

## CET-201 STRUCTURAL ANALYSIS-I

L T P/D Total  
3 2 - 5

Max. Marks: 150  
Theory: 100  
Sessional: 50  
Duration: 3 hrs.

**1. Analysis of stresses and strains:**

Analysis of simple states of stresses and strains, elastic constraints, bending stresses, theory of simple bending, flexure formula, combined stresses in beams, shear stresses, Mohr's circle, Principle stresses and strains, torsion in shafts and closed thin walled sections, stresses and strains in cylindrical shells and spheres under internal pressure.

**2. Theory of Columns:**

Slenderness ratio, end connections, short columns, Euler's critical buckling loads, eccentrically loaded short columns, cylinder columns subjected to axial and eccentric loading.

**3. Bending moment and shear force in determinate beams and frames:**

Definitions and sign conventions, axial force, shear force and bending moment diagrams.

**4. Three hinged arches:**

horizontal thrust, shear force and bending moment diagrams.

**5. Deflections in beams:**

Introduction, slope and deflections in beams by differential equations, moment area method and conjugate beam method, unit load method, principle of virtual work, Maxwell's Law of Reciprocal Deflections, Williot's Mohr diagram

**6. Analysis of statically determinate trusses:**

Introduction, various types, stability, analysis of plane trusses by method of joints and method of sections, analysis of space trusses using tension coefficient method.

**Books:**

- 1 Strength of Materials Part-I, S.Timoshenko, Affiliated East-West Press, New Delhi
- 2 Mechanics of Materials, Popov Nagarjan & Lu, Prentice Hall of India, New Delhi
- 3 Mechanics of Solids, Prasad, V. S. Gakgotia Pub., New Delhi.
- 4 Elementary Structural Analysis, Jain, A. K., Nem Chand & Bros, Roorkee.
- 5 Elementary Structural Analysis, Wibur & Nooris, McGraw Hill Book Co., Newyork.
- 6 Structural Analysis, Bhavikatti,S.S.,Vikas Pub.House,N.Delhi.

**B. Tech. III Semester (Civil)**  
**CET-203 BUILDING CONSTRUCTION, MATERIALS & DRAWING**

L T P/D Total  
4 - 2 6

Max. Marks: 150  
Theory: 100 marks  
Sessional: 50 marks  
Duration: 3 hrs.

**A. CONSTRUCTION**

**1. Masonry Construction:**

Introduction, various terms used, stone masonry-Dressing of stones, Classifications of stone masonry, safe permissible loads, Brick masonry-bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick work, Defects in brick masonry, composite stone and brick masonry, glass block masonry.

**2. Cavity and Partition Walls:**

Advantages, position of cavity, types of non-bearing partitions, constructional details and precautions, construction of masonry cavity wall.

**3. Foundation:**

Functions, types of shallow foundations, sub-surface investigations, geophysical methods, general feature of shallow foundation, foundations in water logged areas, design of masonry wall foundation, introduction to deep foundations i.e. pile and pier foundations.

**4. Damp-Proofing and Water-Proofing:**

Defects and causes of dampness, prevention of dampness, materials used, damp-proofing treatment of buildings, water proofing treatment of roofs including pitched roofs.

**5. Roofs and Floors:**

Types of roofs, various terms used, roof trusses-king post truss, queen post truss etc.

Floor structures, ground, basement and upper floors, various types of floorings.

**6. Doors and Windows:**

Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.

**7. Acoustics, Sound Insulation and Fire Protection:**

Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, wall construction and acoustical design of auditorium, fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.

**B. MATERIALS**

**1. Stones:**

Classification, requirements of good structural stone, quarrying, blasting and sorting out of stones, dressing, sawing and polishing, prevention and seasoning of stone.

**2. Brick and Tiles:**

Classification of bricks, constituents of good brick earth, harmful ingredients, manufacturing of bricks, testing of bricks.

Tiles: Terra-cotta, manufacturing of tiles and terra-cotta, types of terra-cotta, uses of terra-cotta.

### **3. Limes, Cement and Mortars:**

Classification of lime, manufacturing, artificial hydraulic lime, pozzolona, testing of lime, storage of lime, cements composition, types of cement, manufacturing of ordinary Portland cement, testing of cement, special types of cement, storage of cement.

Mortars: Definition, proportions of lime and cement mortars, mortars for masonry and plastering.

### **4. Timber:**

Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, plywood, fiberboard, masonite and its manufacturing, important Indian timbers.

### **5. Ferrous and Non-Ferrous Metals:**

Definitions, manufacturing of cast iron, manufacturing of steel from pig iron, types of steel, marketable form of steel, manufacturing of aluminium and zinc.

### **6. Paints and Varnishes:**

Basic constituents of paints, types of paints, painting of wood, constituents of varnishes, characteristics and types of varnishes.

### **7. Plastic:**

Definition, classification of plastics, composition and raw materials, manufacturing, characteristics and uses, polymerisation, classification, special varieties.

## **C. DRAWINGS**

### **1. Typical drawings of:**

- a) Cavity Wall
- b) Bonds in brick work
- c) Grillage foundation

### **2. Preparation of building drawing mentioning its salient features including the following details:**

- a) Ground floor plan
- b) Two Sectional Elevations
- c) Front and Side Elevations
- d) Plan and Sectional Elevation of stair case, doors/ windows/ ventilators, floor and roof.

### **Books:**

- 1 Building Construction, Sushil Kumar, Standard Pub., N. Delhi
- 2 Building Material, Rangawala
- 3 Construction Engineering, Y.S. Sane
- 4 Building Construction, Gurcharan Singh, Standard Pub., N. Delhi.

**B. Tech. III Semester (Civil)**  
**CET-205 FLUID MECHANICS-I**

L	T	P/D	Total
3	2	-	5

Max. Marks:	150
Theory:	100 marks
Sessional:	50 marks
Duration:	3 hrs.

**1. Introduction:**

Fluid properties, mass density, specific weight, specific volume and specific gravity, surface tension, capillarity, pressure inside a droplet and bubble due to surface tension, compressibility viscosity, Newtonian and Non-newtonian fluids, real and ideal fluids.

**2. Kinematics of Fluid Flow:**

Steady & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional. flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows, graphical and experimental methods of drawing flownets.

**3. Fluid Statics:**

Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, center of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, fluid masses subjected to uniform acceleration, free and forced vortex.

**4. Dynamic of Fluid Flow:**

Euler's equation of motion along a streamline and its integration, limitation of Bernouli's equation, Pitot tubes, venturimeter, Orificemeter, flow through orifices & mouth pieces, sharp crested weirs and notches, aeration of nappe.

**5. Boundary layer analysis:**

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, local and average friction coefficient, separation and its control.

**6. Dimensional Analysis and Hydraulic Similude:**

Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.

**Books:**

- 1 Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth
- 2 Introduction to Fluid Mechanics by Robert W.Fox & Alan T.McDonald
- 3 Fluid Mechanics Through Problems by R.J.Garde
- 4 Engineering Fluid Mechanics by R.J.Garde & A.G.Mirajgaoker

**B. Tech. III Semester (Civil)**  
**CET-207 SURVEYING-I**

L T P/D Total  
3 1 - 4

Max. Marks: 125  
Theory: 75 marks  
Sessional: 50 marks  
Duration: 3 hrs.

1. **Fundamental Principles of Surveying:**  
Definition, objects, classification, fundamental principles, methods of fixing stations.
2. **Measurement of distances:**  
Direct measurement, instruments for measuring distance, instruments for making stations, chaining of line, errors in chaining, tape corrections examples.
3. **Compass and Chain Traversing:**  
Methods of traversing, instruments for measurement of angles-prismatic and surveyor's compass, bearing of lines, local attraction, examples.
4. **Leveling:**  
Definition of terms used in leveling, types of levels and staff, temporary adjustment of levels, principles of leveling, reduction of levels, booking of staff readings, examples, contouring, characteristics of contours lines, locating contours, interpolation of contours.
5. **Theodolite and Theodolite Traversing:**  
Theodolites, temporary adjustment of theodolite, measurement of angles, repetition and reiteration method, traverse surveying with theodolite, checks in traversing, adjustment of closed traverse, examples.
6. **Plane Table Surveying:**  
Plane table, methods of plane table surveying, radiation, intersection, traversing and resection, two point and three point problems.
7. **Tacheometry:**  
Uses of tacheometry, principle of tacheometric surveying, instruments used in tacheometry, systems of tacheometric surveying-stadia system fixed hair method, determination of tacheometric constants, tangential systems, examples.
8. **Curves:**  
Classification of curves, elements of simple circular curve, location of tangent points-chain and tape methods, instrumental methods, examples of simple curves. Transition Curves-Length and types of transition curves, length of combined curve, examples. Vertical Curves: Necessity and types of vertical curves.

**Books:**

1. Surveying Vol.I by B.C.Punmia
2. Surveying Vol.I by T.P.Kanitkar

**B. Tech. III Semester (Civil)**  
**CET-209 ENGINEERING GEOLOGY**

L	T	P/D	Total
3	1	-	4

Max. Marks:	125
Theory:	75 marks
Sessional:	50 marks
Duration.:	3 hrs.

- 1. Introduction:**  
Definition, object, scope and sub division of geology, geology around us. The interior of the earth. Importance of geology in Civil Engineering projects.
- 2. Physical Geology:**  
The external and internal geological forces causing changes, weathering and erosion of the surface of the earth. Geological work of ice, water and winds. Soil profile and its importance. Earthquakes and volcanoes.
- 3. Mineralogy and Petrology:**  
Definition and mineral and rocks. Classification of important rock forming minerals, simple description based on physical properties of minerals. Rocks of earth surface, classification of rocks. Mineral composition, Textures, structure and origin of Igneous, Sedimentary and Metamorphic rocks. Aims and principles of stratigraphy. Standard geological/stratigraphical time scale with its sub division and a short description based on engineering uses of formation of India.
- 4. Structural Geology:**  
Forms and structures of rock. Bedding plane and outcrops, Dip and Strike. Elementary ideas about fold, fault, joint and unconformity and recognition on outcrops. Importance of geological structures in Civil Engineering projects.
- 5. Applied Geology:**  
Hydrogeology, water table, springs and Artesian well, aquifers, ground water in engineering projects. Artificial recharge of ground water, Elementary ideas of geological investigations. Remote sensing techniques for geological and hydrological survey and investigation. Uses of geological maps and interpretation of data, geological reports.
- 6. Suitability and stability of foundation sites and abutments:**  
Geological condition and their influence on the selection, location, type and design of dams, reservoirs, tunnels, highways, bridges etc. Landslides and Hillslope stability.
- 7. Improvement of foundation rocks:**  
Precaution and treatment against faults, joints and ground water, retaining walls and other precautions.
- 8. Geology and environment of earth.**

**Books:**

- 1 A Text Book of Geology by P.K.Mukherjee
- 2 Physical and General Geology by S.K.Garg
- 3 Engineering and General Geology by Prabin Singh
- 4 Introduction of Physical Geology by A.Holmes.

**B. Tech III Semester (Civil)**  
**CET-211 STRUCTURAL MECHANICS-I (P)**

L	T	P/D	Total
-	-	2	2

Max. Marks - 50  
Viva-Voce-25 marks  
Sessional - 25 marks  
Duration – 3 Hours

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin- jointed truss.
4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behaviour of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Uniaxial tension test for steel (plain & deformed bars)
9. Uniaxial compression test on concrete & bricks specimens.

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**B. Tech. III Semester (Civil)**  
**CET-213 FLUID MECHANICS-I(P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:50  
Sessionals:25 marks  
Viva-voce:25 marks  
Duration: 3 hours

- 1 To determine metacentric height of the ship model.
- 2 To verify the Bernoulli's theorem.
- 3 To determine coefficient of discharge for an Orificemeter.
- 4 To determine coefficient of discharge of a venturimeter.
- 5 To determine the various hydraulic coefficients of an Orifice ( $C_d, C_c, C_v$ ).
- 6 To determine coefficient of discharge for an Orifice under variable head.
- 7 To calibrate a given notch.
- 8 To determine coefficient of discharge for a mouth piece.
- 9 Drawing of a flownet by Viscous Analogy Model and Sand Box Model.
- 10 To study development of boundary layer over a flat plate.
- 11 To study velocity distribution in a rectangular open channel.
- 12 Velocity measurements by current meter, float, double float (demonstration only).
- 13 Experiment on Vortex formation (demonstration only).

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**B.Tech.III Semester(Civil)**  
**CET-215 SURVEYING-I(P)**

L	T	P/D	Total
-	-	3	3

Max.Marks:75  
Sessionals:50 marks  
Viva-voce: 25 marks  
Duration:3 hours

- 1 Chain surveying: Chaining and chain traversing.
- 2 Compass traversing.
- 3 Plane tabling: methods of plane table surveying, two point & three point problems.
- 4 Leveling: Profile leveling and plotting of longitudinal section and cross sections.y leveling. Permanent adjustment of level.  
Reciprocal leveling.  
Contouring and preparation contour map.
- 5 Use of tangent clinometer.

