

**UNIVERSITY OF PUNE**

**Structure of T.E. (Civil Engineering) 2008 course  
Semester I**

Sub. code No.	Subject Title	Teaching Scheme Hours per week			Examination Scheme				Total Marks
		Lect.	Tut.	Pract /Drg	Paper	TW	Pract.	Oral	
301001	Structural Analysis - II	4	--	--	100	--	--	--	100
301002	Infrastructure Engg. and Construction Techniques	4	--	2	100	25	--	--	125
301003	Structural Design I	4	--	4	100	25	--	50	175
301004	Fluid Mechanics - II	4	--	2	100	25	--	50	175
301005	Advanced Surveying	4	--	2	100	25	--	50	175
	<b>Total</b>	<b>20</b>	<b>--</b>	<b>10</b>	<b>500</b>	<b>100</b>	<b>150</b>		<b>750</b>

**Structure of T.E. (Civil Engineering) 2008 course  
Semester II**

Sub. code No.	Subject Title	Teaching Scheme Hours per week			Examination Scheme				Total Marks
		Lect.	Tut.	Pract /Drg	Paper	TW	Pract.	Oral	
301006	Hydrology & Water Resources Engg.	4	--	--	100	--	--	--	100
301007	Project Management & Engineering Economics	4	--	2	100	--	--	50	150
301008	Structural Design II	4	--	4	100	25	--	50	175
301009	Environmental Engineering I	4	--	2	100	25	50	--	175
301010	Foundation Engg.	4	--	--	100	--	--	--	100
	Seminar	--	--	2		50	--	--	50
	<b>Total</b>	<b>20</b>	<b>--</b>	<b>10</b>	<b>500</b>	<b>100</b>	<b>150</b>		<b>750</b>

## Structural Analysis II (301001)

### Teaching Scheme

Lectures: - 04 Hours/week

### Examination Scheme

Theory: - 100 Marks

### SECTION I

#### Unit I (08 hours)

a) Slope-deflection method of analysis: Slope-deflection equations, equilibrium equation of slope-deflection method, application to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid jointed rectangular portal frames using slope-deflection method (Involving not more than three unknowns)

#### Unit II (08 hours)

a) Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor, application to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns).

#### Unit III (08 hours)

a) Three hinged arches: Concepts, types of arches, analysis of parabolic with supports at same and different levels, semicircular arches. Determination of horizontal thrust, radial shear and normal thrust.

b) Two hinged arches: analysis of parabolic two hinged arches with supports at same level. Determination of horizontal thrust, radial shear and normal thrust.

### SECTION II

#### Unit IV (08 hours)

a) Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application to pin jointed plane trusses (Involving not more than three unknowns).

b) Application of flexibility method to beams and rigid jointed rectangular portal frames (Involving not more than three unknowns).

#### Unit V (08 hours)

a) Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application to trusses by member approach. Application to beams by structure approach only, (Involving not more than three unknowns).

b) Application to rigid jointed rectangular portal frames by structure approach only (Involving not more than three unknowns).

#### Unit VI (08 hours)

a) Finite Difference Method – Introduction, application to deflection problems of determinate beams by central difference method

b) Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed frames by substitute frame method, cantilever method and portal method.

### **Reference Books**

01. Intermediate Structural Analysis: C.K. Wang, McGraw Hills.
02. Basic Structural Analysis: Wilbur and Norris.
03. Structural Analysis: A Matrix Approach by Pundit and Gupta, McGraw Hills.
04. Structural Analysis by Hibbler, Pearson Education.
05. Theory of Structures by L. S. Negi and Jangid, Tata MacGraw Hill.
06. Theory of Structures Vol. I & II by B. C. Punmia, Laxmi Publication.
07. Theory of Structures Vol. I & II by Perumull & Vaidyanathan, Laxmi Publication.
08. Mechanics of Structure vol. II by Junnarkar S B
09. Matrix and Finite Element Analysis of structure by Madhujet Mukhopadhyay, Abdul Hameed Shaikh.
10. Matrix Method for structural engineering. by Gere ,Weaver.

## Infrastructure Engineering and Construction Techniques (301002)

Teaching scheme:

Lecture: 4 hours/week

Practical: 2 hours/week

Examination scheme

Theory: 100 marks

Term work: 25 marks

### SECTION I

#### Unit I

(08 hours)

##### a. Introduction

Role of Civil Engineers in Infrastructure Development, Advantages of Railways as mode of transport, Organizational structure, feasibility studies

##### Permanent Way:

definition of track, basic components, ideal requirements

##### Rails:

functions, specifications, Tilting of rails and coning of wheels

Formation: function suitability and drainage, treatment, failures and remedies, different cross sections of tracks in cutting and embankment

##### Ballast:

definition functions specifications, necessity of blanket/ sub ballast, design of ballast sections, grading and quantity of ballast

##### Sleepers:

functions, density and spacing, types such as steel, cast iron, pre stressed concrete, synthetic (fiber glass and polymer matrix composite)

##### b. Track Gauges and standards

Types of Gauges, choice, necessity of uniformity, track standards related with track structure for BG and MG, Concept of over dimensioning consignment (ODC), Track fittings and fastenings

#### Unit II

(08 hours)

##### a. Geometric Design:

necessity, types of gradients, curves, grade compensation on curves, alignment, super elevation, equilibrium cant, equilibrium speed, max. permissible limits for cant, cant deficiency, cant excess, speed on curves, safe speed on curves using Indian Railways formula only for fully transition curves, concept of negative cant.

