

## University of Pune

### Structure of S E Civil Engineering - 2008 Course

#### Semester I

Sub. Code No.	Subject Title	Teaching Scheme Hours per week		Examination Scheme				Total Marks
		Lect.	Pract/Drg	Paper	TW	Pract.	Oral	
207001	Engineering Mathematics III	04	---	100	---	---	---	<b>100</b>
201001	Building Materials and Construction	04	04	100	25	---	50	<b>175</b>
201002	Strength of Materials	04	02	100	25	---	50	<b>175</b>
207009	Engineering Geology	04	02	100	25	---	---	<b>125</b>
201003	Geotechnical Engineering	04	02	100	25	---	50	<b>175</b>
	<b>Total</b>	<b>20</b>	<b>10</b>	<b>500</b>	<b>100</b>	<b>---</b>	<b>150</b>	<b>750</b>

#### Semester II

Sub. Code No.	Subject Title	Teaching Scheme Hours per week		Examination Scheme				Total Marks
		Lect.	Pract/Drg	Paper	TW	Pract.	Oral	
201004	Fluid Mechanics I	04	02	100	25	---	50	<b>175</b>
201005	Building Planning	03	04	100	25	---	50	<b>175</b>
201006	Surveying	04	04	100	25	50	---	<b>175</b>
201007	Concrete Technology	03	02	100	25	---	---	<b>125</b>
201008	Structural Analysis – I	04	---	100	---	---	---	<b>100</b>
	<b>Total</b>	<b>18</b>	<b>12</b>	<b>500</b>	<b>100</b>	<b>50</b>	<b>100</b>	<b>750</b>

## 207001 ENGINEERING MATHEMATICS – III (2008 Course)

Teaching Scheme:  
Lectures: 4 hrs./week

Examination Scheme:  
Paper: 100 marks  
Duration: 3 hrs.

### SECTION I

#### **Unit I:** Linear Differential Equations (LDE) (09 Hours)

Solution of  $n^{\text{th}}$  order LDE with Constant Coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous & Symmetric Simultaneous DE.

#### **Unit II:** Applications of DE (09 Hours)

Modeling of problems on bending of beams, whirling of shafts and mass spring systems.

Solution of Partial Differential Equations (PDE):

(i)  $\partial u / \partial t = a^2 (\partial^2 u / \partial x^2)$  (ii)  $\partial^2 u / \partial t^2 = a^2 (\partial^2 u / \partial x^2)$  (iii)  $(\partial^2 u / \partial x^2) + (\partial^2 u / \partial y^2) = 0$  by separating variables only.

Applications of PDE to problems of Civil and allied engineering.

#### **Unit III:** Numerical Methods (09 Hours)

Numerical solutions of (i) System of Linear Equations by Gauss Elimination, Cholesky and Gauss-Seidel methods (ii) Ordinary Differential Equations by Euler's, Modified Euler's, Runge-Kutta 4<sup>th</sup> order and Predictor-Corrector methods.

### SECTION II

#### **Unit IV:** Statistics and Probability (09 Hours)

Measures of Central Tendency, Standard Deviation, Coefficient of Variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression Estimates.

Theorems and Properties of Probability, Probability Density Function, Probability Distributions: Binomial, Poisson, Normal and Hypergeometric; Test of Hypothesis: Chi-Square test.

#### **Unit V:** Vector Differential Calculus (09 Hours)

Physical Interpretation of Vector Differentiation, Vector Differential Operator, Gradient, Divergence and Curl, Directional Derivative, Solenoidal, Irrotational and Conservative Fields, Scalar Potential, Vector Identities

#### **Unit VI:** Vector Integral Calculus (09 Hours)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence Theorem, Stoke's Theorem. Applications to problems in Fluid Mechanics, Continuity equations, Stream lines, Equations of motion, Bernoulli's equations.

#### **Text Books:**

1. Advanced Engineering Mathematics by Peter V. O'Neil (Cengage Learning).
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).

#### **Reference Books:**

1. Engineering Mathematics by B.V. Raman (Tata McGraw-Hill).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
4. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
5. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
6. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

## **201001: Building Materials and Construction**

### **Teaching Scheme**

Lectures: 04 hours /week

Practical: 04 hours /week

### **Examination Scheme**

Paper : 100 marks

Term work: 25 marks

Oral : 50 marks

## **SECTION I**

### **Unit 1: Introduction to Building Construction and Masonry.**

a) Introduction to building construction- definition, types of building as per national building code. Substructure - shallow & deep foundation and their suitability. failure of foundation and its causes & setting out, layout of foundation in black cotton soil, damp proof course, basement construction, its repair and maintenance, plinth filling & soling, underpinning.

b) Masonry- Stone masonry- Principal terms, types of stone masonry, pointing- purpose & types. Brick masonry- characteristics of good building bricks, IS specification & tests, classification of bricks-silica, refractory, fire and fly ash bricks. Brick work types of bonds- English, Flemish, Header, Stretcher, construction procedure, supervision, opening in walls, mortar preparation. **(08 hours)**

### **Unit 2: Block Masonry and Form work.**

a) Block masonry: hollow, solid and cavity wall construction and dry wall. Reinforced brick masonry: applications, advantages, materials required and construction procedure. Composite masonry- types, advantages, applications, materials required and construction procedure.

b) Form work and casting procedure for reinforced concrete columns, R.C.C. beams and girders, R.C.C. slabs, curing methods, precast concrete construction and joints in concrete work. **(08 hours)**

### **Unit 3: Flooring and Roofing Materials.**

a) Flooring materials – materials, tests and IS Specifications, ground and upper floors, functional requirement of flooring, varieties of floor finishes and their suitability, construction details for concrete, tiles and stone flooring. Types of flooring: timber flooring, cement concrete flooring, mosaic flooring ceramic flooring, terrazzo flooring or cast in situ terrazzo flooring, tiled flooring, rubber flooring, cork flooring, epoxy asphalt flooring or mosaic asphalt flooring, filler joist floor, jack arch floor, hollow block and rib floors.

