

## **SYLLABUS OF SEMESTER WISE DEPARTMENTAL SUBJECTS**

### **First Year Second Semester**

#### **BUILDING MATERIAL AND CONSTRUCTION**

Building Materials: Brick, Stones, Lime, Sand, Cement, Admixtures and Plasticizers, Paints and Primers: properties and specifications. Preparation and use of Cement and Lime mortars, Plane and Reinforced Concrete. Building elements: foundation, floors, walls, roofing and wood work. Roof treatment, finishing items for floors, walls, and woodwork. Brick bond: English and Flemish bond, Expansion joint, Prefabricated Constructions, Shuttering and Staging, Details of reinforcements in slab, beam, column, staircase, foundation, lintel and chajja. Plumbing and Fixtures. Corporation / Municipality rules and regulations

#### **SURVEYING-I**

Introduction to surveying: Fundamental Definitions, Errors and Accuracy, Linear measurement and corrections, Chain survey, Prismatic compass survey, Traversing: Principles and Adjustments of Traverse, Plane table surveying, Leveling: Ordinary, Reciprocal, Contouring, Area and volume measurements, Mass diagram.

#### **STRUCTURAL MECHANICS- I**

Introduction to structural elements, Stress-Strain relationship, Relation between different Elastic moduli, Composite section, Thermal stress. Bending moment and Shear force analysis of statically determinate beams. Simple theory of bending of beams: Bending stress, Shear stress and Shear flow. Torsion of circular shafts. Principal stress, Principal planes, Mohr's circle diagram. Combined stress problems. Determinate Plane trusses: Method of joints, Method of section and Graphical method.

#### **BUILDING PLANNING AND DRAWING**

Plan, Elevation and Sections of a RCC framed building. Details of RCC beams, columns, footings, lintels, slabs, staircases. Plan, Elevation and Sections of a two storied masonry building. Detail of wall foundations. Detail of doors and windows, Details of sanitary fittings and water connections, Septic tank; Corporation/ municipality rules and regulations.

### ***Second Year First Semester***

#### **COMPUTER PROGRAMMING - I**

Basic computer system, use of computer, microcomputer, Computer language: Statements, Numerical input/output; Transfer of control, Principles of flow charting, Subroutines, file handling and system-FORTRAN 77 and FORTRAN 90. Numerical analysis and Programming: Newton-Raphson Method, Secant method, Bisection method, Method of false positions, Solutions of a systems of linear and non linear simultaneous equations, Interpolation, Matrix operation, Solutions of ordinary differential equation , Runge-Kutta method, Predictor-Corrector method.

#### **STRUCTURAL MECHANICS-II**

Strain energy principle: Castiglino's theorems, Deflection analysis of determinate beams, frames and trusses, Analysis of Indeterminate trusses. Analysis of propped cantilevers, fixed beams and continuous beams, portal frames. Slope and deflection analysis of beams: Double integration method, Area-Moment theorem and Conjugate beam theory. Three-hinged Arch. Deflection analysis of truss by graphical method-Williot-Mohr diagram. Analysis of Complex trusses-Heneberg's bar exchange method.

#### **SURVEYING-II**

Theodolite: Instrument Specifications, Adjustments and Principles of Angle Measurement. Levelling: Trigonometric and Geodetic, Geodetic Survey: Triangulation Stations, Signals and Corrections. Tachometric

Surveying: Spherical Trigonometry and Azimuth Determination. Engineering Survey: Setting out of Curves: Circular, Transition, Compound, Reverse and Vertical Curves. Tunnel Survey. Hydrographic Survey.

### **COMPUTER LABORATORY-I**

Introduction to computer system, Editing environment, Development of FORTRAN programme to solve matrix and other numerical problems. Solutions of Civil Engineering problems.

### **STRUCTURES SESSIONAL**

Graphical solution of beams, plane frame and trusses. Plan, Elevation and Section of a small workshop building with steel trusses and columns.

### *Second Year Second Semester*

### **SURVEYING-III**

Introduction to Photogrammetry: Terrestrial and Aerial. Principles of Aerial Photogrammetry, Stereoscopic pair, Map Projection, Co-ordinate System. Principles of EDM. Introduction to Remote Sensing. Energy Interaction, Satellite and Sensors, Image Correction, Enhancement and Interpretation. Indian Remote Sensing System. Application to Mapping.