##### Points, Crossings and Turnouts:

Functions, components/ elements of points, types of crossings and types of turnouts.

##### b. Construction and Track maintenance:

Plate laying method, operations involved, common items of track maintenance, concepts and advantages of Modern Directed Track Maintenance (DTM), use of modern track management systems on Indian railways, track quality assessments and monitoring

##### c. Modernization in railways:

with respect to (1) types of railways, (2) traction (3) high speeds, (4) improvements in track structure: components (5) Automation (6) Safety aspects, Introduction to skybus and Metro rails.

### **Unit III**

**(08 hours)**

#### **a. Tunneling:**

Introduction about tunnels, advantages and disadvantages of tunnels compared to open cuts, Criteria for selection of size and shape of tunnels, Advantages of twin tunnels and pilot tunnels, portals and adits, construction of shaft. Factors affecting methods of tunneling.

#### **Methods of Driving tunnels in soft ground:**

General characteristics of soft ground, needle beam method and NATM method of tunneling in practice, TBM.

#### **Driving tunnels in hard ground:**

General sequence of operation and typical distribution of time for each operations, meaning of the term 'Faces of Attack', Mucking, methods of removal of muck. Methods of Ventilation, Lighting and aspects of drainage.

#### **b. Docks and Harbors:**

Introduction, Requirements of harbors and ports, classification of harbors with examples, selection of site for harbor. Definitions/ methods of Breakwater, Wet and Dry Dock, Quay, Bulkhead, Wharves, Jetty, Dolphines, Dock fenders, use of Tetrapods, Triars, Quadripads and Hexapods

## **SECTION II**

### **Unit IV**

**(08 hours)**

#### **a. Construction Techniques:**

Introduction, Role of construction activity in the national and global development, High Rise structures and their construction techniques, types, labour movements, material conveyance, erection methods using hoists and cranes, construction difficulties.

**b. Use of precast/ prefabricated elements** such as columns, beams, slabs, wall panels, door frames, production techniques, quality control for prefab elements, autoclave curing, specialty and precautions at joints, consideration such as strength, economy, making light weight, thermal, acoustic and fire insulation in construction.

### **Unit V**

**(08 hours)**

#### **a. Earth Moving Equipment**

Power Shovels, Back Hoe, Drag-line JCB-Excavator, Loaders Dozer, Scrapers, Use of Trucks, tractor and Dumpers, Work cycle. Hydraulically operated rock breakers, trenching machinery, factors affecting selection, work cycle out put estimation for operation.

#### **b. Economic, maintenance and repair of construction Equipments:**

Depreciation, equipment working rates, investment cost, repair cost, depreciation cost, cost of fuel and lubricants, cost of labour, overheads, problems based on it, preventive maintenance, record keeping, economic life, and economic replacement calculation

### **Unit VI**

**(08 hours)**

#### **a. Concreting methods**

Under water concreting - dredging techniques, use of barges, dewatering systems, pumps, concreting, concrete pumps, boom placers slip form technique, jump form technique, tunnel form work, slip form pavers.

#### **b. Miscellaneous Techniques:**

Guniting, industrial flooring, Production of crushed sand and crushed aggregates, pneumatic-drilling equipment, Use of RMC plants and jet grouting techniques

### **Term-work**

**Term work consist the following.**

- A)** Minimum Three Site Visits covering any of the above topics of the above syllabus and preparation of reports with necessary drawings, sketches and photographs.
- B)** Collection of brochures / pamphlets regarding various construction equipment.  
Information pertaining to the following aspects should be collected.
  - a. Types, different makes of equipment
  - b. Cost, useful life, area of use
  - c. Equipment performance data
- C)** Student should study repetitive Civil Engineering operation and workout cycle time and cost of production of any two equipments.
- D)** An internal seminar on any one of the topic from above syllabus.
- E)** Report on special guest lectures arranged on any topic from the above syllabus.

### **Reference Books**

- 1.** Construction Planning, Methods & Equipment: Puerifoy – Tata McGraw Hill
- 2.** Construction Equipments & its Management: S. C. Sharma, Khanna Publications.
- 3.** Railway Track Engineering: J. S. Mundrey, Tata McGraw Hill
- 4.** Harbour, Dock and Tunnel Engineering: R. Srinivasan
- 5.** Docks and Harbour Engineering: Hasmukh P. Oza and Gautam H. Oza – Charotar Book Stall

## Structural Design I (301003)

### Teaching Scheme

Lecture: 4 hrs/week

Practical: 4 hrs/week

### Examination scheme

Theory: 100 marks

Term work: 25 marks

Oral: 50 marks

Design should be based on IS, 800-2007

### SECTION I

#### Unit I

(12 hours)

a) Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), IS:4000-1992, codes for welded connections. Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender.

b) Tension member: various cross sections such as solid threaded rod, cable and angle sections. Limit strength due to yielding, rupture and block shear. Design of tension member: using single and double angle sections, connections of member with gusset plate by bolts and welds.

