; hand pumps; pump testing; Water hammer and its control measures. Planning and preparing water supply projects. Quality of water: physical, chemical and biological characteristics of water, common water born diseases, standards of portable water for various purposes. Treatment of water: screening and types; aeration units; sedimentation; sedimentation tanks and their types; sedimentation aided with coagulation; classifications of filters and their constructional and operational details. Disinfection: Methods of disinfection; chlorination and its types. Water softening: Importance of water softening; lime- soda process; zeolite process. Miscellaneous treatment methods: Removal of colour, odour and taste, iron and manganese; fluoridation and de-fluoridation.

### **Structural Analysis-1 (Credits: 4)**

Introduction: Statically determinate & indeterminate structures. Analysis of statically determinate structures: trusses, frames, and three hinged arches Strain energy due to axial, bending, shear and torsion loads, Castigliano's theorem, Maxwell-Betti's theorem, Principal of virtual work, reciprocal theorem, and principal of superposition. Analysis of plane redundant frames up to two degree of redundancy by energy method, slope deflection method and moment distribution method Analysis of propped cantilever, fixed beam, continuous beam, and Clapeyron's three-moment theorem two hinge arches Suspension cables, introduction to numerical methods in structural engineering.

Introduction to MIDAS Gen Software

### **Environmental Science (Credits: 2)**

The multidisciplinary nature of environmental studies: Definition, Scope and importance. Natural Resources: Renewable and non-renewable, resources and associated problems, Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of Ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in ecosystem. Biodiversity and its conservation: genetic, species and ecosystem diversity. Biogeographically classification of India, Value of biodiversity, Threats to biodiversity, Endangered and endemic species of India. Conservation of biodiversity. Environmental Pollution: Definition, Causes, effects and control measure of-Air pollution, Water pollution, soil pollution marine pollution, noise pollution, thermal pollution nuclear hazards, Solid Waste Management. Social Issues and the Environment: From unsustainable to sustainable development, urban problem related to energy, Water conservation, rainwater harvesting. Human Population and the Environment: Population growth, variation among nations, population explosion-Family Welfare Programme. Field Work.

### **Environmental Engineering Lab (Credits: 1)**

#### **List of experiments**

1. To determine the pH, conductivity and turbidity of given sample.
2. To estimate the total solids, suspended solids (settleable and non settleable) and dissolved solids of the given sample.
3. To estimate the optimum dosage of coagulant using jar test apparatus.
4. To determine the residual chlorine content in the given water sample.
5. To estimate the chlorides content in the given sample.
6. To estimate the dissolved oxygen content in the given wastewater sample.
7. To estimate the biochemical oxygen demand (BOD) of the given wastewater sample.
8. To estimate the chemical oxygen demand (COD) of given wastewater sample.
9. To estimate the most probable number (MPN) of coliforms in the given water sample.
10. To determine the suspended particulate matter (SPM) content and respirable particulate matter (RPM) in the ambient air.
11. To estimate the noise level at various places in the campus

### **Engineering Geology Lab (Credits: 1)**

1. Study of minerals
2. Petrology- Formation and classification of rocks
3. Stratigraphy of India
4. Structural geology- Strike and dip
5. Structural geology- Classification of folds
6. Structural geology- Faults, joints, unconformities
7. Geological investigation- Interpretation of geological maps
8. Earthquakes and landslides: Classification, causes and effects of earthquakes and landslides  
seismic problems of India
9. Geology of dams and reservoirs
10. Geological studies in tunnelling
11. Geological studies in bridges
12. Geological considerations in road alignment

### **Life Skills (Credits: 2)**

Introduction –Individual: Personality, Perception, Attitudes, Learning, Values, Terminal Values, Instrumental Values, Importance, Attitude and Job Satisfaction, Assertiveness, Emotional Intelligence. Motivation: Basic concepts & theories of motivation, Motivating group members, Stress Management. Teams: Teams vs. Groups, Types of teams, and Contemporary issues in managing teams. Relationship Management Group: Foundation of group behavior, Models of group development, Group structure, Group Processes, Managing change, Managing conflict. Leadership: Basic concepts & theories of leadership, leading a team, Implications for engineers.

### **Year/Sem: IIIInd Year/V Sem**

#### **Design of Concrete Structures (Credits: 3)**

Introduction to the design of Concrete structures; Working & Limit state concepts. Limit state Design of beams for flexure, bond, shear and torsion (singly & doubly reinforced, T-beams & L-beams); axially and eccentrically loaded Columns; One and two-way Slabs, Stair cases; Footings, isolated and combined. Bar bending Schedule through MS-Excel, introduction to AutoRebar/BendWorks software.

#### **Highway Engineering (Credits: 4)**

Importance of transportation, different modes, characteristics & Scope of highway engg in India, Highway development in India, classification of roads, planning surveys, highway planning in India Highway alignment, engineering surveys, drawings and report, realignment. Geometric design: Introduction cross section elements, sight distance, design of horizontal and vertical alignment of highways. Traffic Engineering: Introduction, characteristics, traffic operation. , design of intersections, parking facilities, and lighting, traffic planning. Highway materials: sub grade soil classification, evolution of soil strength, modulus of sub grade reaction, C.B.R test, tests for road aggregate, types of bituminous materials, tests on bitumen. Bituminous paving mixes, marshal method of mix design, Pavement Design: types of pavements, design factors, design of flexible pavements by G.I method, C.B.R. method, Burmister's method, design of rigid pavements by using I.R.C.Recommendations. Highway construction: construction of earth roads, gravel roads, W.B.M. roads, bituminous roads, and Cement concrete pavement, joints in concrete pavement. Highway maintenance: Flexible &rigid Pavement failures,

maintenance of bituminous surfaces,& cement concrete pavements, strengthening of existing pavements, overlay design by Benkelman beam deflection studies. Surface & sub surface Drainage of pavements.

## **HSS elective -2**

### **Indian constitution and traditional knowledge (Credits: qualifying)**

## **Discipline elective -1**

### **Construction Technology and Management (Credits: 3)**

Introduction to various operations in construction, execution and management Types of contract, contract documents, arbitration and settlement of disputes, contract laws and handling of contracts Introduction to network based project management techniques: Defining activities and their interdependence, drawing of network, time and resource estimations, and use of network as scheduling techniques, use of network as control technique. Selection of construction equipment, cost of owning and operating, capacity and utilization, breakdown analysis, economic life, replacement of equipment and sinking fund. Standard and special construction equipments, heavy earthmoving equipments, shovels and cranes, crushing plant, batching plant.