### **THEORY OF STRUCTURES-I**

Theorem of Three moments: Fixed, Propped and Continuous beams. Influence line analysis for determinate beams, trusses and three hinged arches. Column and Struts: Buckling load: Euler's theory, Rankine's theory, empirical formulae, Column under eccentric load, Beam–Column. Buckling analysis by energy principle. Unsymmetrical bending; shear flow and shear centre problems.

### **COMPUTER PROGRAMMING - II**

Introduction to C and C++ programming language: Constants, variables and data type, Operators and Expressions, Input and output, Decision making and branching, Decision making and looping, array, functions, structures and unions, pointers, file management, dynamic memory allocations, object oriented programming concepts. Finite difference technique, Eigen value problems, Numerical integration, Solutions of Civil Engineering software commercial packages.

### **HYDROLOGY**

Introduction – Role of hydrology in Engineering; Hydrological and water cycle; Precipitation, Measurement, rain gauges, intensity, mass curves; Evaporation, Evapotranspiration and Infiltration Losses; Runoff measurements, stream discharge measurement, Hydrograph, Unit hydrograph, Baseflow separation, Rudiments of hydrology: standard coefficients of permeability, coefficient of transmissibility, equilibrium equations of flow of water into wells, steady state well hydraulics, aquifer and aquifer parameters, specific yield, factors affecting ground water flow, field determination of coefficient of permeability, measurement of drawdown. Floods: definition and estimation

### **IRRIGATION ENGINEERING**

Types of Irrigation systems and their detailed descriptions, soil water crop relationship, types of soil, water requirement of crops: Delta and Base Period, Duty. Classification of river; River regime theory, effects of dams on river regime, river training works. Irrigation canals: design principles of irrigation canals, drainage canals and navigation canals, canal linings, canal outlets. Water logging and salt efflorescence, land reclamation.

### **VALUATION, PRICING AND CONTRACT**

Valuation: Value and cost of a property, Purposes of valuation, Capitalised value and year's purchase, Depreciation and obsolescence, Methods of finding depreciation, Reversionary value, Deferred value, Methods of valuation: rental method and land and building method. Belting method of valuation of land, Evaluation of lessor's and lessee's interest in lease hold property.

Pricing: Specifications of different items of works, statement of materials, rate analysis, and approximate estimate.

Contract: Legal and technical aspects of engineering works.

## **COMPUTER LABORATORY-II**

Development of C and C++ programming: Solutions of problems using finite difference techniques, Small Eigen value problems, Solutions of Civil Engineering problems.

## **CIVIL ENGINEERING LABORATORY- I**

### **CONCRETE/ STRUCTURE**

Testing of Cements, Fine aggregates, Coarse aggregates and Water, Fresh and Hardened concrete, Steel bars and plates, Steel and RCC beams and columns. Steel truss. Testing of model structural systems.

### **SURVEYING PRACTICE (Field work)**

Field Work on Surveying I and Surveying II

### *Third Year First Semester*

## **TRANSPORTATION ENGINEERING-I**

Highway Engineering-Introduction, Highway alignment, Traffic studies: speed, volume, delay and capacity of highways, Geometric design of highway: Cross Sectional elements, Curves: Horizontal and Vertical, Intersection Geometry, conflicts and Grade separation, Subgrade and pavement components, Types of pavements, Road drainage.

Railway Engineering-Elements of permanent way: track, rails, sleepers, ballast, rail fastenings; Tractive resistance's, Elements of geometric design-gradients and grade compensation on curves, cant, transition curves, vertical curves, Stress in railway tracks, Points and crossings, Signaling and interlocking, Maintenance of railway track.

## **WATER SUPPLY ENGINEERING**

Water uses: Quantity, requirements, potable water quality; source of water, development of surface sources; reservoir volume; transmission of water. Water distribution system including typical flow sheet. Treatment of water: typical flow-sheets for surface and underground sources; sedimentation; coagulation and flocculation; filtration, disinfections, hardness and chemical softening; rudiment and ion-exchange; elements of rural water supply.

## **THEORY OF STRUCTURES-II**

Slope-Deflection method and Moment distribution method. Beams and Portal frame problems. Two hinged and fixed Arches. Beams Curved in plan. Approximate analysis of Multi bay Multistoried Portal frames: Cantilever method, Portal method. Substitute frame analysis. Method of Elastic Centre. Column analogy technique.

## **DESIGN OF STRUCTURES-I**

Introduction to Reinforced concrete structures. Properties of concrete. Codes of practices. Working stress and limit state design of reinforced concrete structures: Single and Doubly reinforced rectangular, T, L, sections etc. against bending moment, shear forces and Torsion. Bond stress: Development length and Lap length. Design of One-way and Two-way Slabs. Staircase. Continuous beams. Axially loading columns. RCC members under combined bending and axial load. Isolated footing.