#### Unit II

(12 hours)

a) Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section, connections of members with gusset plate by bolts and welds. Design of axially loaded column using rolled steel section.

b) Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds. Column base under axial load: design of slab base, gusseted base. Column base for axial load and uniaxial bending.

### SECTION II

#### Unit III

(12 hours)

a) Flexural member- Laterally supported and unsupported beams using single rolled steel section with and without flange plate, strength in flexure, low and high shear, check for deflection. Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.

b) Design of eccentrically loaded column subjected to uniaxial bending (check for section strength only). Design of column base for axial load and uniaxial bending.

#### Unit IV

(12 hours)

a) Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections.

b) Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports.

## **Term work**

### **Term work consists of the following.**

- A)** Four numbers of half imperial size sheets showing structural detailing based on syllabus. (minimum 16 sketches)
- B)** Design of industrial building including roof truss, purlin, bracings, column, column base and connections.
- C)** Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and connections.

### **OR**

**C)** Design of building including primary and secondary beams, column, column base and connections.

**D)** Two site visits: Report should contain structural details with sketches.

**Four half Imperial size drawing sheet out of which one drawing sheet shall be drawn by using any drafting software.**

**Oral Examination shall be based on the above term work.**

**Note: Maximum number of students in a group not more than three to five for design.**

## **Reference Books**

1. Design of Steel Structure by N Subramanian, Oxford University Press, New Delhi.
2. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S, I K International Publishing House, New Delhi.
3. Limit state design of Steel Structure by V L Shah & Gore, Structures Publication, Pune.
4. Teaching materials of National Workshop on design of steel structure by limit state method organized for faculty of Pune University, Pune.
5. Teaching Resource Material by INSDAG.

## Fluid Mechanics-II (301004)

**Teaching scheme**  
**Lectures: 4 hours/week**  
**Practical: 2 hours/week**

**Examination scheme**  
**Theory: 100 marks**  
**Term Work: 25 marks**  
**Oral: 50 Marks**

### SECTION I

**Unit-I (08 hours)**

**a) Fluid Flow around Submerged Objects:**

Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Drag on sphere, cylinder, flat plate and aerofoil, Karman's vortex street, Effects of free surface and compressibility on drag, Development of lift, Lift on cylinder and Aerofoil, Magnus effect, Polar diagram.

**b) Unsteady Flow:**

Types of unsteady flow; Flow through openings under varying head, Fluid compressibility, Celerity of elastic pressure wave through fluid medium; Water hammer phenomenon; Rise of pressure due to water hammer-rigid water column and elastic water column theories; simple cases neglecting friction.

**UNIT-II (08 hours)**

**a) Impact of Jet:**

Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle.

**b) Centrifugal Pumps :**

General classification of pumps, Centrifugal pumps- Classification, theory working, Centrifugal head, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping, Introduction to reciprocating pump and submersible pumps. Selection of pumps.

**UNIT-III Hydraulic Turbines (08 hours)**

**a) Hydropower generation:** Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working. Cavitation in hydraulic turbines,

**b) Performance of hydraulic turbines :** Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves, Dimensional analysis as applied to hydraulic turbines, selection of turbines,

### SECTION II

**UNIT-IV (08 hours)**

**a) Introduction to open channel flow:** Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation . One dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, current meter, flow through notches weirs.

**b) Uniform flow in open channels :** Characteristics and establishment of uniform flow, uniform flow formulae : Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, hydraulic exponent, Uniform flow computations. Most efficient channel section.

## **UNIT-V**

**(08 hours)**

### **a) Depth-Energy Relationships in Open Channel Flow :**

Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth-discharge diagram. Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it. Important terms pertaining to critical flow viz. section factor, hydraulic exponent; Critical flow computations; channel transitions,

### **b) Hydraulic Jump**

Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel : Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venturiflume, standing wave flume,

## **UNIT-VI**

**(08 hours)**

### **a) Gradually Varied Flow in Open Channels**

Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section.

**b) Gradually varied flow computations:** Methods of GVF computations. Direct Step method, Graphical Integration method,. Standard Step method, direct Integration method, Ven Te Chow method.

### **Term Work**

Term work will consist of a journal giving the detailed report on experiments and assignments performed and visit report.

### **List of Experiments.**

Following experiments and assignments based on the above syllabus shall be performed.

#### **A) Experiments**

1. Flow around a Circular Cylinder/ airfoil
2. Impact of Jet on flat/curved surface.
3. Characteristics of a Pelton Wheel Turbine.
4. Characteristics of a Centrifugal Pump.
- 5 Study of Uniform Flow Formulae of Open channel.
6. Velocity Distribution in Open Channel Flow.
7. Calibration of Standing Wave Flume / Venturi / Partial flume.
8. Study of Hydraulic Jump as Energy Dissipater.