### **Construction Planning and Project Management (Credits: 3)**

Conversion of a Scope of Work into scheduling activities; developing a building plan including preconstruction, construction, and procurement activities; preparing, analyzing, and updating Bar Charts and Critical Path Method Networks; prepare and presenting schedule information; assigning and analyzing resource requirements of a project; performing time/cost trade-off analyses; justifying claims for additional time; processing schedule information in a computerized scheduling package; controlling cost by applying the Earned Value Analysis and other progress metrics

## **Discipline elective -2**

### **Sewage Treatment and Disposal (Credits: 3)**

Introduction, Design and planning of a sewerage system, Estimating sewage discharge, Estimating drainage discharge, Hydraulic design of sewers and storm water drain sections, Sewers, their construction, maintenance and required appurtenances, Pumps for Lifting Sewage, Quality and characteristics of sewage, Disposing of the sewage effluents, Treatment of sewage, Preliminary, primary, secondary and tertiary treatment processes, Sewage collection from houses and buildings, Introduction to Duckweed pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment

### **Waste Water Engineering (Credits: 3)**

Wastewater generation, collection and conveyance: physical, chemical & Biological characteristics and their significance, primary treatment of wastewater: Treatment methods: Unit Operations and Processes Design criteria, secondary treatment of wastewater: Concepts of Biological treatment and removal mechanism – Aerobic and Anaerobic systems, Introduction to extended aeration processes and waste stabilization pond - Design of anaerobic system, Methods of sludge treatment: sludge digestion and drying beds – Disposal of sludges, wastewater disposal: Alternative disposal methods - Self purification of stream house drainage environmental sanitation : General principles - House drainage system - traps and sanitary fitting - Low cost sanitation system

**Highway Engineering Lab (Credits: 1)**

1. Aggregate crushing strength test.
2. Los Angeles abrasion test.
3. Aggregate impact test.
4. Flakiness index & elongation index test.
5. Penetration test.
6. Ductility test.
7. Viscosity test.
8. Softening point test.
9. Flash & fire point test.
10. Determination of bitumen content by centrifuge extractor.
11. Determination of marshal stability value.
12. Determination of rebound deflection of pavement by Benkelman beam.

**Civil Engineering Software Lab (Credits: 1)**

1. Spreadsheet for calculating and drawing shear force and bending moment diagrams of determinate beams.
2. Spreadsheet for designing a singly reinforced beam.
3. Spreadsheet for designing a doubly reinforced beam.
4. Primavera – Creating and analyzing a project – Project 1 part 1
5. Primavera – Creating and analyzing a project – Project 1 part 2
6. Primavera – Creating and analyzing a project – Project 2 part 1
7. Primavera – Creating and analyzing a project – Project 2 part 2
8. STAAD.Pro – Analysis of beams and plane frames
9. STAAD.Pro – Analysis of Trusses
10. STAAD.Pro – Analysis of a building for Gravity loads
11. STAAD.Pro – Analysis of a building for Wind loads
12. STAAD.Pro – Analysis of building for Earthquake load

**Minor project (Credits: 2)****Selected foreign language (Credits: qualifying)****Year/Sem: IIIrd Year/VI Sem****HSS Elective -3****Foundation Engineering (Credits: 4)**

Foundation requirement, types and selection, terminology; Soil exploration techniques (SPT, CPT, pressure-meter tests etc.) and site investigation report; Methods of determination of bearing capacity of shallow foundations, safety factors in foundation design, eccentrically loaded footings, Settlement considerations;

Raft foundation- bearing capacity and design principle, settlements; Pile foundation-types and uses, cast in situ pile construction, pile load capacity-static and dynamic formulae, pile load test, correlation with penetration test data, group action of piles, negative skin friction, settlement computations;

Well and Cassion foundation, construction and sinking of a well; Sheet Pile Walls & Bulk Heads;  
Arching in soils and braced cuts; Ground improvement techniques, deep compaction, soil reinforcement;

### **Steel Structure Design (Credits: 3)**

Introduction: Materials and Specification:-Rolled steel section, types of structural steel, Riveted, welded and bolted connections. Eccentric connection; Design of tension members, Design of one component, two components and built up compression members under axial load; built up columns under eccentric loading; Design of lacing and batten plates, Different types of Column Bases- Slab Base, Gusseted Base, and Connection details; Beams: Permissible stresses in bending, compression and tension. Grillage Foundation, Design of rolled steel sections, plated beams, simple Beam end connections, beam-Column connections. Plate girders: Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded& bolted. Gantry Girder: Design gantry girder considering lateral buckling – I.S code provisions.

### **Water Resources Engineering (Credits: 3)**

Hydrology; Hydrological cycle, precipitation, snowfall and snowmelt, evaporation, transpiration, depression storage, infiltration, overland flow, stream flow measurements, hydrograph. Ground water flow; confined and unconfined aquifers, tube wells, ground water potential. Water Resources; Single and multipurpose projects, reservoir sedimentation. Irrigation Engineering; Water requirements of crops, Moisture-crop relationship, Irrigation requirements, duty and delta, Irrigation efficiencies, modern methods of irrigation, Salinity control, Quality of irrigation water, Rain water management, conjunctive use of water, Water logging causes and control, drainage system design. Canals; Distribution systems for canal irrigation, capacity, losses, alignment of main and distributary canals, most efficient section, lined canals design, regime theory: Lacey's theory and Kennedy's theory, cost analysis of lined and unlined canals. River training; Objectives, methods, structures.

### **Discipline elective -3**

#### **Structural Analysis – II (Credits: 3)**

Kani's method to analyze simple portal frames, Column Analogy, Basic Principles of matrix method Flexibility and Stiffness matrices and their generation, Analysis of Fixed arches, Rolling loads and Influence lines for beams and arches, Plastic Analysis of beams and frames, Approximate Methods to analyze Portal frames: Portal method, cantilever method  
Introduction to MIDAS Civil Software

#### **Theory of structures-I (Credits: 3)**

Types of Structures, Different type of loading and supports, Static and Kinematic Indeterminacy, Displacement due to real work, displacements of Beams, Trusses by Unit Load Method, Displacement due to lack of fit, temperature variation, support movements. Method of Consistent Deformation (Force Method) for Beams, Frames and Trusses upto two degrees of indeterminacy. Flexibility Coefficients, Redundant Trusses, Effect of Temperature, Lack of Fit, Support Movements, And Least Work Method for Trusses.

Fixed and Continuous Beams: Beams fixed at ends, Beams of varying Cross-Sections, Partially Fixed at Ends. Effect of Settlement of Supports. Three Moment Theorem for Continuous Beams, Beams of Uniform and varying Cross-Sections. Effect of Settlement of Supports.