## **SOIL MECHANICS-I**

Introduction to geotechnical engineering, formation and types of soil, Weight and volume relationships; consistency limits, particle size distribution; identification and classification of soil; soil structure and clay mineralogy. Soil water

suction and capillary rise, effective and pore water pressure. Permeability and ground water flow–Darcy's law, factors affecting permeability; laboratory and field determination of permeability, permeability of stratified deposits. Seepage pressure; quick condition; Laplace's equation; construction and use of flow nets, piping and heaving. Compaction of soil–compaction phenomena, laboratory compaction test and field compaction control. Compressibility and consolidation of soil–Terzaghi's theory of one-dimensional consolidation; consolidation test and evaluation of consolidation parameters.

## **ELECTIVE-I**

- i. Concrete Technology
- ii. Advanced Solid Mechanics
- iii. Ground Water Hydrology and Water Conservation
- iv. Ecology and Environmental Management
- v. Water Quality Monitoring and Modelling

### **i. CONCRETE TECHNOLOGY**

Cement-manufacturing process. Physical and Chemical properties. Different types of cement and their uses. Codes of practices, Testing of cement: Physical and Chemical tests. Tests on fresh and hardened concrete. Chemical admixtures and Plasticizers. Durability of concrete. Mix design approaches. High Performance Concrete, Ready Mixed Concrete. Fibre Reinforced Concrete. Shotcrete. Pumped concrete. Fly ash concrete. Self-Compacting concrete. Polymer concrete etc. Grouting and grouting materials.

### **ii. ADVANCED SOLID MECHANICS**

Two and three dimensional elasticity: Equations of equilibrium and compatibility, Plane stress and Plane strain problems, Stress functions, Constitutive relationship. Equations in Cartesian and Polar coordinate systems, Bending of beams, Torsion of shafts. Computer solutions.

### **iii. GROUND WATER HYDROLOGY AND WATER CONSERVATION**

Estimation of aquifer parameters, Subsidence analysis due to withdrawal of ground water, Ground water flow equation, Laplace's equation, Different flow equation for two different water bodies with and without surcharge, Well water capacity and losses, Well hydraulics under unsteady flow condition, Contaminant flow and dynamics of flow, Water Conservation-basic principles and methods, Rainwater Harvesting, Rainwater and artificial recharge, Ground water quality.

### **iv. ECOLOGY AND ENVIRONMENTAL MANAGEMENT**

Definition of Ecology, Ecosystem, Different Ecosystem Classification, Atmosphere, Definition of Environment, Biosphere, Biomass, Biogeochemical Cycle, Productivity, Biodiversity, Food Web, Food chain, Pond Ecosystem, Ecological pyramids, Preservation of Ecosystem, Wetland Ecosystem.

Environmental Management: Definition of Environment, Waste Minimization, Sustainable development, Carrying capacity, Environmental management system (EMS), ISO 140000, Cost-Benefit Analysis, Life cycle assessment, Risk assessment.

Environmental Impact Assessment (EIA): Screening, Scoping, Public consulting, Appraisal-EIA notification, Schedule.

## **v. WATER QUALITY MONITORING AND MODELLING**

Water quality in river, Need for monitoring, Objectives, Sampling systems, Techniques of water quality and monitoring, Mixing regime, Equation for mixing regime, Hydraulic and velocity regime, Water dispersion modelling in river, Lake water modelling, Plankton modelling, Eutrophication modelling.

## **CIVIL ENGINEERING LABORATORY II**

### **CONCRETE**

Mix design of concrete, Non-destructive tests on concrete. Testing of different structural elements and systems.

### **SOIL**

Laboratory experiments in soil mechanics

### **QUANTITY SURVEYING**

Students will be required to prepare taking-off sheet, abstracts and bill of quantities on some assigned problems along with detailed specifications of materials and labour.

### **CE DESIGN SESSIONAL - I**

Design of a small RCC framed building using Limit State method of design including preparation of necessary working drawing and report in accordance with Design of Structures I.

## **CIVIL ENGINEERING LABORATORY III**

### **STRUCTURE**

Solutions of Structural Engineering problems by commercial software packages.