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**B. Tech. IV Semester (Civil)**  
**CET-202 STRUCTURAL ANALYSIS-II**

L	T	P/D	Total
3	2	-	5

Max. Marks:	125
Theory:	75 marks
Sessionals:	50 marks
Duration:	3 hours

- 1 Statically Indeterminate Structures:**  
Introduction, Static and Kinematic Indeterminacies, Castigliano's theorems, Strain energy method, Analysis of frames with one or two redundant members using Castigliano's 2<sup>nd</sup> theorem.
- 2 Slope deflection and moment Distribution Methods:**  
Analysis of continuous beams & portal frames, Portal frames with inclined members.
- 3 Column Analogy Method:**  
Elastic centre, Properties of analogous column, Applications to beam & frames.
- 4. Analysis of Two hinged Arches:**  
Parabolic and circular Arches, Bending Moment Diagram for various loadings, Temperature effects, Rib shortening, Axial thrust and Radial Shear force diagrams.
- 5. Unsymmetrical Bending**  
Introduction Centroidal principal axes of sections, Bending stresses in beam subjected to unsymmetrical bending, shear centre, shear centre for channel, Angles and Z sections.
- 6. Cable and suspension bridges:**  
Introduction, uniformly loaded cables, Temperature stresses, three hinged stiffening Girder and two hinged stiffening Girder.

**BOOKS:**

1. Statically Indeterminate Structures, C.K. Wang, McGraw Hill Book Co., New York.
2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.
4. Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

**B Tech IV semester (civil)**  
**CET-204 DESIGN OF STEEL STRUCTURES-I**

L T P/D Total  
3 - 2 5

Max. Marks: 125  
Theory: 75 Marks  
Sessional : 50 Marks  
Duration 3 Hours

1. **Introduction:**  
Properties of structural steel. I.S.Rolled sections and I.S. specification.
2. **Connections:**  
Importance, various types of connections, simple and moment resistant, riveted, bolted and welded connections.
3. **Design of Tension Members:**  
Introduction, types of tension members, net sectional areas, design of tension members, lug angles and splices.
4. **Design of Compression Members:**  
Introduction, effective length and slenderness ratio, various types of sections used for columns, built up columns, necessity, design of built up columns, laced and battened columns including the design of lacing and battens, design of eccentrically loaded compression members.
5. **Column Bases and Footings:**  
Introduction, types of column bases, design of slab base and gusseted base, design of gusseted base subjected to eccentrically loading, design of grillage foundations.
6. **Design of Beams:**  
Introduction, types of sections, general design criteria for beams, design of laterally supported and unsupported beams, design of built up beams, web buckling, web crippling and diagonal buckling.
7. **Gantry Girders:**  
Introduction, various loads, specifications, design of gantry girder.
8. **Plate Girder:**  
Introduction, elements of plate girder, design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices (brief introduction), Curtailment of flange plates, design beam to column connections: Introduction, design of framed and seat connection.

**DRAWINGS:**

1. Structural drawings of various types of welded connections (simple and eccentric)
2. Beam to column connections (framed & seat connections)
3. Column bases- slab base, gusseted base and grillage foundation.
4. Plate girder.
5. Roof truss.

**Books:**

1. Design of steel structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
2. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
3. Design of steel structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
4. Design of steel structures, S.K.Duggal, TMH Pub., New Delhi.

**B. Tech. IV Semester (Civil)**  
**CET-206 FLUID MECHANICS-II**

L	T	P/D	Total
3	2	-	5

Max. Marks:	125
Theory:	75 marks
Sessionals:	50 marks
Duration:	3 hours

- 1 Laminar Flow:**  
Navier Stoke's equation, Laminar flow between parallel plates, Couette flow, laminar flow through pipes-Hagen Poiseuille law, laminar flow around a sphere-Stokes'law.
- 2 Flow through pipes:**  
Types of flows-Reynold's experiment, shear stress on turbulent flow, boundary layer in pipes-Establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram. Darcy's weisbach equation, other energy losses in pipes, loss due to sudden expansion, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, Hardy Cross method, water hammer.
- 3 Drag and Lift:**  
Types of drag, drag on a sphere, flat plate, cylinder and airfoil, development of lift on immersed bodies like circular cylinder and airfoil.
- 5 Open Channel Flow:**  
Type of flow in open channels, geometric parameters of channel section, uniform flow, most economical section (rectangular and trapezoidal), specific energy and critical depth, momentum in open channel, specific force, critical flow in rectangular channel, applications of specific energy and discharge diagrams to channel transition, metering flumes, hydraulic jump in rectangular channel, surges in open channels, positive and negative surges, gradually varied flow equation and its integration, surface profiles.
- 6 Compressible flow:**  
Basic relationship of thermodynamics continuity, momentum and energy equations, propagation of elastic waves due to compression of fluid, Mach number and its significance, subsonic and supersonic flows, propagation of elastic wave due to disturbance in fluid mach cone, stagnation pressure.
- 7 Pumps and Turbines:**  
Reciprocating pumps, their types, work done by single and double acting pumps. Centrifugal pumps, components and parts and working, types, heads of a pump-statics and manometric heads,. Force executed by fluid jet on stationary and moving flat vanes., Turbines-classifications of turbines based on head and specific speed, component and working of Pelton wheel and Francis turbines, cavitation and setting of turbines.

**Books:**

- 1 Hydraulics & Fluid Mechanics by P.N.Modi and S.M.Seth
- 2 Flow in Open Channels by S.Subraminayam
- 3 Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold

**B. Tech. (Civil) IV Semester  
CET-208 SOIL MECHANICS**

L T P/D Total  
3 2 - 5

Max. Marks: 125  
Theory : 75 Marks  
Sessionals: 50 marks  
Duration : 3 hours

1. **Soil Formation and Composition**  
Introduction, soil and rock, Soil Mechanics and Foundation Engineering, origin of soils, weathering, soil formation, major soil deposits of India, particle size, particle shape, interparticle forces, soil structure, principal clay minerals.
2. **Basic Soil Properties**  
Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.
3. **Classification of soils**  
Purpose of classification, classification on the basis of grain size, classification on the basis of plasticity, plasticity chart, Indian Standard Classification System.
4. **Permeability of Soils**  
Introduction, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability, laboratory determination of coefficient of permeability, determination of field permeability, permeability of stratified deposits.
5. **Effective Stress Concept**  
Principle of effective stress, effective stress under hydrostatic conditions, capillary rise in soils, effective stress in the zone of capillary rise, effective stress under steady state hydro-dynamic conditions, seepage force, quick condition, critical hydraulic gradient, two dimensional flow, Laplace's equation, properties and utilities of flownet, graphical method of construction of flownets, piping, protective filter.
6. **Compaction**  
Introduction, role of moisture and compactive effect in compaction, laboratory determination of optimum moisture content, moisture density relationship, compaction in field, compaction of cohesionless soils, moderately cohesive soils and clays, field control of compaction.
7. **Vertical Stress Below Applied Loads**  
Introduction, Boussinesq's equation, vertical stress distribution diagrams, vertical stress beneath loaded areas, Newmark's influence chart, approximate stress distribution methods for loaded areas, Westergaard's analysis, contact pressure.
8. **Compressibility and Consolidation**  
Introduction, components of total settlement, consolidation process, one-dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande's graphical method of estimating pre-consolidation pressure, Terzaghi's theory of one-dimensional primary consolidation, determination of

coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation.

**9. Shear Strength**

Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests, direct shear test, unconfined compression test, triaxial compression tests, drainage conditions and strength parameters, Vane shear test, shear strength characteristics of sands, normally consolidated clays, over-consolidated clays and partially saturated soils, sensitivity and thixotropy.

**10. Earth Pressure**

Introduction, earth pressure at rest, Rankine's active & passive states of plastic equilibrium, Rankine's earth pressure theory, Coulomb's earth pressure theory, Culmann's graphical construction, Rebhann's construction.

**BOOKS RECOMMENDED**

1. Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age International(P)Ltd.Pub.N.Delhi.
2. Soil Engg. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Pub.,N.Delhi.
3. Engg.Properties of Soils by S.K.Gulati, Tata Mcgraw Hill,N.Delhi.
4. Geotechnical Engg. by P.Purshotam Raju, Tata Mcgraw Hill.
5. Principles of Geotechnical Engineering by B.M.Das,PWS KENT, Boston.

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**B. Tech IV Semester (Civil)**  
**CET-210 SURVEYING -II**

L	T	P/D	Total
3	1	-	4

Max.Marks:100  
Theory:75 marks  
Sessionals:25 marks  
Duration:3 hrs.

1. **Trigonometrical Levelling:**  
Introduction, height and distances-base of the object accessible, base of object inaccessible, geodetical observation, refraction and curvature, axis signal correction, difference in elevation between two points.
2. **Triangulation:**  
Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulation computations, introduction to E.D.M. instruments..
3. **Survey Adjustment and Treatment of Observations:**  
Definite weight of an observation, most probable values, type of error, principle of least squares, adjustment of triangulation figures by method of least squares.
4. **Astronomy:**  
Definitions of astronomical terms star at elongation, star at prime vertical star at horizon, star at culmination, celestial coordinate systems, Napier's rule of circular parts, various time systems:sidereal, apparent, solar and mean solar time, equation of time-cause, effect,determination of longitude,inter-conversion of time, determination of time, azimuth and latitude byastronomical observations.
5. **Elements of Photogrammetry:**  
Introduction:types of photographs, Terrestrial and aerial photographs aerial camera and height displacements in vertical photographs, stereoscopic vision and stereoscopies, height determination from parallax measurement, flight planning, plotting by radiline method, principle of photo interpretation and photogrammetric monitoring in Civil Engineering.
6. **Introduction of remote sensing and its systems:**  
Concept of G.I.S and G.P.S-Basic Components, data input, storage & output.

**BOOKS RECOMMENDED**

- 1 Surveying Vol.2 by B.C.Punmia
- 2 Surveying Vol.3 by B.C.Punmia
- 3 Surveying Vol2 by T.P.Kanitkar

**B. Tech IV Semester (Civil)**  
**CET-212 FLUID MECHANICS-II (P)**

L	T	P/D	Total
-	-	2	2

Max. Marks:75  
Sessionals: 50 mark  
Viva-voce: 25 marks  
Duration: 3 hrs.

- 1 To determine the coefficient of drag by Stoke's law for spherical bodies.
- 2 To study the phenomenon of cavitation in pipe flow.
- 3 To determine the critical Reynold's number for flow through commercial pipes.
- 4 To determine the coefficient of discharge for flow over a broad crested weir.
- 5 To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
- 6 To study the scouring phenomenon around a bridge pier model.
- 7 To study the scouring phenomenon for flow past a spur.
- 8 To determine the characteristics of a centrifugal pump.
- 9 To study the momentum characteristics of a given jet.
- 10 To determine head loss due to various pipe fittings.

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**B. Tech. IV Semester (Civil)**  
**CET-214 SOIL MECHANICS (P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:75  
Sessional:50 marks  
Pract./ Viva-Voce:25 marks  
Duration:3 hrs.

1. Visual Soil Classification and water content determination.
2. Determination of specific gravity of soil solids.
3. Grain size analysis-sieve analysis.
4. Liquid limit and plastic limit determination.
5. Field density by:
  - i) Sand replacement method
  - ii) Core cutter method
6. Proctor's compaction test.
7. Coefficient of permeability of soils.
8. Unconfined compressive strength test.
9. Direct shear test on granular soil sample.
10. Unconsolidated undrained (UU) triaxial shear test of fine grained soil sample.

**BOOKS**

- 1 Soil Testing for Engineers by S.Prakash, PK Jain, Nem Chand & Bros.,Roorkee.
- 2 Engineering Soil Testing by Lambi, Wiley Eastern.
- 3 Engineering Properties of Soils and their Measurement by J.P.Bowles, McGraw Hill.
- 4 Soil Engineering in Theory and Practice, Vol.II, Geotechnical Testing and Instrumentation by Alam Singh, CBS Pub.

**B. Tech. IV Semester(Civil)**  
**CET-216 SURVEYING-II(P)**

L	T	P/D	Total
-	-	2	2

Max. Marks: 75  
Sessionals: 50 marks  
Viva-voce: 25 marks  
Duration: 3 hrs.

1. **Theodilite:**  
Study of theodolite, measurement of horizontal angle, measurement of vertical angle, Permanent adjustment.
- 2 **Tacheometry:**  
Tacheometric constants, calculating horizontal distance and elevations with the help of tacheometer.
- 3 **Curves:**  
Setting of simple circular curves by off set method, off set from chord produced, off set from long chord and by deflection angle method.
- 4 **Trirangulation:**  
An exercise of triangulation including base line measurement.

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**B.Tech.IV Semester(Civil)**  
**CET-218 ENGINEERING GEOLOGY(P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:50  
Pract.:25 marks  
Sessional:25 marks  
Duration:3 hrs.

1. Study of Physical Properties of Minerals.
2. Identification of Rock forming silicate and ore minerals.
3. Recognition of rocks.
4. Use of Clinometer compass and Brunton compass for measurement dip and strike of formations.
5. Drawing of geological cross-sections and study of geological maps.
6. Study of models of geological structure and outcrops patterns of different types of rocks and land forms.