Influence lines for Beams, Trusses and Arches, Rolling Loads on Bridges - Absolute Maximum Bending Moment.

Arches Horizontal Thrust, Radial Shear, Normal Thrust, BMD, Influence Lines for Three Hinged Arches.

Cables and suspension bridges, Two hinge & three hinge stiffened suspension bridges, I.L.D. for suspension bridges.

#### **Discipline elective -4**

##### **Airport and Railway Engineering (Credits: 3)**

Development of air transport in India, Aircraft characteristics airport planning, Airport site selection, Forecasting in aviation, Environmental considerations. Airport design standards, Runway orientation, Change in direction of runway, Basic runway length, Geometric design of runways, Geometric standards for taxiway, Exit taxiway design, Terminal lay out & classification. Airport pavement design, Types of pavements, Design of flexible pavements, Design of rigid pavements. Marking and lighting, Air traffic control, Maintenance of airports.

History of railways in India and Role of Indian Railways in National Development, Engineering Surveys for Track Alignment - Obligatory points. Permanent Way and its components and Functions of each Component, Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creep, Sleepers - Functions, Materials, Density, Ballasts – Functions of ballast, Ballast-less Tracks. Geometric Design of Railway Tracks, Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves, Points and Crossings, Design of Turnouts, Signals, Interlocking and Track Circuiting, Construction, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, maintenance of track, track modernization.

##### **Urban Transportation, planning & Design (Credits: 3)**

Introduction: Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments. Urban Transportation System Planning - Conceptual Aspects: Transport Planning Process, Problem Definition, Solution Generation, Solution Analysis, Evaluation and Choice, Implementation, Sequence of Activities Involved in Transport analysis. Trip Generation Analysis: Trip Production Analysis, Category Analysis, Trip Attraction Modelling. Mode Choice Modelling: Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode Choice, Binary Choice Situations, Multinomial Logit Model, Model calibration, Case studies. Trip Distribution Analysis: Presentation of Trip-Distribution Data, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model, Singly and Doubly Constrained Gravity Models, A case Studies, Growth Factor Methods of Trip Distribution, Uniform Factor Method, Average Factor Method, Fratar Growth-Factor Method, Disadvantage of Growth Factor Method. Route Assignment: Description of transport network, Route Choice Behaviour, The Minimum Path, Minimum Path Algorithm, Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment. Transportation Surveys: Definition of Study Area, Zoning, Types of Movements, Types of Surveys, Home-Interview Survey, Commercial Vehicle Survey, Intermediate Public Transport Survey, Public Transport Survey, Roadside-Interview Survey, Cordon-Line Survey, Post-Card Questionnaire Survey, Registration-Number Survey, Tag-on-Vehicle Survey. Transport Related Land-Use Models: Development of Land - Use models, The Lowry Model, Application of Lowry Model.

##### **Mass Transportation Systems (Credits: 3)**

Modes of transportations, various kinds of public transportation system like bus, bus rapid transit, light rapid transit, railway rapid transit, The evolution and role of urban public transportation modes, Mass transportation systems planning, data collection, trip generation, trip distribution, mode choice and trip assignment. Important issues of public transport systems, service quality and cost, performance monitoring, route and network design, frequency determination, and vehicle and crew

scheduling. Effects of pricing policy, finance and operations, mass transport system management. Roles for the public and private sectors, crew scheduling, corridor strategies, Transit signal priority, Real-time control strategies, fare policy. Current practices of mass transport systems.

### **Docks and Harbor Engineering (Credits: 3)**

General: Historical development of water transportation in India, elements of water transportation, river and ocean transportation, Natural phenomena: Tides, wind, water waves, wind rose diagram, currents, beach protection, littoral drift, design wave height, tide, storm surge and Tsunami. Docks and harbours: Requirements of port & harbour, site investigations, ship characteristics, Types of harbours, harbour size, harbour depth, turning basin, harbour entrance, , Naval hydrographic chart, Harbour works: Types of breakwater, design of breakwater, jetty, fenders, piers, warves, dolphins, trestle, moles, mooring accessories, off-shore moorings, types of dry docks and design, Navigational Aids: Types of navigational aids, requirements of signals, light- house, beacon lights, floating navigational aids, light ships, buoys. Docks and repair facilities: Harbour docks, wet docks, dry docks, repair docks, marine railways, lift docks, keel and bilge blocking, timber gravity docks, construction of docks, lock gates, pumping plant and slipways. Port facilities: Port development, layout of ports, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, cargo carriers, marinas, ship terminals, inland port facilities .Mechanical handling systems, Dredging: Classification, types of dredgers, selection of dredger, uses of dredged materials, execution of dredging, Coastal protection: Coastal erosion and accretion, design of sea wall, revetment, bulkhead, cathodic protection. Case studies: Effect of earth quake and Tsunami, integrity monitoring, Retrofitting and rehabilitation, Maintenance and modernization of existing ports: UPV, Half-cell potential, low strain and high strain integrity tests, rapid and comprehensive EIA, PPR on green field ports, DPR on green field ports.

### **Value added course -2 (Credits: qualifying)**

### **Foundation Engineering Lab (Credits: 1)**

#### **LIST OF EXPERIMENTS:**

**Experiment No.1:** Consolidation test

**Experiment No.2:** Triaxial compression test

**Experiment No.3:** Unconfined compression test

**Experiment No.4:** Direct shear test

**Experiment No.5:** Vane shear test

**Experiment No.6:** Swelling pressure test by swelling pressure apparatus and consolidometer

**Experiment No.7:** CBR test (Soaked and Unsoaked)

**Experiment No.8:** SPT test (Demonstration)

**Experiment No.9:** Plate load test (model)

### **Minor project-2 (Credits: 3)**

## **Year/Sem: IVth Year/VII Sem**

### **Discipline elective -5**

#### **Estimation and Costing (Credits: 3)**

The Units of measurements and payments for various items of works and materials Methods of estimating, estimating steps, estimating of buildings, different types of roofs, sanitary and water supply works, road works, culverts, bridges, wells, and irrigation works,

Types of estimates: preliminary and detailed estimates, contingies, administrative approval, Analysis of rates; factors affecting the rate analysis, material and labour requirements for different types of work, rates of materials & labour. Estimate the unit rate for different items.

Estimating of quantities of materials and transport, Specifications, rules and methods of measurement.

Autocad/3 D home: Draw the plan, elevation, section and views of different civil engineering structures by using 3D home/AutoCAD software and check the estimation done manually by using MS-Excel.