### **SURVEY**

Photogrammetry and Remote Sensing Image Analysis including field work for Ground Truth Verification

### *Third Year Second Semester*

## **TRANSPORTATION ENGINEERING-II**

Introduction to traffic engineering; Traffic Studies–Origin and destination studies, parking studies, accident surveys; Traffic forecasting; Traffic flow characteristics; Capacity and Level of service and its applications–basic freeway segments and highway intersections; Traffic Controls–signs, markings and signals.

Wheel loads; Stresses in a flexible pavements-Two-layer system. Flexible pavement design-CBR method, Mcleod method, Burmister and triaxial method. Determination of stresses of rigid pavements at corners, centres and edges, Design by Westergaard, and IRC method. Design of joints, Highway Material and Testing; Construction of flexible pavement. Introduction to pavement evaluation, Benkelman beam tests.

Element of airport engineering, airport planning and layout; runway and taxiway; grading and drainage.

## **WASTE WATER ENGINEERING**

Sanitary waste water and storm water run off; quantity estimate; sewerage systems and their design principles; sewer construction materials; sewer appurtenances; characteristics of domestic waste water; typical flow sheet for primary and secondary treatment; design principles for screen; grit removal, sedimentation, bio-filter, activated sludge process and septic tank; elements of rural sanitation.

## **HYDRAULIC STRUCTURE**

Storage reservoirs; different types of dams; weirs and barrages and their design principles. Spill-ways; energy dissipation by hydraulic jump; different types of energy dissipators. Seepage through dams. Cut-off walls. Head works; cross drainage works, falls and regulators. Ports, docks and harbours.

## **THEORY OF STRUCTURES-III**

Stiffness and flexibility methods: Matrix methods of structural analysis. Analysis of Suspension bridges, Influence line diagram for Three-hinged and Two-hinged stiffening girders. Influence line diagram for indeterminate structures: Muller-Breslau principle. Plastic analysis of Structures: Beams and Portal frames. Model analysis and applications. Analysis of Space truss – Tension coefficient method.

## **DESIGN OF STRUCTURES-II**

Introduction to Metal structures. Mechanical properties of metals and their specifications for structural use. Codes of practices. Design of Riveted, Bolted and Welded joints and connections. Working stress and limit state design of Tension and Compression members, Beams and Plated beams, Roof trusses, Purlins, Columns, Base connection and foundations. Compound columns with lacing and battens. Design of Steel structures using tubular, rectangular and square section

## **SOIL MECHANICS-II**

Shear strength of soil, Mohr-Coulomb theory, Determination of shear strength from laboratory and field tests. Stability of earth slopes, finite and infinite slopes, stability analysis by Swedish method of slices; stability number; tension cracks. Lateral earth pressure; earth pressure at rest, active and passive conditions; Rankine and coulomb's theory; Earth pressure on retaining walls. Bearing capacity of soil; modes of failure; bearing capacity theories; factors affecting bearing capacity. Subsurface exploration, methods of boring and sampling; different types of samplers; ground water observations.

## **CIVIL ENGINEERING LABORATORY-IV**

### **SOIL/ ENVIRONMENT**

Laboratory experiments in soil mechanics and environmental engineering. Students shall carryout experiments in small group and submit reports.

### **CE DESIGN SESSIONAL - II**

Design of a factory shed including preparation of necessary working drawings and report in accordance with Design of Structures II.

### **SEMINAR-I**

Supervising teachers shall assign topics to the students for their seminar. Each student is to prepare a report and give a presentation in front of teachers and students.

## **ACADEMIC TOUR**

### **Fourth Year First Semester**

## **ENVIRONMENTAL POLLUTION AND CONTROL**

Atmospheric pollution: Definition and Types of pollutants; natural and manmade sources. Effects of air pollution, unit systems, rudiments of control methods; elements of noise pollution.

Community Solid wastes: Sources, quantity and characteristics, collection and transfer methods, methods of disposal, reuse and recycling, Water quality management: Quality criteria for major uses of water, Applied steam sanitation. Streeter -Phelps equation.

### **DESIGN OF STRUCTURES-III**

Design of Multistoried RCC buildings considering wind and seismic forces. Combined and Strip footing. Raft foundation. Pile foundations. Retaining walls. Underground water tanks. Overhead water tank. RCC Culverts and bridges: IRC loading, design of deck slab and girder. Design of Prestressed concrete structures.

### **THEORY OF STRUCTURES-IV**

Theory of plate bending: Navier's solution, Levy's solution. Plate buckling problems. Membrane theory of domes and cylindrical shells. Elasticity problems using Airy's stress function. Introduction to Finite Element analysis. Failure theories for homogeneous isotropic materials-Von Mises criteria, Tresca's criteria etc.