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**B. Tech. IV Semester (Mech.)**  
**CET-220 MECHANICS OF FLUIDS (P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:75  
Sessionals:50 marks  
Viva-voce:25 marks  
Duration :3 hours

1. To determine metacentric height of the ship model.
2. To verify the Bernoulli's theorem.
3. To determine coefficient of discharge for an Orificemeter.
4. To determine coefficient of discharge of a venturimeter.
5. To determine the various hydraulic coefficients of an Orifice ( $C_d, C_c, C_v$ ).
6. To determine coefficient of discharge for an Orifice under variable head.
7. To calibrate a given notch.
8. To determine coefficient of discharge for a mouth piece.
9. To determine the Darcy Weisbach Coefficient of friction for flow through commercial pipes.
10. To determine critical Reynolds' numbers for flow through commercial pipes.
11. To study development of boundary layer over a flat plate.
12. To measure the pressure distribution around a cylinder placed in the air stream and to calculate the coefficient of drag therefrom.
13. To study the momentum characteristics of a given jet.

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**B. Tech IV Semester (Mechanical)**  
**MECHANICS OF FLUIDS PRACTICAL**  
**(CET-220)**

L	T	P/D	Viva-Voce:	25 Marks
-	-	2	Sessional:	50 Marks
			Total :	75 Marks
			Time :	3 Hrs

1. To determine metacentric height of (the ship model).
2. To verify (the Bernoulli's theorem).
3. To determine coefficient of discharge for an Orificemeter.
4. To determine coefficient of discharge of a venturimeter.
5. To determine the various hydraulic coefficients of an Orifice ( $C_d, C_c, C_v$ ).
6. To determine coefficient of discharge for an Orifice under variable head.
7. To calibrate a given notch.
8. To determine coefficient of discharge for a mouth piece.
9. To determine the Darcy Weisbach Coefficient of friction for flow through commercial pipes.
10. To determine critical Reynolds' numbers for flow through commercial pipes.
11. To study development of boundary layer over a flat plate.
12. To measure the pressure distribution around a cylinder placed in the air stream and to calculate the coefficient of drag therefrom.
11. To study the momentum characteristics of a given jet.

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**B. Tech III/IV Semester  
(Common to all branches)  
MATHEMATICS-III  
(MAT-201/202)**

L	T	P		Theory :	75 Marks
3	1	-		Sessional:	50 Marks
				Total :	125 Marks
				Time :	3 Hrs

**Part-A:**

**FINITE DIFFERENCES AND DIFFERENCE EQUATIONS**

**1. Finite Differences:**

Finite differences, Difference operators, Newton's forward and backward interpolation formulae, Bessel's formula and Stirling's formula, Lagrange's interpolation formula for unequal intervals, Numerical differentiation. Numerical Integration: Newton-cote's quadrature formula (Trapezoidal rule, Simpson's 1/3 and 3/8 rule), Gaussian quadrature formula. (9L)

**2. Difference Equations:**

Formation of difference equations, solution of linear difference equations. (4L)

**Part-B:**

**NUMERICAL METHODS WITH PROGRAMMING**

**1. Numerical Solution of algebraic and transcendental Equations:**

Bisection method, Regula-Falsi method, Newton Raphson method. Secant method. (4L)

**2. Solution of Linear Simultaneous Equations:**

Gauss elimination method, Gauss-Jordan method, Crout's triangularisation method, Jacobi's iteration method, Gauss-seidal iteration method. (5L)

**3. Numerical solution of ordinary differential equations:**

Picard's method, Runge's method, Runge-Kutta method, Milne's predictor-corrector method, Adams-Bashforth method. (6L)

**Part-C**

**1. Statistical Methods:**

Method of Least Square and curve fitting, Correlation, Coefficient of Correlation, Rank correlation Regression and lines of Regression, Binomial distribution, Poisson distribution and Normal distribution with their properties and applications. (8L)

**2. Operational Research:**

Linear programming problems formulation. Solving linear programming problems using i) Graphical methods ii) Simplex method iii) Dual Simplex method. (5L)

**Note to Paper Setter:**

Set 9 questions in all, 3 from each part. Candidates have to attempt 5 questions selecting, atleast 1 question from each part.

**Books Recommended:**

- |  |   |                      |
|--|---|----------------------|
| 1. Numerical Methods for Engineers                 | : | Steven C. Chapra     |
| 2. Numerical Mathematical Analysis                 | : | James B. Scarborough |
| 3. Mathematical Analysis in Engineering            | : | Chang C. Mei         |
| 4. Statistical Theory with Engineering Application | : | A. Hald              |
| 5. Mathematical Statistics                         | : | C. E. Weatherburn    |
| 6. Operational Research                            | : | H. A. Taha           |
| 7. Higher Engineering Mathematics                  | : | B. S. Grewal         |

**B. Tech. V Semester (Civil)**  
**CET-301 STRUCTURAL ANALYSIS-III**

L	T	P/D	Total
3	2	-	5

Max.Marks:125  
Theory:75 marks  
Sessionals:50 marks  
Duration:3 hrs.

- Rolling Loads:**  
Introduction, Single concentrated load, uniformly distributed load longer than span, shorter than span, two point loads, several point loads, Max.B.M. and S.F.Absolute, Max.B.M.
- Influence lines:**  
Introduction, influence lines for three hinged and two hinged arches, load position for Max.S.F. and B.M. at a section in the span.
- Fixed Arches:**  
Expression for H and B.M. at a section, Elastic centre.
- Influence Line for statically indeterminate beams:**  
Muller-Breslau Principle, I.L. for B.M. & S.F. for continuous Beams.
- Kani's Method:**  
Analysis of continuous beams and simple frames, analysis of frames with different column lengths and end conditions of the bottom storey.
- Approximate Analysis of frames:**  
(I) for vertical loads, (ii) for lateral loads by Portal method & Cantilever method.
- Matrix Methods**  
Introduction, Stiffness Coefficients, Flexibility Coefficients, Development of flexibility & stiffness matrices for plane frame, Global axis and local axis, analysis of plane frame, pin jointed and rigid jointed.

**Books Recommended:**

- Indeterminate structures, R.L.Jindal S.Chand & Co.,N.Delhi.
- Advanced Structural Analysis-A.K.Jain, NemChand & Bros.,Roorkee.
- Structural Analysis-A Unified Approach, D.S.Prakash Rao,, University Press, Hyderabad.
- Structural Analysis-A unified classical & Matrix Approach, A.Ghali & A.M.Neville,Chapman & Hall London.
- Theory of Structures,- Vol. I&II,- S.P.Gupta & G.S.Pandit, Tata McGraw Hill, N.Delhi.

**B. Tech. V Semester (Civil)**  
**CET-303 DESIGN OF CONCRETE STRUCTURES-I**

L	T	P/D	Total
4	2	-	6

Max.Marks:150  
Theory:100 marks  
Sessional:50 marks  
Duration:4 hrs.

1. **Elementary treatment of concrete technology:**  
Physical requirements of cement, aggregate , admixture and reinforcement, Strength and durability, shrinkage and creep. Design of concrete mixes, Acceptability criterion, I.S.Specifications,
2. **Design Philosophies in Reinforced Concrete:**  
Working stress and limit state methods, Limit state v/s working stress method, Building code, Normal distribution curve, characteristic strength and characteristics loads, design values, Partial safety factors and factored loads, stress -strain relationship for concrete and steel.
3. **Working Stress Method:**  
Basic assumptions, permissible stresses in concrete and steel, design of singly and doubly reinforced rectangular and flanged beams in flexure, steel beam theory, inverted flanged beams, design examples.
4. **Limit State Method:**  
Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement, design examples.
5. **Analysis and Design of Sections in shear bond and torsion:**  
Diagonal tension, shear reinforcement, development length, Anchorage and flexural bond, Torsional, stiffness, equivalent shear, Torsional reinforcement, Design examples.
6. **Concrete Reinforcement and Detailing:**  
Requirements of good detailing cover to reinforcement, spacing of reinforcement, reinforcement splicing, Anchoring reinforcing bars in flexure and shear, curtailment of reinforcement.
7. **Serviceability Limit State:**  
Control of deflection, cracking, slenderness and vibrations, deflection and moment relationship for limiting values of span to depth, limit state of crack width, Design examples.
8. **One way and Two Ways Slabs:**  
General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, openings in slabs, Design examples.
9. **Columns and Footings:**  
Effective length, Minimum eccentricity, short columns under axial compression, Uniaxial and biaxial bending, slender columns, Isolated and wall footings, Design examples.
10. **Retaining Walls:**  
Classification, Forces on retaining walls, design criteria, stability requirements, Proportioning of cantilever retaining walls, counterfort retaining walls, criteria for design of counteforts, design examples.

**Books:**

1. Design of Reinforced Concrete Structures, P. Dayaratnam, Oxford & IBH Pub., N. Delhi.
2. Reinforced Concrete-Limit State Design, A.K. Jain, Nem Chand & Bros., Roorkee.
3. Reinforced Concrete, I.C. Syal & A.K. Goel, A.H. Wheeler & Co. Delhi.
4. Reinforced Concrete Design, S.N. Sinha, TMH Pub., N. Delhi.
5. SP-16(S&T)-1980, 'Design Aids for Reinforced Concrete to IS:456, BIS, N. Delhi.
6. SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing', BIS, N. Delhi.

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**B. Tech. V Semester (Civil)**  
**CET- 305 HYDROLOGY**

L T P/D Total  
3 2 - 5

Max Marks: 125  
Theory: 75 Marks  
Sessional: 50 Marks  
Duration: 3 hrs.

1. **Introduction:**  
Hydrologic cycle, scope and application of hydrology to engineering problems, drainage basins and its characteristics, stream geometry, hypsometric curves.
2. **Precipitation:**  
Forms and types of precipitation, characteristics of precipitation in India, measurement of precipitation, recording and non recording raingages, raingage station, raingage network, estimation of missing data, presentation of rainfall data, mean precipitation, depth -area -duration relationship, frequency of point rainfall, intensity -duration- frequency curves, probable max. precipitation.
3. **Evaporation & Transpiration:**  
Process, evaporimeters and empirical relationships, analytical method, reservoir evaporation and methods of its control, transpiration, evapotranspiration and its measurement, Penman's equation and potential evapotranspiration.
4. **Infiltration:**  
Infiltration process, initial loss, infiltration capacity and measurement of infiltration, infiltration indices.
5. **Runoff:**  
Factor affecting run-off, estimation of runoff, rainfall-run off relationships, measurement of stage staff gauge, wire gauge, automatic stage recorder and stage hydrograph, measurement of velocity-current meters, floats, area velocity method, moving boat and slope area method, electromagnetic, ultrasonic and dilution methods of stream flow measurement, stage discharge relationship.
6. **Hydrograph:**  
Discharge hydrograph, components and factors affecting shape of hydrograph, effective rainfall, unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH, triangular UH, Snyder's synthetic UH, floods, rational methods, empirical formulae, UH method, flood frequency methods, Gumbel's method, graphical method, design flood.
7. **Ground Water:**  
Occurrence, types of aquifers, compressibility of aquifers, water table and its effects on fluctuations, wells and springs, movement of ground water, Darcy's law, permeability and its determination, porosity, specific yield and specific retention, storage coefficient, transmissibility.
8. **Well Hydraulics:**  
Steady state flow to wells in unconfined and confined aquifers.

**Books:**

- 1 Engineering Hydrology by K.Subramanya.
- 2 Hydrology by H.M.Raghunath.
- 3 Hydrology for Engineers by Linsely, Kohler, Paulhus.
- 4 Elementary Hydrology by V.P.Singh.

**B. Tech. V Semester (Civil)**  
**CET-307 GEOTECHNOLOGY-I**

L	T	P/D	Total
3	2	-	5

Max.Marks: 125  
Theory: 75 marks  
Sessionals: 50 marks  
Duration: 3 hrs

**1 Sub-Surface Exploration**

Purpose, stages in soil exploration, depth and lateral extent of exploration, guidelines for various types of structures, ground water observations, excavation and boring methods, soil sampling and disturbance, major types of samplers, sounding methods-SCPT, DCPT, SPT and interpretation, geophysical methods, pressure-meter test, exploration logs.

**2 Drainage & Dewatering**

Introduction, ditches and sumps, well point systems, shallow well system, deep well drainage, vacuum method, Electro-osmosis, consolidation by sand piles.

**3 Shallow Foundations-I**

Design criteria for structural safety of foundation( i ) location of footing,(ii) shear failure criterion, (iii) settlement criterion, ultimate bearing capacity, modes of shear failure, Rankine's analysis Tergazi's theory, Skempton's formula, effect of fluctuation of G.W.T. , effect of eccentricity on bearing capacity, inclined load, I.S Code recommendations, factors affecting bearing capacity, methods of improving bearing capacity.

**4 Shallow Foundations-II**

Various causes of settlement of foundation, allowable bearing pressure based on settlement, settlement calculation, elastic and consolidation settlement, allowable settlement according to I.S.Code. Plate load test and its interpretation, bearing capacity from penetration tests, design bearing capacity.

**5 Shallow Foundations-III**

Situation suitable for the shallow foundations, types of shallow foundations and their relative merits, depth of foundation, footing on slopes, uplift of footings, conventional procedure of proportioning of footings, combined footings, raft foundations, bearing capacity of raft in sands and clays, various methods of designing rafts, floating foundations.

**6 Pile Foundations-I**

Introduction, necessity of pile foundations, classification of piles, load capacity, static analysis, analysis of pile capacity in sands and clays, dynamic analysis, pile load tests, negative skin friction, batter piles, lateral load capacity, uplift capacity of single pile, under-reamed pile.