Drawing work: Plan, elevation, section and views of residential buildings, different types of roofs, sanitary and water supply works, road works, culverts, bridges, wells, and irrigation works, etc. Estimation through MS- Excel, Introduction to CANDY software.

#### **Advanced Building Materials (Credits: 3)**

Plastics, Glass, Timber, Miscellaneous Materials Steel, Aluminum, Air-Cleaning Bricks, Passive Cooling Ceramics, Titanium Foam, Composite Materials, Unidirectional Composites, Short fiber composites and Rubber reinforced composites Laminated composites and its applications Fiber reinforced plastics (FRP) and its applications. Use of C&D waste in concrete, Self-healing concrete, Bacterial Concrete, translucent concrete, light generating cement, Application of shape memory alloys in construction industry.

#### **Theory of Structures-II (Credits: 3)**

State of stress in a body. Tensor notations, Differential equations of equilibrium, Invariants of the stress tensor, Theory of strain, Displacement components, strain components and relation between them, Generalised Hooke's law, Solution of the elasticity problem in terms of displacements, Basic equations of the theory of elasticity, Lamé's equations, Plane problem in Cartesian co-ordinates, Plane problem in polar co-ordinates, Shrink fits, Rotating disks with uniform thickness, Plate with hole, Torsion in prismatic bars, Saint Venant's method, Solution of torsion problem in terms of stresses Strain energy, Elastic plastic behavior, Design philosophy, Linear elastic and plastic behavior, Tresca and Von Mises yield criteria, Visco-elastic behavior.

#### **Wind Resistant Design of Structures (Credits: 3)**

Atmospheric boundary layer- nature of wind- normal and extreme wind-deterministic and probabilistic description- mean return period-mean velocity profile-power law and logarithmic law—average time-turbulence-terrain types-correlation – spectrum of wind-topography. Flow around bluff bodies-Governing equations-Important aerodynamic parameters-pressure and force coefficients-mean and fluctuating pressures- -drag and lift- flow over prisms and circular cylinders- role of Reynolds number and turbulence intensity-effects of aspect ratio.

Basic wind speed-Modification factors- $k_1$ ,  $k_2$ ,  $k_3$  and  $k_4$ -design wind speed-design wind pressures- external and internal pressures-pressure coefficients-Force coefficients-static and dynamic wind loads and effects. Types of wind tunnels- principle of wind tunnel testing-similarity laws-simulation techniques - important flow and response parameters-case studies



Static and dynamic loads- wind sensitive structures-single degree and multiple degrees of freedom Dynamic properties of a structure-Mechanical admittance function- Response of structures to dynamic wind loading. Structural design philosophy- various loads-gravity and lateral loads-Design considerations-low-rise and high-rise buildings –Wind-sensitive structures - Case studies

## **Discipline elective -6**

### **Hydropower Engineering (Credits: 3)**

Introduction: Sources and forms of energy, types of power plants, hydropower development in India and world, hydropower potential, constraints in hydro power development, general arrangement of a hydroelectric project. Hydropower plants classification: layout and components, storage plants, diversion or run-of -river system, pumped storage plants, tidal power plants, micro tidal units, scale of hydro power projects. Load and power studies: Nature of power demand or load, firm power and secondary power. Intake structures: Components of intake, trash rack, spacing of bars. Penstocks and power canals: Classification of penstocks, design of penstocks, economic diameter, surges in canals, design criteria of power canals. Surge tanks: functions, location & arrangement of surge tank, types of surge tanks, hydraulic design. Hydraulic turbines: Types and classification, main components of turbines, efficiency of a turbine, constructional features, selection criteria, characteristic curves, governing of turbines specific speed, drafts tubes-types, draft tube theory, cavitation in turbines, unit quantities. Small hydropower development: Benefits and potential of small hydropower plants.

### **Advanced Reinforced Concrete Structures (Credits: 3)**

Introduction: Review of Limit State Design of Beams, Slabs & Columns according to IS 456-2000. Design of special elements: Design of Slender Columns, Grid Floors, Curved Beams, Deep Beams, Plain & Reinforced Concrete Walls, Retaining Wall. Slabs: Design of Circular & Flat Slabs. Yield Line Analysis of Slabs. Bunker and silos, water tanks: Rectangular Water Tanks, Circular Water Tanks, Overhead and Underground Water Tanks

### **Rock Mechanics (Credits: 3)**

Historical development of rock mechanics, Basic equations from solid mechanics, distribution of rocks on Indian mainland, stereographic presentation of geological data, laboratory testing of rocks, strength, modulus and stress-strain responses of rocks, engineering classification of rock and rock masses, In situ geophysical methods, electrical resistivity methods for ground characterization, deformability tests in rock mass, field shear test & permeability tests, estimation of stresses in rock mass, stability of rock slopes, rock foundations, methods to improve rock mass responses.

### **Environmental Management & Impact Assessment (Credits: 3)**

Environmental management :Environment; Definition and elements -Interaction between abiotic and biotic elements Human interference with the environment -Resource exploitation and use of technology Impact of man, technology on environment - Exploitation and destruction Environmental degradation - current environmental concerns. Concept of environmental management - Conservation, preservation and sustainable development Environmental impact assessment: Introduction to environmental impact assessment - Frame work of Environmental Assessment, prediction and assessment of impact on the air, water, biological & socioeconomic environment – methodologies of EIA, Future Environmental impact Hydropower project, highway project, cement manufacturing. Environmental audit: Introduction - Types of Audits - Features of Effective auditing - programme Planning - Definition - Organisation of Auditing Programme - pre visit data collection Audit Protocol - Onsite Audit - Data Sampling - Inspections - Evaluation and presentation Audit Report. Various environmental management systems.

## **Discipline elective -7**

### **Geo-environmental Engineering (Credits: 3)**

#### Soil- Pollutant Interaction:

Introduction to geo environmental engineering, environmental cycle, sources, production and classification of waste, causes of soil pollution, factors governing soil-pollutant interaction, physicochemical behavior, failures of foundations due to pollutants

Characterization, Stabilization and Disposal, Safe disposal of waste, site selection for landfills, characterization of land fill sites, waste characterization stability of landfills, current practice of waste disposal, passive contaminant system, hazardous waste control and storage system, mechanism of stabilization, solidification of wastes, micro and macro encapsulation, absorption, adsorption, precipitation, detoxification, organic and inorganic stabilization.