### **DESIGN OF FOUNDATION**

Stress distribution, Newark's chart, Boussinesq's theory, pressure bulb. Foundations and their suitability; Foundation requirement and placement, types of foundations, choice of foundation; rigid and flexible footings; contact pressure. Evaluation of bearing capacity from plate load test, cone penetration, standard penetration test and other tests. Settlement of foundations; immediate and consolidation settlement; allowable settlement; differential settlement. Proportioning of footings for equal settlement in different types of soil. Combined footings; raft foundation; buoyant raft; analytical methods of design. Pile foundations; types of piles, pile capacity, static and dynamic formulae; design of piles groups; pile load test.

### **CIVIL ENGINEERING LABORATORY V**

#### **SOIL / ENVIRONMENT**

Laboratory experiments in soil mechanics and environmental engineering. Students shall carry out experiments in small groups and submit reports.

#### **CE DESIGN SESSIONAL - III**

Design projects in accordance with Design of structures III including preparation of working drawings and report

#### **SEMINAR II**

Supervising teachers shall assign topics to the students for their seminars. Each student is to prepare a report and give a presentation in front of teachers and students.

### **Fourth Year Second Semester**

#### **CONSTRUCTION MANAGEMENT**

Principles of management, construction organization and superintendence, operations research; time measurement and scheduling, quantitative management applications, quality management and safety; resource management and inventory; management of accounts; cost and finance; contract and commercial laws; labour and industrial laws; Construction practices; earth work and super structure, Construction equipment and operation.

#### **DESIGN OF STRUCTURES-IV**

Gantry girders and Gantry columns including base and foundation. Steel Portal frames. Pressed steel water tanks-rectangular and circular tanks. Steel Towers. Steel Chimneys. Composite structures. Light gauge steel structures. Steel buildings and Steel bridges. Limit state method of design of steel structures.

## **ELECTIVE II AND ELECTIVE III**

- Group-I:** Bridge Engineering  
Structural Dynamics
- Group-II:** Advanced Structural Analysis and Design  
Wind and Earthquake Engineering
- Group-III:** Advanced Soil Mechanics  
Advanced Foundation Engineering
- Group-IV:** Pavement Design, Evaluation and Management  
Traffic Planning and Management
- Group-V:** Advanced Water and Waste Water Treatment  
Solid and Gaseous Waste Management
- Group-VI:** Hazardous Wastes and its Disposal  
Industrial Water Pollution and Control

### **GROUP - I**

#### **STRUCTURAL DYNAMICS (ELECTIVE-II)**

Introduction to Structural dynamics, Free, Damped and Undamped vibration analysis of Single and Multiple degree of freedom systems: Beams and Portal frames. Plate vibration. Vibration control. Machine foundation. Introduction to Random vibration.

#### **BRIDGE ENGINEERING (ELECTIVE-III)**

Different types of RCC and steel bridge: Principles and application, Site investigation, Bridge hydrology and hydraulics, RCC and steel bridge deck and girder; Different methods of analysis and design, details of bearing, joints, articulation, abutments, pier and well foundation. Cable stayed bridge. Construction technique.

### **GROUP - II**

#### **WIND AND EARTHQUAKE ENGINEERING (ELECTIVE-II)**

Concept of wind, wind mechanics, effect of wind on buildings, chimneys etc., code of practices on analysis and design of wind sensitive structures. Wind tunnel testing.

Characteristics of earthquake, Earthquake response of structures. Concept of earthquake resistant design. Code provision for design of buildings and liquid storage tanks.

#### **ADVANCED STRUCTURAL ANALYSIS AND DESIGN (ELECTIVE-III)**

Finite element formulation for 2dimensional stress analysis and Axi-symmetric problems, Reliability analysis of structures, Solutions of structural instability problems. Use of commercial computer package.

Design of Silo, Bunker and their supporting structures, RCC Chimney, Flat slab.



## **GROUP – III**

### **ADVANCED FOUNDATION ENGINEERING (ELECTIVE-II)**

Foundations on expansive and collapsible soil; under reamed pile, uplift resistance of piles. Well foundation and its elements – size and depth; forces on well foundation; methods of sinking; scour depth; analysis of well foundation for bearing capacity and lateral stability. Braced excavation, types of bracing system; stability considerations, heave and uplift computation of earth pressure and strut load; Ground movement, Construction control. Dewatering - field pumping test, common dewatering methods. Effects of dewatering. Soil dynamics – theory of vibration, degrees of freedom, principles of machine foundation design.