**7 Pile Foundations-II**

Group action in piles, pile spacing, pile group capacity, stress on lower strata, settlement analysis, design of pile caps, negative skin friction of pile group, uplift resistance of pile group, lateral resistance, batter pile group.

**8 Drilled Piers and Caisson Foundations**

Drilled piers-types, uses, bearing capacity, settlement, construction procedure. Caissons-Types, bearing capacity and settlement, construction procedure.

well foundations-shapes, depth of well foundations, components, factors affecting well foundation design lateral stability, construction procedure, sinking of wells, rectification of tilts and shifts, recommended values of tilts & shifts as per I.S.3955.

### **Books Recommended**

- 1 Basic And Applied Soil Mechanics by Gopal Ranjan & ASR Rao. New Age Int.(P)Ltd..
- 2 Analysis and Design of Sub-Structures by Swamisaran, IBH & Oxford.
- 3 Principles of Foundation Engineering By B.M.das, PWS Kent, Boston.
- 4 Foundation Analysis & Design by J.E.Bowles, McGraw Hills.
- 5 Design Aids in Soil Mechanics & Foundation Engineering by S.R.Kaniraj, McGraw Hills.
- 6 Foundation Design by Teng, Prentice Hall, India.

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**B. Tech. V Semester (Civil)**  
**CET-309 PROJECT PLANNING & MANAGEMENT**

L	T	P/D	Total	Max.Marks:100
3	1	-	4	Theory: 75 marks
				Sessionals: 25 marks
				Duration: 3 hrs.

- 1 Construction Management**  
Significance, objectives and functions of construction management, types of constructions, resources for construction industry, stages for construction, construction team, engineering drawings.
- 2 Construction Contracts & Specifications**  
Introduction, types of contracts, contract document, specifications, important conditions of contract, arbitration.
- 3 Construction Planning**  
Introduction, work breakdown structure, stages in planning-pre-tender stages, contract stage, scheduling, scheduling by bar charts, preparation of material, equipment, labour and finance schedule, limitation of bar charts, milestone charts.
- 4 Construction Organization**  
Principles of Organization, communication, leadership and human relations, types of Organizations, Organization for construction firm, site organization, temporary services, job layout.
- 5 Network Techniques in Construction Management-I:CPM**  
Introduction, network techniques, work break down, classification of activities, rules for developing networks, network development-logic of network, allocation of time to various activities, Fulkerson's rule for numbering events, network analysis , determination of project schedules, critical path, ladder construction, float in activities, shared float, updating, resources allocation, resources smoothing and resources leveling.
- 6 Network Techniques in Construction Management-II:PERT**  
Probability concept in network, optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance, standard deviation, slack critical path, probability of achieving completion time, central limit theorem.
- 7 Cost-Time Analysis**  
Cost versus time, direct cost, indirect cost, total project cost and optimum duration, contracting the network for cost optimisation, steps in time cost optimisation, illustrative examples.
- 8 Inspection & Quality Control**  
Introduction, principles of inspection, enforcement of specifications, stages in inspection and quality control, testing of structures, statistical analysis.

**Books Recommended**

- 1 Construction Planning & Management by P.S.Gehlot & B.M.Dhir, Wiley Eastern Ltd.
- 2 PERT & CPM -Principles & Applications by L.S.Srinath. Affiliated East-west Press(P)Ltd.
- 3 Project Planning & Control with PERT & CPM by B.C.Punmia & K.K.Khandelwal,Lakshmi Pub. Delhi
- 4 Construction Management & Planning by B.sengupta & H.Guha, Tata McGraw Hills.

**B. Tech V Semester (Civil)**  
**CET-311 STRUCTURAL MECHANICS -II( P )**

L	T	P/D	Total
-	-	2	2

Max. Marks-50  
Viva-Voce-25  
Sessional- 25  
Duration: 3 hrs.

1. Experiment on a two hinged arch for horizontal thrust & influence line for Horizontal thrust
2. Experimental and analytical study of a 3 bar pin jointed Truss.
3. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
4. Begg's deformeter- verification of Muller Breslau principle.
5. Experimental and analytical study of an elastically coupled beam.
6. Sway in portal frames - demonstration
7. To study the cable geometry and statics for different loading conditions.
8. To plot stress-strain curves for concrete.

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**B. Tech. V Semester (Civil)**  
**CET-313 CONCRETE LAB(P)**

L	T	P/D	Total
-	-	2	2

Max. Marks: 50  
Sessionals: 25 marks  
Viva-voce: 25 marks  
Duration : 3 hrs.

**Tests on Cement**

- 1 Standard consistency of cement using Vicat's apparatus.
- 2 Fineness of cement by Sieve analysis and Blaine's air permeability method.
- 3 Soundness of cement by Le-Chatelier's apparatus.
- 4 Setting time of cement, initial and final.
- 5 Compressive strength of cement.
- 6 Measurement of specific gravity of cement.
- 7 Measurement of Heat of Hydration of cement.

**Tests on Aggregate**

- 1 Moisture content and bulking of fine aggregate.
- 2 Fineness modulus of coarse and fine aggregates.

**Tests on Concrete**

- 1 Workability of cement concrete by (a) Slump test, (b) Compaction factor test, (c) Flow table test,.
- 2 Compressive strength of concrete by (a) Cube test, (b) Cylinder test
- 3 Indirect tensile strength of concrete-split cylinder test.
- 4 Modules of rupture of concrete by flexure test
- 5 Bond strength between steel bar and concrete by pull-out test
- 6 Non-destructive testing of concrete

**Books Recommended:**

- 1 Concrete Manual-M.L.Gambhir, Dhanpat Rai & Sons, N.Delhi.
- 2 Concrete Technology-M.L.Gambhir, Tata McGeraw Hill, N.Delhi..

**B. Tech. V Semester (Civil)**  
**CET-315 GEOTECHNOLOGY (P)**

L	T	P/D	Total
-	-	2	2

Max.Marks: 50  
Pract/Viva-Voce: 25 marks  
Sessional: 25 marks  
Duration: 3 hrs.

1. Grain Size Analysis-Hydrometer method.
2. Shrinkage Limit Determination.
3. Relative Density of Granular Soils.
4. Consolidated Drained (CD) Triaxial Test.
5. Consolidated Undrained (CU) Triaxial Test with Pore Water Pressure Measurement.
6. Consolidation Test.
7. Undisturbed Sampling.
8. Standard Penetration Test.
9. Dynamic Cone Penetration Test.
10. Model Plate Load Test.

**Books:**

- a. Soil Testing for Engineers by S.Prakash & P.K.Jain, Nem Chand & Bros., Roorkee.
- b. Engineering Soil Testing by Lambi, Wiley-Eastern.
- c. Engineering Properties of Soils & Their Measurement by JE Bowles, McGraw Hill.
- d. Soil Engineering in Theory & Practice by Alam Singh, Vol.II, Geotechnical Testing & Instrumentation, CBS Pub.

**B. Tech. VI Semester (Civil)**  
**CET-302 DESIGN OF STEEL STRUCTURES-II**

L T P/D Total  
3 - 2 5

Max.Marks: 150  
Theory:100 marks  
Sessional: 50 marks  
Duration: 3 hrs,

1. **Elementary Plastic Analysis and Design:**  
Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, analysis, plastic analysis applied to steel beams and simple portal frames and design.
2. **Industrial Buildings:**  
Loads, general arrangement and stability, design considerations, design of purlins, design of roof trusses, industrial building frames, bracings and stepped columns.
3. **Design of Water Tanks:**  
Introduction, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.
4. **Design of Steel Stacks:**  
Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.
5. **Towers:**  
Transmission line towers, microwave towers, Design loads, classification, design procedure and specification.
6. **Cold Formed Sections:**  
Introduction and brief description of various type of cold formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, design of compression and bending elements.

**Books:**

- a. Design of Steel Structures, A.S.Arya & J.L.Ajmani, Nem Chand & Bros., Roorkee.
- b. Design of Steel Structures, P.Dayartnam, Wheeler Pub. Allahabad.
- c. Design of Steel Structures, Gaylord & Gaylord, McGraw Hill, Newyork/International Students Edn., Toyo Kogakusha, Tokyo.
- d. IS:800-1984, Indian Standard Code of Practice for General Construction in Steel.
- e. IS-801-1975, Indian Standard Code of Practice for Use of Cold formed light gauge steel structural members in general building construction.

**B. Tech. VI Semester (Civil)**  
**CET-304 IRRIGATION ENGINEERING-I**

L T P/D Total  
3 2 - 5

Max.Marks:150  
Theory: 100 marks  
Sessionals: 50 marks  
Duration: 3 hrs.

- 1 **Introduction:**  
Irrigation-necessity, advantages, disadvantages, impact of irrigation on human environment , need and development of irrigation in India, crops and crop seasons, ideal cropping pattern and high yielding varieties of crops.
- 2 **Soil-water relationship and irrigation methods:**  
Soil-water relationship, root zone soil water, infiltration, consumptive use, field capacity, wilting point, available moisture in soil, GCA, CCA, intensity of irrigation, delta, base period, Kor depth, core period, frequency of irrigation, duty of water, relation between delta, duty and base period, irrigation requirement, flooding methods, border strip method, check basin and furrow method, assessment of irrigation water, sprinkler irrigation, favourable conditions, sprinkler systems, hydraulics of sprinkler irrigation, planning, design and maintenance of sprinkler systems, drip irrigation-components parts, advantages and limitations, suitability of drip irrigation.
- 3 **Canal irrigation:**  
Component of canal distribution system, alignment of channels, losses in irrigation channels, design discharge, silt theories and design of alluvial channels, comparison of Kennedy's and Lacey's theories, canal section and design procedure, Garretts and Lacey's diagrams.
- 4 **Water logging and land reclamation:**  
Water logging-effects, causes and measures of prevention, lining of irrigation channels, type of lining, design of lined channel land drainage, open drains, design considerations, advantages of tile drains, depth of tiledrains, layout of closed drains, discharge and spacing of closed drains, diameter of tile drain, outlets for tile drains, maintenance of tile drains, purpose of land reclamation and methods of land reclamation.
- 5 **River Training:**  
Classification of rivers, river training and its objectives, classification of river training works, methods of river training, marginal embankments, guidebanks, spurs, cutoffs, bank pitching and launching apron.
- 6 **Canal outlets:**  
Classification, requirements of a good outlet, design of pipe, APM and open flume outlet, flexibility proportionality, setting and sensitivity of outlet.

**Books:**

- 1 Irrigation, Water Resources and Water Power Engg. by P.N.Modi.
- 2 Fundamentals on Irrigation Engg. by Bharat Singh.
- 3 Irrigation Engg & Hydraulic Structures by S.K.Garg.
- 4 Irrigation Engg. by S.K.Sharma.
- 5 Irrigation-Theory & Practice by A.M. Michael.

**B. Tech. VI Semester (Civil)**  
**CET-306 WATER RESOURCES & SYSTEMS ENGINEERING**

L	T	P/D	Total
3	2	-	5

Max.Marks:150  
Theory: 100 marks  
Sessional: 50 marks  
Duration: 3 hrs.

**1 Water Resources Planning:**

Role of water in national development, assessment of water resources, planning process, environmental consideration in planning, system analysis in water planning, some common problems in project planning, functional requirements in multipurpose projects, multipurpose planning, basinwise planning, long term planning.

Reservoir planning-dependable yield, sedimentation in reservoir, reservoir capacity, empirical-area reduction method.

**6. Economic and Financial Analysis:**

Meaning and nature of economic theory, micro and macro economics, the concept of equilibrium, equivalence of kind, equivalence of time and value, cost benefit, discounting factors and techniques, conditions for project optimality, cost benefit analysis, cost allocation, separable and non-separable cost, alternate justifiable and remaining benefit methods, profitability analysis.

**7. Water Resources Systems Engineering:**

Concept of system's engineering, optimal policy analysis, simulation and simulation modeling, nature of water resources system, analog simulation, limitations of simulation, objective function, production function, optimality condition, linear, non-linear and dynamic programming, applications to real time operations of existing system, hydrologic modeling and applications of basic concepts.

**4. Applications of System Approach in Water Resources:**

Applications of system engineering in practical problems like hydrology, irrigation and drainage engineering, distribution network, mathematical models for forecasting and other water resources related problems.

**Books:**

- 1 Water Resources Engineering by Linseley and Franzini
- 2 Economics of Water Resources Engineering by James and Lee.
- 3 Optimisation Theory and Applications by S.S.Roy
- 4 Water Resources Systems Planning & Economics by R.S.Varshney.
- 5 Operational Research-An Introduction by Hamdy A.Taha.

**B. Tech. VI Semester (Civil)**  
**CET-308 GEOTECHNOLOGY-II**

L	T	P/D	Total
3	2	-	5

Max.Marks:150  
Theory: 100 marks  
Sessionals: 50 marks  
Duration: 3 hrs.