#### **B) Assignments (all compulsory):**

- (a) Study of Specific Energy Diagram/Specific Force Diagram.
- (b) Characteristics of various GVF Profiles and computer program on G V F.
- (c) Design of Pelton Wheel Turbine/Centrifugal Pump.

#### **C) Site visit to Hydropower generation plant/Research Institute.**

**Oral Examination shall be based on the above term work.**

### **Reference Books**

1. Engineering Fluid Mechanics by Garde, Mirajgaonkar, Scitech
2. Fluid Mechanics by Dr Jain A. K., Khanna Pub.
3. Open Channel Flow: K. G. Ranga Raju - Tata McGraw Hill.
4. Open Channel Flow by K Subranmanya, TMH, Third Ed.
5. Open Channel Hydraulics: Ven te Chow - Tata McGraw Hill.
6. Hydraulics and Fluid Mechanics by P. N. Modi & S. N. Seth Standard book house

## **Advanced Surveying (301005)**

### **Teaching Scheme**

**Lectures: 4 Hours /Week**

**Practical: 2 hours/Week**

### **Examination Scheme**

**Paper: 100 Marks**

**Oral : 50 Marks**

### **SECTION I**

#### **Unit-I**

**(08 hours)**

#### **Geodetic Surveying & GPS**

a) Objects, Methods of Geodetic Surveying, Introduction to Triangulation, classification of Triangulation Systems, Triangulation figures, Concept of well conditioned Triangle, selection of stations, intervisibility and height of stations.

b) Introduction to GPS, GPS systems (viz. Glonass, Galileo etc...) and their features, Segments of GPS (Space, Control and User), their importance and role in GPS, Absolute Position and Differential Position GPS, Role of Differential Position GPS in establishing controls, Factors governing accuracy in GPS positioning, Different types of errors in GPS positioning.

#### **Unit-II**

**(08 hours)**

#### **Triangulation Adjustment**

Kinds of errors, Laws of weights, Determination of most probable values (MPV) of conditioned and independent quantities, Method of Least Squares, Indirect observations, Probable error and its determination, Distribution of error to the field measurements, Normal equation, Method of correlates, station and figure adjustment of Geodetic Quadrilateral without central station, Spherical triangle, Calculations of spherical excess and sides of spherical triangle.

#### **Unit –III**

**(08 hours)**

#### **Trigonometric Levelling and Setting out works**

a) Trigonometric Levelling - Terrestrial refraction, Angular corrections for curvature and refraction, Axis Signal correction, Determination of Difference in Elevation by single observation and reciprocal observations.

b) Setting out of Construction works.

Setting out of a bridge, determination of the length of the central line and the location of piers. Setting out of a tunnel – surface setting out and transferring the alignment underground.

### **SECTION II**

#### **UNIT IV**

**(08 hours)**

#### **Aerial Photogrammetry -**

Objects, Applications, Aerial camera, comparison of map and aerial photograph, Vertical, Tilted and Oblique photographs, Scale of vertical photograph, Relief displacement in vertical photograph, Measurement of parallax, parallax bar and determining the differential equation, Mirror stereoscope and parallax equation, Flight planning, Ground control points (GCPs) and their importance in conventional and digital photogrammetry, radial line method, Introduction to digital photogrammetry, different stereo viewing techniques in digital photogrammetry, Method of creation of elevation data, Different products of digital photogrammetry.

## **Unit – V**

**(08 hours)**

### **Remote Sensing and Geographical Information System**

**a) Remote Sensing** Introduction and definition, Necessity, importance and use of remote sensing, Ideal Remote Sensing System, Electromagnetic energy and spectrum and its interaction with atmosphere and objects, Atmospheric window, Spectral signature, Platforms for RS, Difference between Aerial photograph and satellite image, image interpretation and elements of visual image interpretation such as size, shape, tone, texture, etc. Advantages and limitations of RS, Different applications of RS- (Land use and land cover mapping, Disaster management Flood & Earth Quake, and Resource Inventory management,) Digital Image processing, its objectives and different methods.

### **b) Geographical Information System**

Introduction, Definition, Objectives, Components, Coordinate systems and projections, Georeferencing, Input data, GIS data Types (Raster, vector, attribute data), introduction to data analysis, vector and raster analysis methods -- query analysis and network analysis for vector, DEM, Visibility analysis, Slope analysis, Watershed analysis for raster, limitations of GIS, Applications of GIS, management and analysis of different types of data using GIS.