#### Transport of Contaminants:

Contaminant transport in sub surface, advection, diffusion, dispersion, governing equations contaminant transformation, sorption, biodegradation, ion exchange, precipitation, hydrological consideration in land fill design, ground water pollution, bearing capacity of compacted fills, pollution of aquifers by mixing of liquid waste, protecting aquifers.

#### Detection and Testing Methods

Methodology, review of current soil testing concepts, proposed approach for characterization and identification of contaminated ground soil for engineering purposes.

#### Remediation of Contaminated Soils:

Rational approach to evaluate and remediate contaminated sites, monitored natural attenuation, exsitu and insitu remediation, solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting, ground water remediation, pump and treat, air sparging, reactive well application of geo synthetics in solid waste management - rigid or flexible liners.

### **Pre-stressed Concrete Structures (Credits: 3)**

Introduction to basic concept of pre-stressing, System of pre-stressing , Loss of pre-stress, Analysis for flexure, Design for flexure shear and torsion, Deflection and cracking consideration, Transmission of pre-stress, Precast elements: poles, railway sleepers, beams, slab, use of relevant codes of practice. Introduction to design of prestressed bridges.

### **Design of Hydraulic Structures (Credits: 3)**

Diversion Head Works; Weirs and Barrages - Layout of a diversion Head work and its components. Failures of hydraulic structures founded on pervious foundations - creep theory for seepage flow - (Bligh's Lacey's and Khosla's). Storage works; Design of gravity dams : modes of failure and criteria for structural stability of gravity dams - Diversion problems in dam - construction of Galleries - joints - foundation treatment - Types of earthen dams - methods of construction - Causes of failure of earthen dams , Seepage Analysis - seepage control in Earthen dams. Spillways; Spillway types, control concepts, overflow, side channels, shaft and siphon spillways, chutes, cavitations, aeration Maintenance of Hydraulic structures; Types, procedure, charts, Annual maintenance.

### **Traffic Engineering (Credits: 3)**

Administration and functions, road user and vehicle characteristics, Speed, journey time and delay surveys, vehicle volume counts, classification and occupancy, O&D surveys, parking surveys, photographic techniques in traffic survey, statistical

methods for traffic engineering, speed studies, traffic forecasting ,geometric design ,traffic signs ,road markings, traffic signals, street furniture, regulation of traffic, road accidents ,street lighting ,traffic management , highway capacity, basic diagram of traffic flow.

### **Open elective -1**

#### **Introduction to Sustainability (Credits 3)**

Introduction - Fundamentals of Sustainable approach- Sustainability and resources, present practices at national and international level. Ecosystems and Extinctions, weather versus climate, climate change in the past and modern climate change. Energy Overview, various energy sources, renewable energy sources, energy conservation. Water conservation, sources of contamination, challenges in water management. Municipal waste, Plastic waste, Industrial waste, Recycling, Reuse and Management. Environmental Policy, Introduction to EIA, Environmental Policy Assessment and life cycle assessment, case studies. Sustainability Metrics and Future Aspects, Socio-economic feasibility of sustainable products.

#### **Major project part -1**

Project is a course requirement wherein under the guidance of a faculty member, a final year student is required to do an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study. The student is expected to do literature survey and carry out development and/or experimentation. Through project work the student has to exhibit both analytical and practical skills. The project is done in two semesters, i.e. 7th and 8th , on a continuous problem

#### **Summer training**

### **Year/Sem: IVth Year/VIII Sem**

#### **Discipline elective -8**

#### **Dams and Reservoir Design (Credits: 3)**

Planning of project, Purpose of development, Project study, Ecological and environmental considerations, Flood studies, Economic considerations. Selection of type of dam, Classification of types, Physical factor governing selection of type, legal, economic, aesthetic considerations. Foundation and construction materials: Investigation, Source of information, Surface exploration, sampling, Field and laboratory tests. Earthfill dam: Design principles, Foundation design, Embankments, Embankment details. Rockfill dam: Origin and usage, Definition and types, Foundation design, Embankment design, Membrane design Concrete gravity dam: Introduction, Origin and development, Forces acting on dam, Requirements for stability, Dams on pervious foundations.

#### **Advanced Concrete Technology (Credits: 3)**

Basic concrete Technology: Ingredients of concrete; cement, aggregate, mineral and chemical admixture, water, properties of concrete, workability, strength, durability, essentials of concrete mix design, codal requirement. Approach to design for durability: Deleterious agencies, mechanism of attack, transport phenomena, ingress of liquids and gases in concrete, suction, permeability and diffusion, chloride diffusion coefficient, role of cover and mix proportion, latest provisions in modern code of practice. High Performance concrete: Definition, logical development, self compacting concrete, mix design, field practices, sustainable construction, role of mineral and chemical admixtures, examples as application in India.

Special Concrete: Light weight concrete, heavy weight concrete, Fiber Reinforced Concrete, Ferrocement, vacuum treated concrete, controlled permeability formwork. Quality control: Role of workmanship, batching, mixing, transportation, placing, compaction, curing, extreme weather concreting, role of RMC, statistical concept and acceptable criteria. Assessment of concrete and structures: Testing of concrete, accelerated strength test, core testing, nondestructive testing, load test on structures, distress investigations. Repair Techniques: Approach; planning for repair, material and procedure. Formwork Scheme, Introduction to formwork design with relevant codes of practice.

### **Underground Technology (Credits: 3)**

Introduction to various underground structures, Underground construction methodology & equipments, Excavations, soil support methods, diaphragm walls, Management of groundwater, dewatering methods, Cofferdams, Caisson & wells, Methods of Basement construction, Grouting, In-situ Densification: Preloading, Compaction Grouting, Dynamic Compaction, Blast densification, Vibro-Compaction and Vibro-Replacement, Compaction piles, Reinforcement of embankments and foundations, Tunnels: Introduction, Tunnel stabilization and lining, Cut and Cover Tunnels, Bored Tunnels, Immersed Tube Tunnels, Water Conveyance Tunnels, Micro-tunnels; Underground Conduits: Ditch Conduits, Positive Projecting Conduits, Negative Projecting Conduits, Imperfect Ditch Conduits, Tunnelled Conduits

### **Advanced Pavement Design (Credits: 3)**

Advanced highway materials; Sub grade soils, special problems in soil stabilization works, stone aggregates, Bituminous materials, Bituminous paving Mixes, Modified binders, Cement concrete Mixes, Design of bituminous mixes by Marshall method, modified Hubbard –field method, Hveem method etc, Flexible pavements: Layered system concept, California Resistance value or Stabilometer method Triaxial test method, McLeod method, Burmister method, IRC: 37 method.