- 1 Earth Dams:**  
Introduction, types of sections, earth dam foundations, causes of failure and criteria for safe design, control of seepage through the embankment, control of seepage through the foundation, drainage of foundations, criterion for filter design. Introduction to rock fill dams.
- 2 Stability of slopes:**  
Causes of failure, factors of safety, stability analysis of slopes-total stress analysis, effective stress analysis, stability of infinite slopes types of failures of finite slopes, analysis of finite slopes-mass procedure, method of slices, effect of pore pressure, Fellenius method to locate center of most critical slip circle, friction circle method, Taylor's stability number, slope stability of earth dam during steady seepage, during sudden draw down and during and at the end of construction.
- 3 Braced Cuts:**  
Depth of unsupported vertical cut, sheeting and bracing for deep excavation, movements associated with sheeting and bracing, modes of failure of braced cuts, pressure distribution behind sheeting.
- 4 Cofferdams:**  
Introduction, types of cofferdams, design and lateral stability of braced cofferdams, design data for Cellular cofferdams, stability analysis of cellular cofferdams on soil and rock, inter-lock stresses.
- 5 Cantilever Sheet Piles:**  
Purpose of sheet piles, cantilever sheet piles, depth of embedment in granular soils-rigorous method, simplified procedure, cantilever sheet pile, penetrating clay, limiting height of wall.
- 6 Anchored Bulkheads:**  
Methods of design, free earth support method in cohesionless and cohesive soils, fixed earth support method in cohesionless soils-Blum's equivalent beam method.
- 7 Soil Stabilization:**  
Soil improvement, shallow compaction, mechanical treatment, use of admixtures, lime stabilization, cement stabilization, lime fly ash stabilization, dynamic compaction and consolidation, Bituminous stabilization, chemical stabilization, pre-compression, lime pile and column, stone column, grouting, reinforced earth.
- 8 Basics of Machine Foundations:**  
Terminology, characteristics elements of a vibratory systems, analysis of vibratory motions of a single degree freedom system-undamped free vibrations, undamped forced vibrations, criteria for satisfactory action of a machine foundation, degrees of a freedom of a block foundation, Barken's soil spring constant, Barken's method of a determining natural frequency of a block foundation subjected to vertical oscillations.

**Books Recommended:**

- 1 Analysis and Design of Foundation and Retaining Structures by S.Prakash, Gopal Ranjan & S.Saran, Sarita Prakashan.
- 2 Analysis and Design of Sub Structures by Swami Saran, IBH Oxford
- 3 Basic and Applied Soil Mechanics by Gopal Ranjan and ASR Rao, Newage Int.Pub.
- 4 Soil Dynamic by Shamsher Prakash, McGraw Hill
- 5 Foundation Design by Teng, Prentice Hall
- 6 Soil Mechanics & Foundation Engineering by Bharat Singh, Shamsher Prakash, Nem Chand & Bros, Roorkee.

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**B. Tech. VI Semester (Civil)**  
**CET-310 TRANSPORTATION ENGINEERING -I**

L T P/D Total  
3 1 - 4

Max.Marks:100  
Theory:75 marks  
Sessional: 25 marks  
Duration: 3 hrs.

1. **Introduction:**  
Transportation and its importance. Different modes of transportation. Brief review of history of road development in India and abroad: Roman, Tresagne, Telford and Macadam constructions. Road patterns. Classification of roads, Objectives of highway planning, Planning surveys. Saturation system of planning.
2. **Highway Plans, Highway Alignment And Surveys:**  
Main features of 20 years road development plans in India. Requirements of an ideal highway alignment. Factors affecting alignment. Surveys for highway alignment.
3. **Cross Section Elements And Sight Distance Considerations:**  
Cross section elements: friction, carriageway formation width, land width, camber, IRC recommended values. Types of terrain Design speed. Sight distance, stopping sight distance, overtaking sight distance, overtaking zones, intermediate sight distance, sight distance at intersections, head light sight distance, set back distance. Critical locations for sight distance.
4. **Design Of Horizontal And Vertical Alignment:**  
Effects of centrifugal force. Design of superelevation. Providing superelevation in the field. Radius of circular curves. Extra-widening. Type and length of transition curves. Gradient, types, values. Summit curves and valley curves, their design criterion. Grade compensation on curves.
5. **Traffic Characteristics And Traffic Surveys:**  
Road user and vehicular characteristics. Traffic studies such as volume, speed and O & D study. Parking and accident studies. Fundamental diagram of traffic flow. Level of service. PCU. Capacity for non-urban roads. Causes and preventive measures for road accidents.
6. **Traffic Control Devices:**  
Traffic control devices: signs, signals, markings and islands. Types of signs. Types of signals. Design of an isolated fixed time signal by IRC method. Intersections at grade and grade separated intersections. Design of a rotary. Types of grade separated intersections.
7. **Highway Materials:Soil And Aggregates:**  
Subgrade soil evaluation: CBR test, plate bearing test. Desirable properties of aggregates. Various tests, testing procedures and IRC/IS specification for suitability of aggregates. Proportioning of aggregates for road construction by trial and error and Routhfuch method.
8. **Bituminous Materials And Bituminous Mixes:**  
Types of bituminous materials: bitumen, tar, cutback and emulsions. Various tests, testing procedures and IRS/IS specifications for suitability of bituminous materials in road construction. Bituminous mix, desirable properties. Marshall' method of mix design. Basic concept of use of polymers and rubber modified bitumen in bituminous mixes.

**Books:**

1. Highway Engg. by S.K.Khanna & C.e.G.Justo, Nem Chand & Bros,Roorkee.
2. Principles of Transportation and Highway Engg. by G.V.Rao,Tata McGraw Hill Pub., N.Delhi.
3. Traffic Engg. And Transport Planning by L.R.Kadiyali,Khanna Pub.Delhi.
4. Traffic Engg. by Matson, T.M.,Smith,W.S. and Hurd,P.W.McGraw Hill Book Co., New York.

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**B. Tech. (Civil) VI Semester**  
**CET 312 WATER SUPPLY AND TREATMENT**

**L T P/D T**

3 1 - 4

Max. Marks: 100

Theory: 75 marks

Sessional: 25 marks

Duration: 3 Hours

**1 Water Quantity:**

Importance and necessity of water supply scheme. Water demands and its variations. Estimation of total quantity of water requirement. Population forecasting. Quality and quantity of surface and ground water sources. Selection of a source of water supply. Types of intakes.

**2 Water Quality:**

Impurities in water and their sanitary significance. Physical, chemical and bacteriological analysis of water. Water quality standards.

**3 Water Treatment:**

Objectives, treatment processes and their sequence in conventional treatment plant, sedimentation – plain and aided with coagulation. Types, features and design aspects. Mixing basins and Flocculation units. Filtration – mechanism involved, types of filters, slow and rapid sand filtration units (features and design aspects). Disinfection principles and aeration.

**4 Water Distribution:**

Distribution system – Gravity system, Pumping System, Dual system, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System, their merits and demerits. Distribution Reservoir-functions & determination of storage capacity.

**Books:**

1. Water Supply and Sewerage: E.W. Steel.
2. Water Supply Engineering: S.R. Kshirsagar.
3. Water Supply Engineering: S.K. Garg.
4. Water Supply Engineering: B.C. Punmia.
5. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

**B. Tech. VI Semester (Civil)**  
**CET-314 TRANSPORTATION ENGINEERING-I (P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:50  
Pract: 25 marks  
Sessional: 25 marks  
Duration: 3 hrs.

**LIST OF EXPERIMENTS**

1. Aggregate Impact Test.
2. Los-Angeles Abrasion Test on Aggregates.
3. Dorry's Abrasion Test on Aggregates.
4. Deval Attrition Test on Aggregates.
5. .Crushing Strength Test on Aggregates.
6. Penetration Test on Bitumen.
7. Ductility Test on Bitumen.
8. Viscosity Test on Bituminous Material
9. Softening Point Test on Bitumen.
10. .Flash and Fire Point Test on Bitumen.

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**B. Tech. VII Semester (Civil)**  
**CET-401 DESIGN OF CONCRETE STRUCTURES-II**

L	T	P/D	Total	Max.Marks: 100
4	-	-	4	Theory: 100marks
				Duration: 4 hrs.

1. **Continuous Beams:**

Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear, beams curved in plan-analysis for torsion, redistribution of moments for single and multi-span beams, design examples.

2. **Flat slabs and staircases:**

Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs, openings in flat slab, design of various types of staircases, design examples.

3. **Foundations:**

Combined footings, raft foundation, design of pile cap and piles, under-reamed piles, design examples.

4. **Water Tanks, Silos and Bunkers:**

Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground and overhead tanks, Inlet tanks, design considerations, design examples.

Silos and Bunkers-Variou theories, Bunkers with sloping bottoms and with high side walls, battery of bunkers, design examples.

5. **Prestressed Concrete:**

Basic principles, classification of prestressed members, various prestressing systems, losses in prestress, initial and final stress conditions, analysis and design of sections for flexure and shear, load balancing concept, I:S:Specifications .

End blocks-Analysis of stresses, Magnel's method, Guyon's method, Bursting and spalling stresses, design examples.

6. **Building Frames**

Introduction, Member stiffnesses, Loads, Analysis for vertical and lateral loads, Torsion in buildings, Ductibility of beams, design and detailing for ductibility, design examples.

7. **Yield Line Theory:**

Basic assumptions, Methods of analysis, yield line patterns and failure mechanisms, analysis of one way and two way rectangular and non-rectangular slabs, effect of top corner steel in square slabs, design examples.

**Books:**

1. Plain and Reinforced Concrete, Vol.2, Jai Krishna & O.P.Jain, Nem Chand & Bros.,Roorkee.
  2. Pre-Stressed Concrete, N.Krishna Raju, TMH Pub.,N.,Delhi.
  3. Design of Prestressed Concrete Structures, T.Y.Lin, John Wiley & Sons., N.Delhi.
  4. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
  5. IS 1343-1980,IS Code of Practice for Prestressed Concrete.
  6. IS 3370-1976(Part I to IV), Indian Standard Code of Practice for Liquid Retaining Structures.
  7. IS 456-2000, Indian Standard of Practice for Plain and Reinforced Concrete.
- IS 1893, 4326 & 13920 Indian Standard Code of Practice for Earthquake Resistant Design of Structures.**

**B. Tech. VII Semester (Civil)**  
**CET-403 IRRIGATION ENGINEERING-II**

L T P/D Total  
3 1 - 4

Max.Marks: 100  
Theory: 75 marks  
Sessionals: 25 marks  
Duration: 3 hrs.

- 1 **Regulation works:**  
Canal falls-necessity and location, development of falls, design of cistern element , roughening devices, design of Sarda type fall, design of straight Glacis fall. Off-take alignment, cross-regulator and distributory head regulators, devices to control silt entry into the off-taking channel and silt ejector, canal escapes, types of escapes.
- 2 **Cross drainage works:**  
Classification and their selection, hydraulic design aspects of aqueducts, syphon aqueducts, super passage, canal syphon and level crossing, design of transitions.
- 3 **Diversion canal headworks:**  
Various components and their functions, layout plan, selection of site for diversion headworks, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections, silt excluders.
- 4 **Storage Headworks:**  
Types of dams, selection of a site, gravity dam-two dimensional design, forces acting, stability criterion, elementary profile of a dam, cutoffs and drainage galleries, arch dams-constant angle and constant radius arch dam, simple design and sketches, most economical angle, Earth dam, design principles, seepage through earth dams, seepage line, control of seepage, design of filters.
- 5 **Spillways and Energy Dissipators:**  
Essential requirements of spillway and spillway's capacity, types of spillways and their suitability, Ogee spillways, chute, side channel, shaft and syphon spillways, energy dissipation below spillways, stilling basins, USBR and I.S.Stilling Basins.

**Books:**

- 1 Irrigation, Water Resources and Water Power Engineering by P.N.Modi.
- 2 Fundamentals on Irrigation Engineering by Bharat Singh.
- 3 Irrigation Engineering and Hydraulic Structures by S.K.Garg.
- 4 Theory and Design of Irrigation Structures Vol.I & II by R.S.Varshney, Gupta & Gupta.

**B. Tech. (Civil) VII Semester**  
**CET - 405 Transportation Engineering - II**

L	T	P/D	Total
3	1	-	4

Max. Marks: 100  
Theory: 75 Marks  
Sessional: 25 Marks  
Duration: 3 Hours

- 1. Design Of Flexible Pavements:**  
Types of pavements. Flexible and rigid pavements. Components of a pavement and their functions. Factors affecting design of pavements. Design of thickness of a flexible pavement by Group Index method, CBR method (including latest IRC guidelines), Triaxial method and Burmister's method.
- 2. Design Of Rigid Pavements:**  
Westergaard's theory, critical locations of loading, load and temperature stresses. Critical combination of stresses. IRC guidelines for determination of thickness of a rigid pavement. Joints: requirements, types, patterns. Spacing of expansion and contraction joints. Functions of dowel and tie bars.
- 3. Highway Construction : Non-Bituminous Pavements:**  
Brief introduction to earthwork machinery, shovel, hoe, clamshell, dragline, bulldozers. Principles of field construction of subgrade. Compacting equipments. Granular roads. Construction steps of WBM. WMM. Construction of cement concrete pavements. Slip-form pavers. Basic concepts of the following: soil stabilized roads, use of geo-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements.
- 4. Construction Of Bituminous Pavements:**  
Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of BUSG, Premix carpet, BM, DBM and AC. Brief coverage of machinery for construction of bituminous roads: bitumen boiler, sprayer, pressure distributor, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MOST specifications.
- 5. Highway Maintenance:**  
Pavement failures. Maintenance operations. Maintenance of WBM, bituminous surfaces and cement concrete pavements. Pavement evaluation. Benkleman beam. Introduction to various types of overlays.
- 6. Highway Drainage And Hill Roads:**  
Surface drainage: types, brief design. Types of sub-surface drainage. Special characteristics of hill roads: geometrics, hair pin bends, construction of hill roads, drainage of hill roads, maintenance problems of hill roads
- 7. HIGHWAY ECONOMICS AND FINANCE**  
Need of economic evaluation. Highway user benefits and costs. Methods of economic evaluation: benefit cost ratio method, net present value method, internal rate of return method, comparison. Highway finance.