## **Unit-VI**

**(08 hours)**

### **Hydrographic Surveying**

Objects, applications, Establishing controls, Shore line survey, Sounding, Sounding Equipment, Methods of locating soundings – conventional and using GPS, Reduction of soundings, Plotting of soundings, Nautical Sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL

## **Term work**

**Term work shall consist of the following practicals and project.**

### **Geodetic Surveying and Trigonometrical leveling (Any two)**

1. Measurement of horizontal and vertical angles with 1” theodolite.
2. Determination of elevation of inaccessible objects by trigonometrical leveling.
3. Establishing control station using single or dual frequency GPS receiver

### **Hydrographic Surveying (Any Two)**

1. Study and use of nautical sextant and measurement of horizontal angles
2. Plotting of river cross-section by hydrographic surveying
3. Solution to three point problem by analytical and any one graphical method

### **Aerial Photogrammetry (Any Two)**

1. Study of Aerial photograph and finding out the scale of the photograph.
2. Determination of Air Base distance using mirror stereoscope.
3. Determination of differential elevation by differential parallax

### **Remote Sensing and GIS (Any two)**

1. Study of RS images and visual interpretation
2. Classification of satellite image using image processing software
3. Study of any one GIS software
4. Study of vector and raster data products and bringing out difference between them.

### **Project: (Any one)**

1. Adjustment of Geodetic Quadrilateral without central station by approximate method and method of correlates

2. Field survey (500 sq.m.) using Differential GPS (Control as well as mapping).
3. Survey of a small property with total station and preparation of map using any post processing software.

**Oral examination based on above term work.**

#### **Reference Books**

1. Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
2. Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
3. Surveying - Vol. II and III by Dr. K. R. Arora Standard Book House
4. Elements of Photogrammetry by Paul R. Wolf, McGraw Hill Publication
5. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
6. Remote sensing in Civil Engineering by J. M. Kenzie and M. C. Matthews.
7. The GIS book, 5<sup>th</sup> Edition, George B Korte, PE onward Press
8. Advanced Surveying -Total Station, GIS and Remote Sensing by Satheesh Gopi, R.Sathikumar and N. Madhu , Pearson publication
9. Surveying Vol. 2 by S. K. Duggal, McGraw Hill Publication

## Hydrology And Water Resource Engineering (301006)

**Teaching Scheme:**  
**Lectures: 4 hrs./ week.**

**Examination Scheme:**  
**Paper: 100 Marks.**

### SECTION-I

**Unit – I** (08 hours)

**Introduction to Hydrology:**

Application of hydrology,

**Precipitation: Forms, :**

Types of precipitation, measurement, analysis of precipitation data, mass rainfall curves, intensity-duration curves, concepts of depth-area-duration analysis, frequency analysis, computation of mean rainfall

**Evaporation and Infiltration :**

Elementary concepts of evaporation and infiltration, effect of infiltration on runoff and recharge of ground water, evapotranspiration. Consumptive use factors affecting measurement and computations for evaporation, infiltration and evapo- transpiration.

**Stream Gauging:**

Selection of site, various methods and instruments of discharge measurements.

**Unit – II** (08 hours)

**Runoff:**

Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph, theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph.

**Floods:**

Estimation of peak flow, rational formula and other methods, flood frequency analysis Gumbells method, Design floods,

**Unit III** (08 hours)

**Reservoir Planning.**

Types of developments: Storage and diversion works. Purpose: Single and multi-Reservoir Planning, investigation for locating a reservoir, Selection of site, estimation of required storage, mass curves, reservoir sedimentation, flood routing, height of dam, reservoir operation, economics of reservoir planning, Benefit-Cost ratio, application of optimization techniques, system approach.

**Unit – IV** (08 hours)

**Water Requirements of Crops:**

Soil classification, soil moisture and crop water Relationship, factors governing consumptive use of water, principal Indian crops, Their season and water requirement, crop planning agricultural practices, calculations of canal and reservoir capacities – duty, delta, irrigation efficiency, water quality for irrigation.

**Introduction to Irrigation:**

Definition, functions, advantages and necessity, methods of irrigation, surface irrigation, subsurface irrigation, micro irrigation.

**Assessment of Canal Revenue**

Various methods.

**Unit – V****(08 hours)****Ground Water Hydrology:**

Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy, s law, permeability, safe yield of basin. Hydraulics of wells under steady flow condition in confined and unconfined aquifers, specific capacity of well, well irrigation: tube wells, open wells, their design and construction.

**Unit VI****(08 hours)****Lift Irrigation Schemes:**

Various components and their design principles, lifting devices

**Water Management:**

Distribution, warabandi, rotational water supply system,

**Water Logging and Drainage:**

Causes of water logging, Preventive and Curative measures, drainage of irrigated lands, reclamation of water logged, alkaline and saline lands.

**Reference Book**

1. Irrigation Engineering - S. K. Garg.
2. Irrigation, Water Resources and water power engineering- Dr. P. N. Modi Publ Standard book house.
3. Irrigation and water power Engineering.- Dr. Punmia and Dr . Pande, Standard Publisher
4. Irrigation Engineering Bharat Singh
5. Engineering hydrology – Subramanyam Tata McGraw Hill.
6. Hydrology & water resoures – R.K. Sharma Dhanpatrai & sons
7. Theory & design of irrigation structures Vol.I, II, IIIVarshney Gupta and Gupta Nemchand and brothers publication
8. Water Management – Jasapal Singh, M.S.Achrya, Arun Sharma – Himanshu Publication.