Rigid pavements: design parameters, modulus of sub grade reaction, stresses calculation, design of slab, spacing of joints, dowel bars, tie bars, reinforcement, IRC:58 method. Overlays: Pavement strengthening problems, types of overlays, advantages of Cement concrete overlays over bituminous overlays, white topping, overlay design, IRC:81 method. Joint filling & sealing, pre stressed concrete pavements, Influence charts.

### **Discipline Electives -9**

#### **Highway Construction, Maintenance & Management (Credits: 3)**

Highway construction: History of road construction, equipments for the road construction, stages of construction, limitations in pavement construction due to weather. Earthwork: Clearing and grubbing, excavation, embankment construction, replacement of soils, soil stabilization. Non bituminous pavement constructions: granular subbase, water bound macadam, Bituminous pavement construction: Sub grade, granular sub base, base course, binder course, wearing coat, interlayer coats. Cement concrete pavement: Dry lean concrete, laying of concrete pavement, concrete surfacing, joints for cement concrete pavement, Highway maintenance: General, distress in pavements, cracking, patching, rutting, pot holes, stripping and swelling, evaluation of pavement, structural evaluation, pavement maintenance. Introduction to transport economics: Recycling of pavements: Introduction, selection of road for recycling, methods and equipments for recycling. Hill Roads: Alignment, geometrics, design and construction for hill roads, drainage design, maintenance. Quality control of road works : control of alignment, quality control tests during construction,

#### **Design of Water and Wastewater Treatment Plant (Credits: 3)**

Water treatment: unit processes and flow sheets. Sedimentation: Design of primary and secondary sedimentation tank, Settling and removal efficiency for discrete and flocculent settling. Coagulation: coagulants and their reactions, determination of optimum dose of coagulant, design of rapid mix chamber. Flocculation, definition, hydraulic and mechanical flocculators and their design, criteria for good flocculation. Filtration: design of slow sand and rapid sand introduction to dual media filters. Disinfection: various disinfectants, Water softening by lime soda process and ion exchange; calculation of dose of chemicals. Design of a complete water treatment plant. Wastewater Treatment: Secondary Treatment: Activated Sludge Process-flow sheet, aeration tanks, design of activated sludge units & modifications, trickling filters, theory and design using NRC equation. Anaerobic digestion of sludge, design of anaerobic digesters Tertiary Treatment: Introduction to microstraining, ion exchange, reverse osmosis, electrodialysis, ammonia stripping, nitrification and denitrification, biological phosphorus removal advanced biological systems, chemical oxidation. Design of complete wastewater treatment plant.

### **Earthquake Resistant Structures (Credits: 3)**

Nature of Earthquakes: Plate Tectonics Theory, Faults and fault movements, Magnitude of earthquakes, Intensity scaling of earthquakes: subjective intensity and instrumental intensity, Characteristics of earthquake ground motions. Response Of Simple Structures To Earthquake Ground Motions: Seismic response of linear elastic single degree of freedom (SDOF) systems, Seismic response of inelastic SDOF systems Response spectra. Response of Multi Degree Of Freedom Systems (MDOF) To Earthquake Ground Motions: Free vibration analysis, Equivalent Lateral Load Procedure, Mode Superposition Procedure. Seismic Design Principles: Earthquake design philosophy, Design spectrum, Earthquake resistance of building systems, Response modification factors. Seismic Code Procedures: Classification of building systems, Selection of analysis procedure, Capacity design principles for reinforced concrete buildings, Case study: analysis and design of a multistory R/C frame.

### **Advanced Foundation Engineering (Credits: 3)**

Bearing capacity from field tests data, bearing capacity for footings on layered soils, on slopes; bearing capacity of foundations with uplift or tension force; proportioning of footings; Stresses and displacements in layered and anisotropic soils; Foundations on difficult soils - residual soils, sanitary landfills and geoenvironmental considerations; Special footings and beams on elastic foundation, Design of raft foundation by flexible methods; Design of Piles for resisting uplifts, and laterally loaded piles; Settlement of pile groups; Design of foundations for vibration control, analysis and design of machine foundations; Computational methods in Geomechanics, Introduction to forensic geotechnical engineering.

### **Open Elective -2**

#### **Remote Sensing & GIS Applications (Credits: 3)**

System, data acquisition and processing; Applications; Multi concept in remote sensing. Physical basis of remote sensing - Electro-magnetic radiation (EMR) - nature, nomenclature and radiation laws; Interaction in atmosphere - nature, its effects in various wavelength regions.

Atmospheric windows; Interaction at ground surface - soils and rocks, vegetation, water, etc.; Geometric basis of interaction. Platform and sensors - Terrestrial, aerial and space platforms; Orbital characteristics of space platforms, sun & geo-synchronous; Sensor systems radiometers, optomechanical and push broom sensor; Resolution - spectral, spatial, radiometric and temporal; Data products from various air and space borne sensors - aerial photographs, LiDAR, Landsat, SPOT, IRS, ERS, IKONOS, etc. Image interpretation- Elements of interpretation; Manual and digital interpretation; Field verification.

Geographical Information Systems: Components of GIS- data acquisition, spatial and attribute data, pre-processing, storage and management; Data structures-raster and vector data; GIS analysis functions; Errors and corrections; Data presentation and generation of thematic maps; GIS applications.

### **Wind Engineering (Credits: 3)**

Atmospheric boundary layer- nature of wind- normal and extreme wind-deterministic and probabilistic description- mean return period-mean velocity profile-power law and logarithmic law—average time-turbulence-terrain types-correlation – spectrum of wind-topography. Flow around bluff bodies-Governing equations-Important aerodynamic parameters-pressure and force coefficients-mean and fluctuating pressures- -drag and lift- flow over prisms and circular cylinders- role of Reynolds number and turbulence intensity-effects of aspect ratio.

Basic wind speed-Modification factors- $k_1$ ,  $k_2$ ,  $k_3$  and  $k_4$ -design wind speed-design wind pressures- external and internal pressures-pressure coefficients-Force coefficients-static and dynamic wind loads and effects. Types of wind tunnels- principle of wind tunnel testing-similarity laws-simulation techniques - important flow and response parameters-case studies

Static and dynamic loads- wind sensitive structures-single degree and multiple degrees of freedom Dynamic properties of a structure-Mechanical admittance function- Response of structures to dynamic wind loading. Structural design philosophy-various loads-gravity and lateral loads-Design considerations-low-rise and high-rise buildings –Wind-sensitive structures - Case studies

### **Introduction to Disaster Management (Credit 3)**

Overview of Disaster Management: Introduction, Disaster Management Cycle, Education and Public Awareness, The Role of Media in Disaster Management, Disaster Associated Health Issues Physical and Socio-economic Impacts of Disasters, Vulnerable Groups in Disasters

The Role of Technology in Disaster Management, Geographic Information Systems (GIS) and Global Positioning System (GPS) in Disaster Management , Remote Sensing and Disaster Management , Early warning systems.