## 8. TUNNELS

Sections of tunnels: advantages, limitations and suitability of each section. Shaft. Pilot tunnel. Driving tunnel in rocks: sequence of construction operations, full face method, heading and bench method, drift method. Driving tunnels in soft ground: sequence of construction operations, needle beam method, shield tunneling, compressed air tunneling.

### Recommended Books

1. Highway Engg by S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
2. Principles and Practice of Highway Engg. by L.R.Kadiyali, Khanna Publishers, Delhi.
3. Principles of Pavement Design by Yoder,E.J & Witczak,M.W., John Wiley and Sons, USA.
4. Tunnel Engineering by S.C.Saxena, Dhanpat Rai Publications, N.Delhi.
5. A text book of Tunnel, Bridges and Railway Engg. by S.P.Bindra, Dhanpat Rai Delhi.

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**B. Tech. (Civil) VII Semester**  
**CET-407 SEWERAGE AND SEWAGE TREATMENT**

**L T P/D Total**  
2 1 - 3

Max. Marks: 100  
Theory: 75 marks  
Sessional: 25 marks  
Duration: 3 hrs.

- 1. Collection of sewage:**  
Importance of sanitation, Systems of sewerage – separate, combined and partially separate. Quantity of sanitary sewage and variations. Shapes of sewer – circular and egg shaped. Design of sewers, self-cleansing velocity and slopes, Construction and testing of sewer lines. Sewer materials. joints and appurtenances.
- 2. Sewage Characterisation:**  
Quality parameters- BOD, COD, Solids, D.O., Oil & Grease. Indian Standards for disposal of effluents into inland surface sources and on land.
- 3. Sewage Treatment:**  
Objectives, sequence and efficiencies of conventional treatment units. Preliminary treatment, screening and grit removal units. Theory and design aspects of primary treatment, secondary treatment- activated sludge process & its modifications, Tricking filter, sludge digestion and drying beds. Stabilization pond, aerated lagoon, UASB process, septic tank and Imhoff tank.
- 4. Disposal of Sewage:**  
Disposal of sewage by dilution – self-purification of streams. Sewage disposal by irrigation (sewage treatment).

**Recommended Books:**

1. Waste Water Engineering: Metcalf and Eddy.
2. Sewage and Sewage Treatment: S.K. Garg.
3. Sewage and Sewage Treatment: S.R. Krishansagar.
4. Waste Water Engineering: B.C. Punmia.

Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

**B. Tech. VII Semester (Civil)**  
**CET-409 CONCRETE STRUCTURES-II(DRAWING)**

L	T	P/D	Total
-	-	3	3

Max. Marks: 75  
Pract.: 25 marks  
Sessional: 50 marks  
Duration: 3 hrs.

Preparing drawing sheets showing reinforcement details in case of:

1. Flat slabs
2. Underground and Overhead Water Tanks.
3. Combined Footings, Pile Foundations, Raft foundation.
4. T-Beam Bridge.
5. Silo/Bunker.

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**B. Tech. VII Semester (Civil)**  
**CET-411 IRRIGATION ENGINEERING DESIGN & DRAWING**

L	T	P/D	Total
-	-	3	3

Max.Marks: 75  
Sessional: 50 marks  
Viva-voce: 25 marks  
Duration: 3 hrs.

**Complete design and drawing of the following:**

- 1 Design of weirs and barrages on permeable foundation for surface and sub surface flow conditions.
- 2 Design of Guide Banks.
- 3 Flood Routing using step by step method.
- 4 Design of Syphon Aquaduct.
- 5 Design of Sarda type fall & sloping glacis fall.
- 6 Seepage line in a homogeneous earth dams on impermeable foundation with horizontal drainage.
- 7 Design of Ogee Spillway and stilling basin.

**Note:** Emphasis would be given to the computer aided designs of some of above structures.

**B. Tech. VIII Semester (Civil)**  
**(Departmental Elective-I)**  
**CET-413 ELEMENTS OF EARTHQUAKE ENGINEERING**

L	T	P/D	Total
3	1	-	4

Max.Marks: 100  
Theory: 75 marks  
Sessionals: 25 marks  
Duration: 3 hrs.

- 1. Seismology:**  
Introduction, plate tectonics, earthquake distribution and mechanism, seismicity, seismic waves, earthquake magnitude and intensity, seismic zoning and seismometry.
- 2. Single Degree of Freedom Systems:**  
Various types of dynamic loads, vibration of single degree of freedom system, Free and forced vibrations, types of damping, critical damping. Transmissibility, vibration measuring instruments, response spectrum.
- 3. Multi-degrees of Freedom(MDOF)Systems:**  
Equation of Motion, normal modes and natural frequencies, semi-definite systems, dynamic vibration absorbers, vibration dampers, principle of orthogonally, Stodolas method, Holzer's method, matrix method, modal analysis and its limitations. Mode super position method.
- 4. Seismic Analysis and Design:**  
General principles, assumptions, seismic coefficient method, response spectrum method, strength and deflection, design criterion for structures, significance of ductility, design and detailing for ductility, codal provisions, design examples.
- 5. Seismic Performance, Repair and Strengthening:**  
Methods for assessing seismic performance, influence of design ductility and masonry infill, criterion for repair and strengthening, repair and strengthening techniques and their applications, additions of new structural elements.
- 6. Vibrational Control:**  
General features of structural control, base isolation, active and passive control system. Earthquake resistance design as per I.S.:1893, I.S.4326 and I.S.13920.

**Books Recommended:**

- 1 Elements of Earthquake Engineering, Jai Krishna, A. R. Chandershekar & Brajesh Chandra , South Asian Pub New Delhi.
- 2 Dynamics of Structures, Clough & Penzion, McGraw Hill
- 3 Earthquake Engineering, Y-X Hu,S-C.Liu and W.Dong, E and FN Sons., Madras.
- 4 Earthquake Resistant Concrete Structures, George G. Penelis and J. Kapoor, E & FN Sons, Madras.
- 5 Structural Dynamics, Mario Paz, CBB Pub. N. Delhi.

**B. Tech. VII Semester (Civil)**  
**CET-415 ROCK MECHANICS(Departmental Elective-I)**

L	T	P/D	Total
3	1	-	4

Max.Marks: 100  
Theory: 75 marks  
Sessionals: 25 marks  
Duration: 3 hrs.

- 1 **Introduction:**  
Importance of rock mechanics, composition of rocks, geological and lithological classification of rocks, classification of rocks for engineering purposes, R.Q.D. method of classification of rocks.  
Theories of Brittle failure.
- 2 **Laboratory Testing of Rocks:**  
Various methods of obtaining rock cores, methods of sample preparation, methods of removing end friction of the rock samples. Compression testing machine, uniaxial compression strength of rock samples, methods of finding tensile strength-direct and indirect methods, Brazilian test, shear box test, triaxial shear test, punch shear test.
- 3 **In-situ Testing of Rocks:**  
Field direct shear test on rock blocks, field triaxial strength, use of flat jacks, chamber test, plate load test, cable jacking test.
- 4 **Stress Evaluation in Field:**  
Stress-relief technique(over coring), use of strain gauges, bore hole, deformation cell, photo-elastic stress meter, stress measurement with flat jack. Hydraulics Fracturing Techniques.
- 5 **Stabilization of Rocks:**  
Rock bolting, principle of rock bolting, various types of rock bolts, application of rock bolting. Field testing of rock bolts and cable anchors.
- 6 **Elastic and Dynamic Properties of Rocks:**  
Stress-strain behaviour dynamic properties, resonance method and ultra-sonic pulse method.
- 7 **Pressure on Roof of Tunnels:**  
Trap door experiment, Terzaghi's theory, Bieramer, kommerel, Protodyakanov theory.
- 8 **Stress Around the Tunnels:**  
Basic design and Principles of tunnels in rocks, design of pressure tunnels in rocks.

**Books :**

- 1 Rock Mechanics , Vol.I,II,III,IV by Lama,et.al.
- 2 Fundamentals of Rock Mechanics by Jaeger and Cook
- 3 Rock Mechanics by Stagg & Zienkiewicz.
- 4 Rock Mechanics & Design of Structures in Rocks by Obert & Duvell
- 5 Rock Mechanics & Engineering by Jaeger
- 6 Art of Tunneling by Schzy.

**B. Tech. (Civil) VII Semester (Departmental Elective-I)**  
**CET - 417 ADVANCED TRAFFIC ENGINEERING**

L	T	P/D	Total
3	1	-	4

Max. Marks : 100  
Theory: 75 Marks  
Sessional: 25Marks  
Duration: 3 Hours

- 1. Introduction And Traffic Characteristics**  
Objectives and scope of traffic engg. Organisational set up of traffic engg department in India. Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.
- 2. Traffic Surveys**  
Methods of conducting the study and presentation of the data for traffic volume study, speed study and origin and destination study. Speed and delay study. Parking surveys. On street parking, off street parking. Accident surveys. Causes of road accidents and preventive measures. Use of photographic techniques in traffic surveys.
- 3. Highway Capacity**  
Importance. Space and time headway. Fundamental diagram of traffic flow. Relationship between speed, volume and density. Level of service. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.
- 4. Traffic Control**  
Types of traffic control devices. Traffic signs, general principles of traffic signing, types of traffic signs. Road markings, types, general principles of pavement markings. Design of rotary. Grade separated intersections. Miscellaneous traffic control aids and street furniture.
- 5. Signal Design**  
Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method, approximate method, Webster's method and IRC method
- 6. Traffic Regulation And Management**  
Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements, one way streets, tidal flow operations, exclusive bus lanes, traffic restraint, road pricing.
- 7. Traffic And Environment**  
Detrimental effects of traffic. Vehicular air pollution. Situation in India. Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption. Arboricultur.
- 8. Computer Application, Traffic Simulation**  
Computer application in traffic engg., transport planning and public transport. Traffic simulation, advantages. Steps in simulation. Scanning techniques. Introduction to Intelligent vehicle highway system. Various types of IVHS.

**Books:**

1. Traffic Engg. And Transport Planning *by* L.R.Kadiyali, Khanna Publishers, Delhi.
2. Highway Engg *by* S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
3. Traffic Engg. *by* Matson, T.M., Smith, W.S. and Hurd, F.W., McGraw- Hill Book Co., New York.
4. Traffic Flow Theory *by* Drew, D.R., McGraw- Hill Book Co., New York.

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**B. Tech. VII Semester-(Open Elective-I)**  
**CET-419 HYDRO ELECTRIC POWER DEVELOPMENT**

L	T	P/D	Total
3	1	-	4

Max.Marks: 125  
Theory: 75 marks  
Sessional: 50 marks  
Duration: 3 hrs.

- 1. Introduction:**  
Sources of power , estimation of water power, necessity and importance of harnessing small hydro power, flow duration and power duration curves, load curve, load factors, capacity factors, utilisation factors, firm and secondary power.
- 2. Types of Hydro Power Plants:**  
Elements of Hydro power, classification of hydro-power plants, run-of-river plants, storage plants diversion canal development, pumped storage plants, tidal power plants, base load and peak load plants on a power grid.
- 3. Intakes:**  
Intake structures, functions and their types, components of intakes-forebay, trash racks, gates and valves, force required to operate gates.
- 4. Conveyance System:**  
Penstocks, design criterion, economical diameter anchor blocks, cradles and footings, water hammer, instantaneous closure of power canal, surge tank, surges in canals.
- 5. Turbines:**  
Types of turbines, specific speed and classification of turbines, synchronous speed, scroll casing , flumes and draft tubes, dimensions of scroll casing and draft tubes, setting of turbines
- 6. Power House:**  
General layout and arrangements of hydro-power units, number and size of units, sub-structure, spacing of units, super-structure, underground power stations, tidal power.

**Books:**

- 1 Water Power Engineering, Dandekar, M.M., Sharma,K.N.
- 2 Hydro-Electric Engineering Practice Vol.I ,II & III Brown J.G.
- 3 Water Power Engineering, Borrows, H.K.
- 4 Water Power Development, Vol.I & II, Mosonyi,E.
- 5 Water Power Engineering, M.M.Deshmukh.

**B. Tech. VII Semester (Open Elective-I)**  
**CET-421 CONCRETE TECHNOLOGY**

L	T	P/D	Total
3	1	-	4

Max.Marks: 125  
Theory: 75 marks  
Sessional: 50 marks  
Duration: 3 hrs.