## Project Management & Economics (301007)

### Teaching Scheme

Lectures 4 hours/week

Practicals- 2hours/week

### Examination Scheme

Theory: 100 Marks

Oral: 50 Marks

### SECTION-I

#### Unit 1

(08 Hours)

##### a) Introduction to Project management & organization.

Importance, objectives & functions of management, Categories of project, Project life cycle, importance of organization, Principles of organization, Authority, Delegation of authority  
Types of Project Organization- Line, Functional, Line & Staff, Matrix Structure, Project Structure

##### b) Project Planning & Scheduling.

Gantt chart & its limitations, Network Planning, Network Analysis- C. P. M. Activity on Arrow (AOA), Critical path & type of floats, Activity on Nodes-Precedence network analysis,  
P. E. R. T.

#### Unit 2

(08 Hours)

Project Time Control, Project cost Control, Crashing, Resource Allocation & leveling, Updating, Monitoring & Control,

#### Unit 3 Materials Management.

(08 hours)

Objectives of Materials management and balancing with emphasis on supply management and cost reduction, material requirement, scheduling monitoring, receipts, storage, Inspection, inventory control- ABC analysis, EOQ, Break-even analysis.

### SECTION II

#### Unit 4 Site layout and Safety Engineering.

(08 Hours)

Site layout-factors for site layout selection, Site layout for various Civil engineering projects. Safety Engineering Causes of accidents on various sites, Safety measures and safety policies to be adopted, Determination of safety parameters, Personal protective equipment.

#### Unit 5 Project Economics.

(08 Hours)

Introduction to project economics, Definition, principles, Importance in construction Industry, Difference between Cost, Value, Price and its relevance to Marketing utility, Law of Diminishing Marginal Utility.

Demand, demand schedule, law of demand, demand curve, elasticity of demand, supply, supply schedule, supply curve, elasticity of supply, law of substitution, Equilibrium, Equilibrium price, Equilibrium amount, factors affecting price determination.

#### Unit 6 Project Appraisal.

(08 Hours)

Technical Appraisal -General, brief discussion relevant to particular project. Financial appraisal- Definition of Money, Rent, simple and compound interest, profit, Annuities, Capital, Types of Capital, Working and fixed Capital.

Cost composition, benefits, interest rates, discount rate, time value of money, parameters and criteria for project selection, benefit - cost analysis-B/C ratio, NPV, IRR, Pay-back period.

**Term Work:-**

1. To draw C.P.M network for a small Civil engineering Project having about 25 activities. Determination of Critical path and calculation of floats for the project.
2. Assignment based on Crashing.
3. Assignment on Resource Leveling/Updating.
4. Assignment based on ABC analysis.
5. Assignment using computer software for Project Planning and Scheduling
6. Assignment based on Project selection criteria.(Benefit Cost Analysis)
7. Visit to any 2 construction sites and preparing Site layout plan and safety plan for the 2 construction sites visited.

**Oral Examination shall be based on the above term work.**

**Reference Books**

1. Construction Engineering and Management by S. Seetharaman, Umesh Publications, New Delhi.
2. Total Project Management – The Indian Context by P. K. Joy Macmillan India Ltd.
3. PERT and CPM Principles and Applications by L. S. Srinath, Affiliated East West Press Pvt. Ltd. New Delhi.
4. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
5. Construction Management and Planning by B. Sengupta and H Guha, Tata McGraw Hill Publishing Company, New Delhi.
6. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
7. Financial Management by Prasanna Chandra, Tata McGraw – Hill Publication.
8. Engineering Economics, James Riggs, David Bedworth, Sabah Randhawa, McGraw Hill
9. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.

## Structural Design II (301008)

### Teaching scheme

Lectures: 4 hours/week

Practical: 4 hours/week

### Examination scheme

Theory: 100 Marks

Term work: 25 Marks

Oral: 50 Marks

Design should be based on IS: 456- 2000

### SECTION I

#### Unit I

(12 hours)

a) Introduction to various design philosophies R.C structures: Historical development, working stress method, ultimate load method and limit state method.

**Working stress method:** Moment of resistance of singly reinforced rectangular R.C. sections, under reinforced, balanced and over reinforced sections. Moment of resistance of doubly reinforced rectangular sections.

b) **Limit state method:** Limit state of collapse, limit state of serviceability and limit state of durability. Characteristic strength, characteristic load, concept of safety - probabilistic approach, semi probabilistic approach. Partial safety factors for material strengths and loads. Study of structural properties of concrete.

Assumptions of Limit state method, strain variation diagram, stress variation diagram, design parameters for singly reinforced rectangular R.C. section, Moment of resistance of Under reinforced and balanced section, M.R. of doubly reinforced rectangular section and flanged section.