### **ADVANCED SOIL MECHANICS (ELECTIVE-III)**

Theory of elasticity and plasticity, different failure envelopes, Three dimensional consolidation and its application; secondary consolidation. Different types of triaxial shear tests and their practical use; choice of test; pore pressure parameters. Effective stress analysis for slope stability; flow through earth dam. Stress path and its applications. Ground improvement principles and techniques. Heavy tamping, compaction piles. Preloading with sand drains/sand wicks. Field control. Principles of stone column. Numerical methods in geotechnical engineering.

## **GROUP - IV**

### **PAVEMENT DESIGN EVALUATION AND MANAGEMENT (ELECTIVE-II)**

Stress in pavements – multilayer theory; Deformation and strains in pavement layers; Pavement behavior under moving loads; Pavement design - AASHTO methods and mechanistic approach. Design of airport pavement. Pavement materials under repetitive loading. Pavement evaluation, maintenance management and quality control. Assessment of pavement quality, overlay design of flexible pavement and rigid pavement.

### **TRAFFIC PLANNING AND MANAGEMENT (ELECTIVE-III)**

Theory of traffic flow - Analytical models, shock waves and bottlenecks; Queuing theory and its application; Highway capacity at signalized and unsignalized intersections including delay components; Trip Generation, Distribution, Modal split and Traffic Assignment and evaluation; Land-use transport models; Transportation economics; Urban transportation management

## **GROUP -V**

### **ADVANCED WATER AND WASTEWATER TREATMENT (ELECTIVE-II)**

Aeration, Sedimentation, Type-I and Type-II analysis (Discrete and Flocculent), Tube settler, Coagulation and Flocculation, Derivation of 'G' Values, Disinfection Methods and Kinetics, Application of Chick's Law, Filtration hydraulics, Bed preparation with runoff bank sands, Filter plant design, Design of Clariflocculator, Membrane filtration process, Application problem.

Structural design of buried sewer, Inverted siphon, Methods of determination of ultimate BOD and biochemical reaction rate constant, Wastewater treatment: screen, grit chamber, primary clarifier, kinetics of biological reactions and evaluation of reaction constants, design of activated sludge process, Two stage Trickling filter, Sludge treatment.

### **SOLID AND GASEOUS WASTE MANAGEMENT (ELECTIVE-III)**

Definition, types and sources of solid waste, Solid waste collection, container collection system design, transfer and transport, physical and chemical composition, composting, microbial aspect; methodology, sanitary land fill methodology, area computation, equipment; incineration process: material and energy recovery. Gaseous waste: Green house effect; ozone deflection, acid rain, photochemical smog, air pollution indexing system, mobile sources, elements of air pollution meteorology; thermal inversion; plume patterns; monitoring and analysis of ambient air pollutants; dispersion; principles of point source control methods.

## **Group-VI**

### **HAZARDOUS WASTE AND ITS DISPOSAL (ELECTIVE-II)**

Hazardous waste characteristics: ignitability, corrosivity, reactivity, carcinogenicity, mutagenicity; Risk assessment: Hazard identification, dose response assessment, explosive assessment, risk characterization and management; Hazardous waste rule; Physical, chemical and biological treatment of hazardous waste.

### **INDUSTRIAL WATER POLLUTION AND CONTROL (ELECTIVE-III)**

Water requirements for different types of industries, Wastewater characteristics, Effects on Environment and stream, Sampling process, Grab and Composite sample, Process description of some major industries, Concept of Waste Minimization, Equalisation, Neutralisation, Physical and chemical treatment process, Biological treatment for high strength waste, Recovery of useful materials, Heavy metal removal method, Reuse of treated wastewater.

Case studies: Tannery, Electroplating, Power plant, Paper mill, Slaughter house, Petroleum oil refinery

## **CIVIL ENGINEERING LABORATORY-VI**

### **STRUCTURE**

Testing of steel and concrete structural systems under static and dynamic loads. Testing of Special concrete.

### **TRANSPORTATION**

Testing of road construction materials, different test on road and road surfaces.

### **SPECIAL PROJECTS**

Students will be assigned problems in accordance with their chosen elective subjects. Students will have to submit a report and drawings.

### ***GENERAL VIVA-VOCE***

Students will be asked questions by a panel of teachers in different subjects of Civil Engineering.

### **CE DESIGN SESSIONAL-IV**

Design projects in accordance with Design of structures IV including preparation of working drawings and report.