1. **Concrete as Structural Material:**  
Introduction, preparation of concrete, grades of concrete, advantages of concrete, concept of quality control.
2. **Concrete Making Materials:**  
Cement, tests on cement (physical tests), types of Portland cement, various types of cement-ordinary Portland cement, rapid hardening cement, low heat cement, sulphate resistant cement, portland-pozzolona cement, high strength Portland cement, high alumina cement, waterproof cement, white Portland cement, hydrophobic cement, coloured Portland cement.  
Aggregates, classification of aggregates based on petrographic, size, shape & textures, deleterious substances in aggregates, bulking of fine aggregate, sieve analysis, grading of aggregates as per IS-383-1970. Fineness Modulus, Maximum size of aggregate. Quality of mixing water, curing water.
3. **Properties of Concrete:**  
Introduction, workability, factors influencing workability, measurement of workability, requirements of workability, properties of hardened concrete, stress and strain characteristics of concrete, Young's modulus of concrete, creep and shrinkage of concrete, permeability of concrete, durability of concrete sulphate attack, fire-resistance, thermal properties of concrete, construction joints, expansion and contraction joints.
4. **Production of Concrete:**  
Introduction, batching of materials, mixing of concrete materials, transportation of concrete, compaction of concrete, ready mixed concrete, vibrators, Internal vibrators, external vibrators, concrete curing and formwork removal.
5. **Non-Destructive Testing of Concrete:**  
Significance of Non-Destructive Testing, Rebound Hammer, Ultrasonic pulse velocity techniques, Penetration techniques, pullout tests, vibration methods, Radioactive techniques. Cover meter, core-tests.
6. **Deterioration of Concrete & its Prevention:**  
Causes of concrete deterioration, deterioration by water, surface wear, frost action, deterioration by chemical reactions, sulphate attack, alkali-aggregate reaction, corrosion of embedded steel in concrete. Prevention of deterioration of concrete.
7. **Repair Technology for Concrete Structures:**  
Symptoms and diagnosis of distress, evaluation of cracks, repair of cracks, common types of repairs, distress in fire damaged structures, underwater repairs.
8. **Special Concrete:**  
Light weight concrete, definition and its properties, applications, high strength concrete, definitions, its properties and applications, mass concrete, waste material based concrete, shotcrete, fiber reinforced concrete: Materials.

Fibers-types and properties, ferrocement, polymer concrete composites, heavy-weight concrete for radiation shielding.

9 **Prestressed Concrete:**

Introduction, Basic concepts, classification and types of prestressing, prestressing systems, properties of materials, pretensioned and post-tensioned concrete elements.

**Books:**

1. Gambhir, M.L., 'Concrete Technology', TMH Pub. N. Delhi.
2. Shetty, M.S., 'Concrete Technology', S. Chand & Co. N. Delhi.

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**B. Tech VII SEMESTER (Open Elective-I)**  
**CET – 423 ENVIRONMENTAL ENGINEERING**

**L T P T**  
**3 1 – 4**

**Max. Marks: 125**  
**Theory: 75 marks**  
**Sessional: 50 marks**  
**Duration: 3 hrs.**

- 1. Introduction**  
Environment and its segment, biosphere, impact of humans upon environment, impact of environment upon humans, biodiversity and sustainable development.
- 2. Ecology**  
Meaning, scope and sub-division on ecology. Ecosystems and its types. Energy flow – radiation and heat budget, food chains, trophic levels, ecological pyramids, biogeochemical cycles (nitrogen, sulphur, phosphorus), consortism and its ranks. Ecological balance in nature, sources and effects of radioactive fall outs, disposal of radioactive wastes, chemical and biological agents and effects of chemical and biological warfare, population explosion - its effects and India scenario.
- 3. Energy And Environment**  
Energy, uses of energy, historical background, economics of energy, conventional and non-conventional sources of energy, renewable energy sources (such as solar, wind, tidal, wave, geothermal, hydro and bio mass energy) and their environmental impact with special reference on Indian scenario.
- 4. Air Pollution**  
Composition and structure of atmosphere, classification and sources of air pollutants, effects of air pollution on plants, animal and human health and economic effects of air pollution. Meteorological parameters influencing air pollution, plume behaviour. Effects of air pollution on meteorological conditions (such as green house effect, ozone depletion and acid rains). El-Nino and its effects. Automobile pollution - effects and control measures. Atmospheric self – cleansing processes, approaches and techniques of air pollution control. Air pollution control devices like settling chamber, cyclones, ESP, bag – filters, catalytic converters, etc.
- 5. Noise Pollution**  
General introduction to noise pollution, human acoustics, unit of measurement, loudness, measurements of noise and weighting networks, sources and effects of noise pollution. Noise abatement/control and noise standards.
- 6. Solid Wastes**  
Definition, types, composition and sources of solid – wastes. Method of disposal - land filling, incineration, pulverization, and composting. Selection of method of disposal. Solid waste management and reuse of materials.

### **Books Recommended**

1. 'Environmental Engineering' by H. S. Peavy. D. R. Rowe, et. Al., McGraw Hill Book Co. New Delhi.
2. Ecology' by E. P. Odum, Oxford and IBN Pub. New Delhi.
3. Air Pollution' by M. N. Rao.
4. Environmental Noise Pollution' by P. F. Cuniff, John Wiley & Sons.
5. Environmental Engineering' by S. S. Deswal & S. Deswal, Dhanpat Rai & Co.

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**B. Tech. VII Semester**  
**CET-425 Machine Foundations (Open Elective-I)**

L	T	P/D	Total
3	1	-	4

Max.Marks: 125  
Theory: 75 marks  
Sessional: 50 marks  
Duration: 3 hrs.

- Theory of Vibrations:**  
Definitions, harmonic motion, vibrations of a single degree freedom system, transmissibility, theory of vibration measuring instruments.
- General Principles of Machine Foundation Design:**  
Types of machines and machine foundations, criteria for satisfactory action of a machine foundation, permissible amplitude, allowable soil pressure, permissible stresses in concrete and steel, permissible stresses in timber.
- Evaluation of Parameters:**  
Modes of vibration of a rigid block foundation, Barken's soil spring constants, determination of coefficients of elastic uniform compression and Elastic uniform shear.
- Foundations for Reciprocating Machines:**  
Analysis of block foundation by Barken's theory of linear elastic weightless spring analogy, Indian Standard for design and construction of foundation for reciprocating machine, design procedure, design examples.
- Foundation for Impact Machines:**  
Dynamic analysis, Barken's recommendations for weight and base contact area, IS Code practice for design and construction of foundations for impact machines, design procedure, design examples.
- Foundations for Rotary Machines:**  
Special considerations, design criteria, methods of analysis and design.
- Vibration Isolation and Screening:**  
Active isolation, passive isolation, methods of isolation, wave screening, vibration absorbing materials, planning for vibration isolation.

**Books:**

- Dynamics of Bases and Foundations by D.D.Barken
- Soil Dynamics by Shamsheer Prakash
- Soil Dynamics and Machine Foundations by Swami Saran
- Principles of Soil Dynamics by B.M.Das
- Vibration and Shock Isolation by Crede

**B. Tech. VIII Semester (Civil)**  
**CET-402 Bridge Engineering**

L	T	P/D	Total
3	1	-	4

Max.Marks: 100  
Theory: 75 marks  
Sessionals: 25 marks  
Duration: 3 hrs.

- 1 **Introduction:**  
Definition, components of bridge, classification of bridges, selection of site , economical span, aesthetics consideration, necessary investigations and essential design data.
- 2 **Standard Specifications For Roads And Railways Bridges:**  
General, Indian Road Congress Bridge Code, width of carriage way, clearance, various loads to be considered for the design of roads and railway bridges, detailed explanation of IRC standard live loads.
- 3 **Design Consideration for R. C. C. Bridges:**  
Various types of R.C.C. bridges(brief description of each type) , design of R.C.C. culvert and T-beam bridges.
- 4 **Design Consideration for Steel Bridges:**  
Various types of steel bridges (brief description of each), design of truss and plate girder bridges.
- 5 **Hydraulic & Structural Design:**  
Piers, abutments, wingwall and approaches.
- 6 **Brief Description:**  
Bearings, joints, articulation and other details.
- 7 **Bridge Foundation:**
- 8 Various types, necessary investigations and design criteria of well foundation.

**Books:**

- 1 Essentials of Bridge Engineering, D.J.Victor, Oxford & IBH Pub.N.Delhi.
- 2 Design of Bridges, N.Krishna Raju, Oxford & IBH, N.Delhi.
- 3 Bridge Deck Analysis, R.P.Pama & A.R.Cusens, John Wiley & Sons.
- Design of Bridge Structures, T.R.Jagadish & M.A.Jairam, Prentice Hall of India, N.Delhi.

**B. Tech. (Civil) VIII Semester**  
**CET - 404 Railway and Airport Engineering**

L	T	P/D	Total
3	1	-	4

Max. Marks : 100  
Theory: 75 Marks  
Sessional: 25 Marks  
Duration: 3 Hours

**Part-A Railway Engineering**

- 1. Introduction, Permanent Way And Rails**  
Rail transportation and its importance in India. Permanent way: requirements and components. Gauges in India and abroad. Selection of gauge. Coning of wheels. Adzing of sleepers. Rails: functions, composition of rail steel, types of rail sections, requirements of an ideal rail section, length of rails. Defects in rails. Creep of rails. Long welded rails and continuously welded rails.
- 2. Sleepers, Fastenings And Ballast**  
Sleepers: functions, requirements of an ideal sleeper. Types of sleepers: wooden, cast iron, steel and concrete sleepers, advantages, disadvantages and suitability of each type. Sleeper density. Fastenings for various types of sleepers: fish plates, spikes, bolt bearing plates, keys, chairs, jaws, tie bars. Elastic fastenings. Ballast: functions, requirements, types of ballast and their suitability.
- 3. Points And Crossings**  
Necessity. Turnout: various components, working principle. Switch: components, types. Crossing: components and types. Design elements of a turnout, design of a simple turnout. Layout plan of track junctions: crossovers, diamond crossing, single-double slips, throw switch, turn table, triangle.
- 4. Signalling, Interlocking And Train Control**  
Signals: objects, types and classification. Semaphore signal: components, working principle. Requirements / principles of a good interlocking system. Brief introduction to devices used in interlocking. Methods of control of train movements: absolute block system, automatic block system, centralised train control and automatic train control systems.
- 5. Geometric Design Of The Track**  
Gradients, grade compensation. Superelevation, cant deficiency, negative superelevation. Maximum permissible speed on curves. Tractive resistances, types. Hauling capacity of a locomotive.
- 6. Stations, Yards And Track Maintenance**  
Stations: functions and classification. Junction, non-junction and terminal stations. Yards: functions, types. Marshalling yard: functions, types. Maintenance of railway track: necessity, types of maintenance. Brief introduction to mechanised maintenance, M.S.P and D.T.M.

## Part-B Airport Engineering

**1. Introduction And Airport Planning**

Air transportation, its importance and characteristics, status in India. Layout plan of an airport and its basic elements: terminal area, apron, taxiway, runway, hanger. Aircraft characteristics, their effect on elements of an airport. Site selection of an airport. Classification of airports.

**8. Runway Layout And Pavement Design**

Runway orientation, Wind Rose diagram. Basic runway length. Corrections to basic runway length. Runway patterns. Difference between highway and runway pavement. Types of runway pavements. Design factors for runway pavement. Brief introduction to design of thickness of a runway pavement.

**Note:** In total 8 questions will be set, 6 from part-A and 2 from part-B. Candidates will be required to attempt 5 questions selecting atleast 1 from part-B.

**Books:**

1. A text book of Railway Engineering by S.C.Saxena and S.P.Arora, Dhanpat Rai Publicatios, N.Delhi.
2. Railway Track Engg. by J.S.Mundray, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.
3. Airport Planning and Design by S.K.Khanna, M.G.Arora, Nem Chand Bros., Roorkee.
4. The Planning and Design of Airports by Robert Hornjeff, McGraw Hill Book Co.
5. Air Transportation Planning and Design by Virender Kumar & Satish Chandra, Galgotia Publications, N.Delhi.

**B. Tech. VIII Semester (Civil)**  
**CET-406 Industrial Waste Water Treatment**

L	T	P/D	Total
3	1	-	4

Max. Marks: 100  
Theory: 75 marks  
Sessional: 25 marks  
Duration: 3 hrs.

Effects of industrial wastes on streams, sewerage systems and wastewater treatment plants. Various steps to minimize effects of industrial effluents on waste water treatment plants and receiving streams-conservation of water, process change, reuse of waste water, volume reduction, strength reduction, neutralization, equalization and proportioning. Population equivalent. Industrial effluent standards for disposal into inland surface water sources and on land for irrigation.

Study of the following Industries from waste generation, quality and its treatment including brief overview of manufacturing process:

Textile, tannery, sugar mill, distillery, dairy, pulp & paper, metal plating, oil refinery, nitrogenous fertilizers, thermal power plants and radio active wastes.

**Books:**

- a. Industrial and Hazardous Waste Treatment by N.L.Nemerow & A.Dasgupta.
- b. Industrial Effluents by N.Maryasakam.
- c. Waste Water Treatment by M.N.Rao & A.K.Dutta.

**B. Tech. VIII Semester (Civil)**  
**CET-408 Estimation And Accounts**

L T P/D Total  
- - 3 3

Max. Marks: 50  
Viva Voce: 25 marks  
Sessional: 25 marks  
Duration: 3 hrs.

**1. Estimate:**

Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.B. and R.V.C.C. works, Plastering, White-washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, roads etc.

**2. Specification of Works:**

Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete, brick work, floorings, D.P.C., R.C.C., cement plastering, white and color washing, distempering, painting.