#### Unit II

(12 hours)

a) Design of slab: One way, simply supported, cantilever and continuous slabs. Two way slab: simply supported, continuous and restrained.

b) Design of staircase: Dog legged and open well.

### SECTION II

#### Unit III

(12 hours)

Design of flexural members: Simply supported, continuous, cantilever beams (singly reinforced, doubly reinforced and flanged) for flexure, shear, bond and torsion. Redistribution of moments.

#### Unit IV

(12 hours)

a) Column: Introduction, strain and stress variation diagrams, axially loaded short column with minimum eccentricity requirements. Design of short column for axial load, uni-axial, Biaxial bending using interaction curves.

b) Design of isolated column footing for axial load, uni-axial and biaxial bending.

### Term work

#### Design Assignments (Term work)

a) Design of G + 2 (residential/commercial/public) building covering all types of slabs, beams, columns, footings and staircase (two flights).

Detailing of reinforcement should be as per SP-34 & IS 13920

Full imperial drawing sheets in four numbers.

Out of which one drawing sheet shall be drawn by using any drafting software.

b) Reports of two site visits. (Building under construction)

**Oral Examination shall be based on the above term work.**

**Note: Maximum number of students for projects not more than three.**

#### **Reference Books**

1. Limit State Theory and Design: Dr. V. L. Shah and Dr. S.R. Karve - Pune Vidyarthi Gruh Publication, Pune.
2. Limit State Analysis and Design: P. Dayaratnam, Wheeler Publishing company, Delhi.
3. Comprehensive Design of R.C. Structures by Punmia, Jain and Jain – Standard Book House, New Delhi.
4. RCC Analysis and Design: Sinha, S, Chand and Co. New Delhi.
5. Reinforced Concrete Design by Varghese, PHI, New Delhi.
6. Reinforced Concrete Design by Pillai Menon, Tata Mc Graw Hill, New Delhi.
7. Design of Concrete Structure by J N Bandyopadhyay, PHI, New Delhi.

## Environmental Engineering-I (301009)

### Teaching Scheme

Lecture: 4 hrs/week

Practical: 2 hrs/week

### Examination scheme

Theory: 100 marks

Term work: 25 marks

Practical: 50 marks

### SECTION I

#### Unit I

(08 hours)

**a. Introduction to water supply scheme:** Data collection for water supply scheme, components and layout. Design period, factors affecting design period.

**b. Water intake structures:** General design considerations, types such as river intake, canal intake and reservoir intake. Conveyance of raw water: Different types of pipes used, Different valves, designing of rising main, hydraulic design of pumping station.

**c. Quantity:** Rate of water consumption for various purposes like domestic, industrial, institutional, commercial, fire demand and water system losses, factors affecting rate of demand, Population forecasting.

**d. Quality:** Physical, Chemical, Radioactivity and Bacteriological Characteristics. Standards as per IS: 10500.

#### Unit II

(08 hours)

**a. Water treatment:** Principles of water treatment processes. Introduction to different types of water treatment flow sheets.

**b. Aeration:** Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain.

**c. Sedimentation:** Plain and chemical assisted - principle, efficiency of an ideal settling basin, settling velocity, types of sedimentation tanks, design of sedimentation tank. Design of tube settlers.

**d. Coagulation and flocculation:** Theory, common coagulants, coagulant aids like bentonite clay, lime stone, silicates and polyelectrolytes, mean velocity gradient "G" and power consumption, design of flocculation chamber, Design of clariflocculator.

#### Unit III

(08 hours)

**a. Filtration:** Theory of filtration, mechanism of filtration, filter materials, types of filters- Rapid gravity filter, slow sand filter and pressure filter, multimedia and dual media filters, components, under drainage system, working and cleaning of filters, operational troubles, Design of filters.

**b. Disinfection:** Theory, factors affecting disinfection, types of disinfectants, types and methods of chlorination, break point chlorination, bleaching powder estimation.

### SECTION II

#### Unit IV

(08 hours)

**a. Water softening methods:** lime-soda, zeolite and ion exchange.

**b. Demineralization:** Industrial water treatment for boilers and process water, methods like R.O., electrodialysis and ion exchange.

**c. Water treatment of swimming pools.**

**d. Adsorption:** odour and colour removal.

**e. Fluoridation and defluoridation.**

## Unit V

(08 hours)

**a. Water distribution system:** System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage of Water- Detection and Prevention.

**b. Rainwater harvesting:** Introduction to rainwater harvesting, need of rain water, methods of rainwater harvesting, components of domestic rain water harvesting system, design of roof top rainwater harvesting system.

## Unit VI

(08 hours)

**a. Noise pollution:** Sources and effects of Noise Pollution. Sound measurements – Sound pressure, Intensity, Sound pressure level, Loudness, Equivalent noise level and Cumulative noise level. Noise control techniques.

**b. Air pollution:** Classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights, plume behaviour and meteorological parameters. Air pollution control mechanism. Equipment for particulate contaminants. Principle and working of Settling chamber, Cyclone, Fabric filter, ESP. Gaseous contaminants control by adsorption and absorption technique.