Natural Hazards: causes, distribution pattern, consequences and mitigation measures for : Earthquake, Tsunami , Cyclone, Flood, Drought, Landslide.

### **Major Project Part-2**

Project is a course requirement wherein under the guidance of a faculty member, a final year student is required to do an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study. The student is expected to do literature survey and carry out development and/or experimentation. Through project work the student has to exhibit both analytical and practical skills. The project is done in two semesters, i.e. 7th and 8th , on a continuous problem.

## Specialization (Construction Management)

### **Sustainable Construction (Credits: 3)**

Principles of Sustainability: Introduction, Major environmental challenges, Global warming, introduction to green buildings and LEED, fossil fuels, Carbon footprints, renewable energy, Indian scenario on sustainable construction, world-wide scenario, green building assessment tools.

Energy and Water conservation: Energy and water conservation in building sites, roads, bridges

Building Science fundamentals: HVAC systems, indoor environment quality (IEQ), net zero energy buildings,

Sustainable materials: Construction and demolition waste, Green concrete, use of industrial and agricultural wastes in construction, bio-composites.

Sustainability techniques: Economics of sustainable construction, basics of Life Cycle assessment, basics of sensors and monitoring systems for sustainable construction, Environmental ethics

### **Construction Planning and Control (Credits: 3)**

Conversion of a Scope of Work into scheduling activities; developing a building plan including preconstruction, construction, and procurement activities; preparing, analyzing, and updating Bar Charts and Critical Path Method Networks; prepare and presenting schedule information; assigning and analyzing resource requirements of a project; performing time/cost trade-off analyses; justifying claims for additional time; processing schedule information in a computerized scheduling package; controlling cost by applying the Earned Value Analysis and other progress metrics

### **Construction Safety and health (Credits: 3)**

Concept of safety, factors affecting safety: psychological and technological, planning for safety provisions, techniques for construction safety management, safety considerations during construction, demolition and use of equipment; management of accidents/injuries, site management with regard to safety recommendations, training for safety awareness, implementation of health & safety plans, construction hazards & solutions, formulation of safety manuals, safety legislation, standards/codes with regard to construction safety, case studies, construction safety management – fundamentals, measuring performance & recording information, health hazard in construction, personal protective and lifesaving equipment, the safety policy; assessing the risks, control strategies for construction work; fire safety, the health and safety plan, training; meetings, understanding people, access to information, environment, health and safety issues - construction and the environment, construction health and safety law

### **Advances in Construction Materials (Credits: 3)**

Introduction to building materials like bricks, cement concrete, lime, soil, provisions in latest code of practices, high performance concrete, sustainable materials, mineral and chemical admixtures, industrial waste materials, high strength concrete, corrosive resistant materials, types of fibers, damp proofing materials, light weight concretes, porous concretes, ultra high strength concrete, reactive powder concrete, Geopolymer concrete, construction chemicals, self compacting concrete, bituminous materials, road tar, cut backs, emulsions, decorative materials, Plastics, aluminum materials. Types of steels, Wiring materials, plumbing materials, fire resisting materials, sound proofing materials, light weight aggregates, sand, sponge concrete, Composite Materials, Classification of Composite Materials, Classification of Polymers, Ceramic matrices, hardware

materials, Role of fibres in composites, characterization of composites, composite materials, testing methods, Codal provisions. Field practices.

### **Value Engineering (Credits: 3)**

Introduction, concept of cost & value, objectives, fundamentals and principles, methodology, techniques and applications of value engineering, project scope and budget, cost control, cost models, function analysis, life cycle costing, integrating value engineering in planning, design and construction, case studies.

### **Construction Financial Management (Credits: 3)**

Introduction, modern financing theory, real estate development & finance, construction accounting systems, analysis of financial statements, managing costs, determining labor burden, managing general overhead costs, setting profit margins for bidding, profit center analysis, cash flows for construction projects & construction companies, time value of money, risks & uncertainties and management decision in capital budgeting, taxation and inflation, financing a company's financial needs, tools for making financial decisions, interest factors, amortization schedule, computerized accounting systems, international financial management, practical problems & case studies.

### **Project Oriented Practice (Credits: 2)**

## **Specialization (Structural Engineering)**

### **Recent Advances in Construction Materials (Credits: 3)**

Foams and lightweight materials, fibre reinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete, Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concrete at high temperature, High strength concrete, changes in concrete with time, corrosion of concrete in various environments, corrosion of reinforcing steel, electro chemical process, measures of protection, Ferro-cement, materials and properties polymers Civil Engineering Polymers, fibres and composites, fibre reinforced plastic in sandwich panicles, modelling. Architectural use and aesthetics of composites. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, polymer foams and polymers in building physics, Polymer concrete composites.

### **Theory of structures (Credits: 3)**

Strain Energy: Theories of Elastic Failure. Gradually and suddenly applied Loads. Impact and Falling Loads. Deflection of Structures: Strain Energy Method for Deflection of Beams and Determinate Trusses, Castigliano's First Theorem and its Application to find Deflections

Columns and Struts: Long and Short Columns, Axial and Eccentric Loads. Euler's Theory and Rankine's Formula for Axially Loaded Columns. Eccentrically Loaded Columns, ISI-Formula for Columns, Introduction to Beam-Column behaviour and Column with Lateral Loads.

Unsymmetrical Bending: Principal Moment of Inertia, Unsymmetrical Bending of Standard Structural Section, Change in Orientation of Neutral axis-plane, Shear Centre. Shells and pressure vessels: thin walled cylindrical and spherical pressure vessels under internal and external radial pressure. Wire wound thin tubes



Curved Flexural Members: Circumferential Stresses in Curved Beam, Correction Factors for Straight Beams Formula, Radial Stresses in Curved Beams, Application to Closed Rings and Chain Links. Bending of Curved Bar out of its Plane of Initial Curvature Application to Beams Curved in Plain. Springs : closed coiled and open coiled helical springs. Stress in the spring materials. stiffness of springs, spring subjected to axial loads and couples. Grouping of springs.