**3. Rate Analysis:**

Purpose, importance and requirements of rate analysis, units of measurement, preparation of rate analysis, procedure of rate analysis for items:- Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing (white-washing and distempering).

**4. Public Works Account:**

Introduction, function of P.W. department, contract, guidelines, types of contracts, their advantages and disadvantages, Tender and acceptance of tender, Earnest money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction.

**Books**

- a. Estimating and Costing for Building & Civil Engg. Works by P.L. Bhasin, S.Chand & Co., N.Delhi.
- b. Estimating, Costing & Specification in Civil Engg. by M.Chakarborty, Calcutta.
- c. Estimating & Costing in Civil Engg.: Theory & Practice by B.N.Dutta, S.Dutta & Co., Lucknow.
- d. Building Construction Estimating by George H.Cooper, McGraw Hill Book Co., New York.

**B. Tech. VIII Semester (Civil)**  
**(Departmental Elective-II)**  
**CET-410 GROUND WATER ENGINEERING**

L	T	P/D	Total
3	2	-	5

Max. Marks: 100  
Theory: 75 marks  
Sessional: 25 marks  
Duration: 3 hrs.

Properties of Aquifers, Formation constants, compressibility of aquifers, Equation of motion for steady and unsteady ground water flow in isotropic homogeneous aquifers, Dupit's assumptions. Unconfined flow with a recharge, tile drain problem. Ground water exploration and methods of investigations.

Effect of boundaries, interference of water, leaky aquifers, Thiem's equilibrium formula for unconfined and confined aquifers and determination of hydraulic properties of aquifers. Partial penetration of an aquifer by a well, spherical flow in a well. Non equilibrium formula for aquifer (unsteady radial flows).

Tubewells, optimum capacity, silting of tubewell, design of tubewells in different aquifers, tubewell types, parts, bore hole, strainers, its types, well pipe, casing pipe, blind pipe. Construction and working of tubewells, site selection, drilling operation, cable tool method, hydraulic method, rivers Rotary Method and drilling fluids, well screen assembly installation, verticality and alignment of tubewells, gravel packing, development of tubewells, sickness, in construction and corrosion and failure of tubewells, Pumping equipment and hydraulic testing of pumps.

Artificial recharge of ground water, considerations and methods, recharge techniques induced infiltration, water spreading, flooding, basins, ditching, modification of natural channels, irrigation, recharge pits, shafts and recharge wells.

**Books:**

1. Groundwater Hydrology, D.K.Todd, John Wiley & Sons Inc. New York.
2. Groundwater, H.M.Raghunath, Wiley Eastern Ltd., N.Delhi

**B. Tech VIII Semester (Civil)**  
**Departmental Elective-II**  
**CET-412 ENVIRONMENTAL IMPACT ASSESSMENT**

L	T	P/D	Total
3	2	-	5

Max.Marks: 100  
Theory: 75 marks  
Sessional: 25 marks  
Duration: 3 hrs.

1. **Environment and Human Activity:**  
Resources, pollution, reuse and environmental management.
2. **Management of Aquatic Environment:**  
Water quality controls. Drainage basin activities and water pollution. The impact of human activity on aquatic resources. The control measures, regional planning.
3. **Air Quality Management:**  
Atmosphere, effect of human activity on air quality, waste disposal alternative. Optimization, planning of waste disposal.
4. **Waste Management:**  
Impact of waste disposal of human activity.
5. **Land Use Management:**  
Impact of land use on human life. Control of hazards in land use, management of land use.
6. **Environmental Assessment:**  
National environmental policy, implication of environment assessment in design process. Preparation of assessment, quantification. General requirements of environmental standards. Techniques of setting standards.
7. Case studies of EIA of river valley projects and thermal power projects.

**Books:**

- a. Environmental Impact Analysis by R.K.Jail and L.V.Urban
- b. Environmental Impact Assessment by Canter
- c. Environmental Impact Assessment by J.Glasson

**B. Tech. VIII Semester  
Civil (Open Elective-II)  
CET-414 RIVER MECHANICS & FLOOD CONTROL**

L T P/D Total

3 1 - 4

Max.Marks:125  
Theory:75 marks  
Sessionals:50 marks  
Duration:3 hrs.

- 1. Introduction:**  
Indian rivers, flood, flood problems, river morphology, behaviour of river flow, role of sediments in rivers, changes in regimes, river gauging, causes of flood and losses, alleviation of flooding.
- 2. Hydrologic Statistics:**  
Probabilistic treatment of hydrologic data, frequency & probability functions, statistical parameters, fitting a probability distribution, probability distribution for hydraulic variables.
- 3. Flood Mitigation by River Protection:**  
Basis of river engineering, flow types, resistance flow, energy slope, backwater effect, three dimensional flow, circular and helicoidal flow, river improvement works, river survey, protection by embankment, discharge capacity, design of dyke, stability analysis of dykes, bank protection, bank recession, types of bank protection works, channel improvement, cutoffs diversion, bypass channel, cutoff channel, flood ways, flood plain zeroing, spreading grounds.
- 4. Flood Mitigation by Reservoirs:**  
Design factors, storage capacity determinations, sequent peak algorithm method, live storage, ripple mass curve flood routing, flood storage, dead storage, reservoir classification, reservoir sedimentation, distribution of sediments in reservoirs, measurement of sediment yields, sediment load measurement, Mood's method, life of reservoir, reservoir operation based on annual storage and regulation, single and multi purpose reservoirs, gate operation schedule, maximum and minimum flow operation, multi purpose reservoir operation, reservoir economics-cost benefit ratios, optimisation of benefits.
- 5. Flood Forecasting & Warning:**  
Basic data, communication network, forecasting techniques and procedures, forecast of rainfall, runoff from rainfall, forecasting stages, peak travel time, forecast reporting flood warning, engineering methods for flood fighting
- 6. Engineering Economics of Flood Control:**  
Estimation of flood damages, estimation of benefits of flood control, cost benefit analysis of flood control project.

**Books:**

- 1 Flood Control & Drainage Engg. by S.N.Ghosh.
- 2 Hydrology & Flood Control Engg. by S.K.Garg.
- 3 Hydrology & Water Resources Engg. by K.C.Patra.

**B. Tech. VIII semester  
(Open Elective-Ii)  
(CET-416) GEOSYNTHETICS ENGINEERING**

L	T	P	Total	Max. Marks: 125
				Theory: 75 marks
3	1	-	4	Sessional : 50 marks
				Time : 3 hours

- 1. Basic Description of Geosynthetics:**  
Historical Development, The Nomenclature, Function, Use Around The World, Applications, Development in India.
- 2. Raw Materials – Their Durability And Ageing:**  
Raw Materials, Durability, Degrading Agencies, Polymers, Biological Resistance, Chemical Resistance, Weathering Resistance.
- 3. Manufacturing Methods:**  
Fibres, Yarn, Nonwoven Geotextiles, Woven geotextiles, D.S.F. Fabrics.
- 4. Geogrids – Testing And Evaluation:**  
Factors Influencing Testing, Sampling, Physical Properties, Mechanical Properties under Uniaxial loading, Creep testing.
- 5. Erosion Control With Geogrids:**  
Wind Erosion, Rain Water Erosion, Erosion Control Measures, Placement of Geogrid.
- 6. Bearing Capacity Improvement With Geogrids:**  
Advantages, Mechanism, Modes of Failure, Friction Coefficient, Experimental Studies.
- 7. Application of Geosynthetics in Water Resources Projects:**  
*Case Studies:* Dhruvdam, Hiran II Dam, Meda Creek Irrigation Scheme, Lining of Kakrapar Canal.

**Books Recommended:**

1. Designing with Geosynthetics, (Prentice-Hall)  
Robert M. Koerner
2. Engineering With Geosynthetics, (Tata McGraw-Hill)  
G.V. Rao & G.V.S. Raju

**B. Tech. VIII Semester**  
**(Open Elective-II)**  
**CET-418 INTRODUCTION TO FINITE ELEMENT METHOD**

L T P/D Total  
3 1 - 4

Max.Marks:125  
Theory:75 marks  
Sessional:50 marks  
Duration:3 hrs.

1. **Introduction:**  
Field conditions, boundary conditions, functional approximation, finite differences method, development of finite element method.
2. **Element Properties:**  
Displacement models, relation between the nodal degrees of freedom and generalized coordinates, convergence requirements, natural co-ordinate systems, shape functions, element strains and stresses, development of element stiffness, matrix and equivalent nodal loads, static condensation.
3. **Isoparametric Elements:**  
Isoparametric, super-parametric and sub-parametric elements, computation of stiffness matrix of isoparametric elements, convergence criteria for isoparametric elements, numerical integration technique using Gauss Quadrature.
4. **One Dimensional Element:**  
Truss element, analysis of plane truss problem, Hermitian beam element, beam on elastic foundation, solution of beam problem.
5. **Plane Stress and Plane Strain Analysis:**  
Triangular elements, rectangular elements, isoparametric elements, patch test, axisymmetric solid element.
6. **Plane Bending Analysis:**  
Displacement functions, plate bending elements, reduced integration, stress smoothing technique.
7. **Conduction Heat Transfer:**  
Formulation of finite element method for heat conduction, various weighted residual techniques, one dimensional heat conduction, two dimensional conduction heat transfer.
8. **Direct Stiffness Method of Analysis and Solution Technique:**  
Assemblage of elements, direct stiffness method, boundary conditions and reactions, Gauss elimination and matrix decomposition.
9. **Finite Element Analysis Software:**  
Pre-and Post-processors finite element analysis software, error estimates and adaptive meshing.

**Books:**

- a. Krishnamurthy, C.S., 'Finite Element Analysis-Theory and Programming', TMH Pub.N.Delhi.
- b. Cook, R.D., Malkus, D.S. and Plesha, M.E., 'Concept and Applications of Finite Element Analysis', John Wiley & Sons, New York.
- c. Desai, C.S. and Abel, J.F., 'Introduction to the Finite Element Method', Affiliated East-West Press Pvt.Ltd.N.Delhi.
- d. Manicka Selvam, V.K., 'Finite Element Primer', Dhanpat Rai Pub., N.Delhi.

**B. Tech. VIII Semester  
(Open Elective-II)  
CET-420 TRANSPORT PLANNING**

L	T	P/D	Total
3	1	-	4

Max. Marks : 125  
Theory : 75 Marks  
Sessional : 50 Marks  
Duration : 3 Hours

**1. TRANSPORT PLANNING PROCESS**

Status of transportation in India. Objectives and scope of transport planning. Urban, regional and national transport planning. Transport planning process, various stages. Land use and traffic.

**2. TRANSPORTATION SURVEY**

Definition of study area. Zoning. Types of surveys. O-D surveys. Inventories of existing transport facilities, land use and economic activities.

**3. TRIP GENERATION**

Trip purpose. Factors affecting trip generation. Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods.

**4. TRIP DISTRIBUTION**

Methods of trip distribution. Basic concepts of uniform factor method, average factor method and opportunity model. Trip distribution by gravity model.

**5. TRAFFIC ASSIGNMENT**

Principles of assignment. Assignment techniques. All or nothing assignment. Brief review of multipath assignment, capacity restraint assignment and diversion curves.

**6. MODAL SPLIT**

General considerations for modal split. Factors affecting modal split. Brief introduction to various methods of modal split.

**7. EVALUATION**

Need for evaluation. Several plans to be formulated. Testing. Considerations in evaluation. Economic evaluation, basic principles, brief introduction to various methods of economic evaluation, comparison.

**8. MASS RAPID TRANSIT SYSTEMS**

Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

**Books:**

- (i) Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- (ii) Highway Engg by S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
- (iii) Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.

**B. Tech. (Civil) VIII Semester**  
**CET - 422 TRANSPORTATION ENGINEERING – II (P)**

L	T	P/D	Total
-	-	2	2

Max. Marks : 50  
Sessional : 25 Marks  
Pract /Viva voce: 25 Marks  
Duration : 3 Hours

**LIST OF EXPERIMENTS**

1. Flakiness and Elongation Index of aggregates.
2. Specific gravity and water absorption test on aggregates.
3. Specific gravity of bitumen.
4. Proportioning of aggregates.
5. Marshall's stability test.
6. Stripping test on aggregates.
7. Determination of bitumen content.
8. CBR lab test on soil.
9. Traffic volume study using videography technique.
10. Traffic speed study using videography technique.

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**B. Tech. VIII Semester (Civil)**  
**CET-424 ENVIRONMENTAL ENGINEERING-II(P)**

L	T	P/D	Total
-	-	2	2

Max.Marks:50  
Pract:25 marks  
Sessional:25 marks  
Duration:3 hrs.

1. To determine the acidity of a sewage sample.
2. To determine the alkalinity of a sewage sample.
3. To determine total, suspended, dissolved and settleable solids in a sewage sample.
4. To determine volatile and fixed solids in a sewage sample.
5. To determine oil and grease in a sewage sample.
6. To determine the chloride concentration in a sewage sample.
7. To determine the sulphate concentration in a sewage sample.
8. To determine the B.O.D. of a given sewage sample.
9. To determine the C.O.D. of a given sewage sample.
10. To determine the T.O.C. of a given sewage sample.
11. To determine the fecal count of a given sewage sample.
12. Microscopic studies of a sewage.