## Term Work

**The term work shall consist of the following:**

### List of Practical

#### A) Determination of

1. pH and Alkalinity
2. Total hardness and its components
3. Chlorides
4. Chlorine demand and residual chlorine
5. Sodium or Potassium or Calcium using flame photometer.
6. Turbidity and optimum dose of alum.
7. Most Probable Number (MPN)
8. Fluorides or Iron
9. Ambient air quality monitoring for Suspended particulate matter, SO<sub>x</sub>, NO<sub>x</sub> and ambient noise levels.

#### B) Site visit to water treatment plant.

C) Study of Software or programming for analysis of water distribution system or programming for design of water treatment units.

**Practical examination will be based on above exercises.**

### Reference Books

1. Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2. Water Supply and Treatment Manual: Govt. of India Publication.
3. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
4. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.
5. Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
6. Environmental Engineering: M. R. Gidde and R. K. Lad, Nirali Prakashan.

7. Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
8. Rain Water Harvesting: Making water every body's business by CSE (Centre for Science and Environment) [www.cse.org](http://www.cse.org)
9. Harvesting Faith: Linda K. Hubalek. Published by Butterfield books.
10. Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.

## Foundation Engineering (301010)

Teaching Scheme

Lectures: 4hours/week

Examination Scheme

Theory:100 marks

### SECTION I

#### Unit-I

##### **Subsurface Investigations for Foundations.**

**(08 hours)**

Purpose and planning of subsurface exploration. Methods of Investigation: Trial pits, borings and methods of boring depth & number of exploration holes, RQD. Geophysical methods – Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field testing-SPT, DCPT, SPCT and its correlation with soil properties. Pressure meter test, Final report of investigation with recommendation analysis.

#### Unit-II

##### **Bearing capacity.**

**(08 hours)**

Basic definitions, Modes of shear failure . Bearing capacity analysis- Terghazi's Henson's, Meyerhof's and Skempton equations - Rectangular and Circular Footings. Estimation of bearing capacity using plate load test, SPT, DCPT and SPCT. Presumptive bearing capacity, Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Plate load test and its limitations, Housel's perimeter shear concept. Types of shallow foundation: types and applications. Floating foundation.

#### Unit-III

##### **Settlement Analysis and Consolidation settlement.**

**(08 hours)**

Elastic settlement: Causes of settlement. Pressure bulb, contact pressure, & seat of settlement, Elastic settlement, I.S. criteria- Total, Differential settlement and tolerable settlement, Effect of lowering of water table. Use of Plate load test and SPCT in settlement analysis, Allowable soil pressure. Consolidation settlement: Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation, Square root of time fitting method and logarithm of time fitting method. Time factor, Actual time and Cv relationship. Rate of settlement and its applications in shallow foundation. Normal consolidation, over consolidation and preconsolidation pressure.

### SECTION II

#### Unit-IV

##### **Deep Foundations.**

**(08 hours)**

Introduction. Pile classification, Pile installation-Cast in situ, driven and bored pile displacement and non displacement piles. Load carrying capacity of pile by static method, Dynamic methods-Engineering news formula, and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action-Feld rule, Rigid block method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition. Types and uses. Drilled piers and methods of installations. Well foundation: components, sand island method.

#### Unit V

##### **Sheet Piles and Cofferdams and Foundation on Black Cotton Soils.**

**(08 hours)**

Strutting for excavation, pressure distribution, design of cantilever sheet pile- Approximate method, Anchored sheet piles, free earth support. Cofferdams and it's types with steel sheet piles and precast concrete piles, interlocking circular piles, RC Diaphragm wall method

Foundation on Black Cotton Soils: Characteristics of black cotton soil, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles-Design principles and its construction Techniques. Stone columns, preloading technique and vibrofloating method.

#### **Unit VI**

**(08 hours)**

#### **Soil Reinforcement and Earthquake Geotechnics.**

Mechanism of reinforced soil. Factors affecting behavior and performance of reinforced soil: reinforcement, reinforcement distribution. Geosynthetics: type's, functional properties and requirements. Geosynthetic applications in Civil Engineering. Earthquake Geotechnics: Types of earthquakes. Seismic waves, Location of earthquakes, Strength of an earthquake, Strong ground motion, Factors influencing ground motion, Seismic hazards, liquefaction, Effect of liquefaction on Built Environment, Evaluation of liquefaction susceptibility, liquefaction hazard mitigation.

#### **Reference Books**

1. Soil mechanics and Foundations by B.C Punmia, Laxmi Publications
2. Soil Mechanics and Foundation Engineering- V. N. S Murthy
3. Geotechnical Engineering- C.Venkatramaiah.
4. Geotechnical Engineering by Conduto, PHI, New Delhi.
5. Geotechnical Engineering by Shahi. K.Gulati & Manoj Dutta, Tata McGraw Hill
6. Basic and applied soil mechanics by Gopal Ranjan and A.S.Rao, New Age Publications
7. A Text book of Geotechnical Engineering- Iqbal H. Khan
8. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.