Basics of Mechanical Vibration : Signal degree of freedom system : Free & Forced vibration, Linear viscous damper, Coulomb Damper, response Harmonic Excitation Rotation Unbalance & support Excitation, Vibration isolation and Transmissibility. Single Degree of freedom system as vibrometer accelerometer

### **Special Reinforced Concrete Structures (Credits: 3)**

Introduction: Review of Limit State Design of Beams, Slabs & Columns according to IS 456-2000. Design of special re elements: Design of Slender Columns, Grid Floors, Curved Beams, Deep Beams, Plain & Reinforced Concrete Walls, Retaining Wall. Slabs: Design of Circular & Flat Slabs. Yield Line Analysis of Slabs. Bunker and silos, water tanks: Rectangular Water Tanks, Circular Water Tanks, Overhead and Underground Water Tanks.

### **Finite Element Methods (Credits: 3)**

Introduction, Matrix-Displacement Formulation, Element Shapes, Nodes, Nodal Unknowns and Coordinate Systems, Shape Functions, Strain-Displacement Matrix, Assembly Stiffness Equation - Direct Approach, Galerkin's Method, Virtual Work Method, Variational Method, Applications of FEM in Civil Engineering 1-D Static Problems: Rod, String, Beam, Shaft One-dimensional Formulations; Boundary Conditions; Solution Algorithms; Descretization; Stress Deformation Analysis 2-D Static Problems: Plane Stress, Plane Strain, Axisymmetric Problems, Stability of Columns and Thin Plates Two-dimensional Formulations; Boundary Conditions; Solution Algorithms; Descretization.

### **Earthquake Engineering (Credits: 3)**

Nature of Earthquakes: Plate Tectonics Theory, Faults and fault movements, Magnitude of earthquakes, Intensity scaling of earthquakes: subjective intensity and instrumental intensity, Characteristics of earthquake ground motions. Response Of Simple Structures To Earthquake Ground Motions: Seismic response of linear elastic single degree of freedom (SDOF) systems, Seismic response of inelastic SDOF systems Response spectra. Response of Multi Degree Of Freedom Systems (MDOF) To Earthquake Ground Motions: Free vibration analysis, Equivalent Lateral Load Procedure, Mode Superposition Procedure. Seismic Design Principles: Earthquake design philosophy, Design spectrum, Earthquake resistance of building systems, Response modification factors. Seismic Code Procedures: Classification of building systems, Selection of analysis procedure, Capacity design principles for reinforced concrete buildings, Case study: analysis and design of a multistory R/C frame.

### **Design of Industrial Structures (Credits: 3)**

Moment connections: Simple, Semi-rigid and Rigid Connections; Connection Configurations; Angle Cleat Connections; End-plate Connections; Semi-rigid Connections; Moment-rotation Characteristics

Industrial buildings: Structural Configurations; Functional and Serviceability Requirements; Industrial Floors; Roof Systems; Plastic Analysis and Design of Portal Frames; Crane Gantry Girders; Design for Wind Actions; Design for Earthquake Actions

Multi-storied buildings: Structural Configurations; Steel-Concrete Composite Floor Systems; Loading; Analysis for Gravity Loads; Lateral Load Resisting Systems; Analysis for Lateral Loads; Dual Systems; Advanced Structural Forms, Towers & tanks.

## **Project Oriented Practice (Credits: 2)**

### **Minor Specialization (Quantity Surveying)**

#### **Building Planning and Drawing (3 Credits)**

Drawing Standards- Guidelines for Building Drawing, General convention, for showing different materials in section, Thumb rules for effective planning, Building Bye-Laws, Specifications of Buildings.

Stairs and Double Storeyed Buildings – Terminology, Guidelines for staircases planning, Different types of Stairs, Specifications.

Doors and Windows – Guidelines for selecting Doors and Windows, Terminology.

Inclined roof buildings – Terminology, Specifications for Truss Drawings, Problems on Trusses, Problems on inclined roof buildings.

#### **Estimation of Buildings and Roads (3 Credits)**

Procedure of Estimating, Methods of Building Estimate, Estimates of Buildings, Estimate of different types of roofs, Estimates RCC work and structures, Estimates of Sanitary and Water supply works, Road Estimating

#### **Quantity Surveying of Bridges and Hydraulic Structures (3 Credits)**

Estimating of Culvert, Bridges and Wells, Irrigation works. Analysis of Rates, Types of Estimate – Sanction, Project.

#### **Construction Contracts and Laws (3 Credits)**

Basics of the legal system including contracts, torts, land zoning and property ownership, bonds and insurance, bidding, subcontracting, contractor liability, mechanics liens, litigation and arbitration, Indian and international construction law, hazardous waste issues and labor laws, disputes and disputes resolutions, case studies, Indian contract act, elements, types, features-suitability-design of contract documents, international contract document, law of torts; tenders: prequalification-bidding-accepting-evaluation of tender, formation and interpretation, potential contractual problems, world bank procedures and guidelines; BOT projects, arbitration, comparison of actions and laws, agreements, conditions of arbitrations, powers and duties of arbitrator, rules of evidence, Dispute Redressal Boards(DRB), Laws: legal requirements, insurance and bonding, laws governing sale, purchase and use of urban and rural land, land revenue codes, tax laws, income tax, sales tax, excise and customs duties, legal requirements for planning, property law, agency law, local government laws for approval, statutory regulations

#### **Construction Financial Management (3 Credits)**

Introduction, modern financing theory, real estate development & finance, construction accounting systems, analysis of financial statements, managing costs, determining labor burden, managing general overhead costs, setting profit margins for bidding, profit center analysis, cash flows for construction projects & construction companies, time value of money, risks &

uncertainties and management decision in capital budgeting, taxation and inflation, financing a company's financial needs, tools for making financial decisions, interest factors, amortization schedule, computerized accounting systems, international financial management, practical problems & case studies

### **Quality Assurance & Quality Control (3 Credits)**

Construction Organization Types of Organization-Inspection, Control and enforcement-Quality Management Systems and Method- Responsibilities and authorities in Quality assurance and Quality control-Architects, Engineers, Contractors, and Consultants, Quality circle Quality Management: Quality policy, Objectives and methods in construction industry-Consumer satisfaction-Ergonomics-Time of Completion-Statistical Tolerance-Taguchi's concept of quality Codes and standards-Documents-Contract and construction programming-Inspection procedures, Processes and products-Total QA / QC Programme and cost implication Quality Assurance and Control -Objectives-Regularity agent-Owner, Design, Contract And Construction Oriented Objectives, Methods-Techniques and Needs Of QA/QC-Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Major Failure Aspects And Failure Mode Analysis. Standardization - Selection Of New Materials-Influence Of Drawings, Detailing And Specification Based On Codal Provisions.