b) Roofing materials: galvanized iron pre-coated aluminum sheets, fiber sheets, and Mangalore tiles. Roof construction: types and their suitability, method of construction, types of trusses, types of shell structure, space and frame structure, fixing details of roof covering. **(08 hours)**

## **SECTION II**

### **Unit 4: Doors, Windows, Arches and Lintels.**

a) Doors and windows: definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Types of doors: glazed or sash doors, plastic doors, flush doors, louvered doors, collapsible doors, revolving doors, rolling steel doors, sliding doors, swing doors, folding doors. Types of windows: casement window, double hung window, pivoted window, sliding windows, louvered or Venetian window, metal window, sash or glazed window, bay window, corner window, dormer window, gable window, skylight window, circular window, mosquito proof window, curtain wall window. Ventilators: purpose and types.

**b)** Arches and lintels: principle of arch action, types of arches, method of arch construction, centrifugal and renewal. Lintels: necessity and types, chajja or weather shade- necessity and types. Protective coatings: plastering types (lime plaster, cement plaster, gypsum plaster used in spray fire proofing, plaster of Paris) and application, mortar painting and varnishing, types and application, white washing, distempering, oil paints. Scaffolding- Purpose, types, suitability. Wall cladding: materials, method, wall papering and glazing work. **(08 hours)**

#### **Unit 5: Vertical Circulation and Safety in Construction.**

**a)** Vertical circulation: consideration in planning, design and construction, staircase: types, materials, fire resisting materials, design of stair, and details of ramps. Ladders, lifts, and escalator. Types of staircase: straight stairs open well stairs, quarter turn stairs, half turn stairs, turning stairs, dog-legged stairs, circular stairs, geometrical stairs, bifurcated stairs, and spiral stairs

**b)** Safety in construction: safety on site, storage of materials, construction safety, prevention of accidents, fire proof construction. Repairs and maintenance: addition, and alteration, strutting and shoring. **(08 hours)**

#### **Unit 6: Miscellaneous Materials.**

**a)** Miscellaneous materials: properties, types and uses of following materials, lime, polymers, plastic types, mastic, gypsum, ferro-crete, clay tiles and glazed wares, artificial stones. Timber: types and properties, seasoning, testing, aluminum and alloys.

**b)** Glass: uses, types and properties, application and ingredients, manufacturing process and market forms, Glass claddings, Aluminum composite panel cladding. Ceramic product: ceramic sanitary application, water closet, urinals, tabs, washes basins, their common sizes, pipes and fitting. Eco-friendly materials: eco-friendly decorating materials, eco-friendly flooring, thatch, bamboo, linoleum, cork etc. **(08 hours)**

### **Term Work**

**It shall consist of the following exercises and seminar.**

#### **A) Development of a given line plan of a residential building.**

Draw to a scale of 1: 50

1. Detailed Plan.
2. Elevation.
3. Section.
4. Following Sketches pertaining to the above plan.
  - a. Door
  - b. Window
  - c. Stair
  - d. Masonry
  - e. Lintel

#### **B) Draw sketches using computer software of the following:**

1. Foundations- two plates
  - a) Line sketches of shallow and deep footing.
  - b) Details of any one of the shallow footings.
2. Arches- two plates.
  - a) Different types of arches
  - b) Details of arch showing different components
3. Trusses- one plate. (Showing different components)

- C) One seminar report and presentation based on various aspects of construction and materials.
- D) Site visit and technical report about the visit (Minimum Two).
- E) Collection of advertisements of construction materials and equipments and other literature.

**Reference Books:**

1. Building Construction by B.C. Punmia.
2. Building Construction by S.C. Rangwala
3. Building Construction by Bindra and Arora.
4. Building Construction and Materials by Sushil Kumar.
5. Doors and Windows, Stairs by R. Barry.
6. Materials of construction by Ghosh, Tata McGraw Hill.
7. Building Materials Technology by Branyly, Tata McGraw Hill.
8. Properties of concrete by a M Neville.
9. Properties Evaluation and Control of Engineering, Tata McGraw Hill.
10. Building Construction by Mitchell.
11. National Building Code.

## 201002: Strength of Materials

### Teaching Scheme

Lectures : 04 hours/week

Practicals: 02 hours/week

### Examination Scheme

Theory paper : 100 mark (03 hours)

Oral Examination: 50 marks

Term work : 25 marks

## SECTION I

### Unit 1: Stresses and Strains.

a) Concept of stress and strain (linear, lateral, shear and volumetric), Hook's law, elastic constants and their relationship, stress-strain diagrams for brittle, elastic and plastic materials, factor of safety and working stresses, generalized Hook's law.

b) Axial force diagram. Stresses, strains and deformations in determinate and indeterminate structures for homogenous and composite structures under concentrated loads, self-weight and temperature changes. (08 hours)

### Unit 2: Shear Force and Bending Moment Diagram.

a) Concept of shear force and bending moment. Relation between shear force, bending moment and intensity of loading. Shear force and bending moment diagrams for cantilevers, simple and compound beams due to concentrated, uniformly distributed, uniformly varying loads and couples in determinate beams

b) Bending moment and loading diagram from given shear force diagram. Shear force and loading diagram from given bending moment diagram. (08 hours)

### Unit 3: Bending and Shear Stresses.

a) Stresses due to bending: theory of simple or pure bending, concept and determination of moment of inertia for various cross-sections. Assumptions, derivation of flexure formula, bending stress distribution diagrams, Moment of Resistance of cross-section. Flitched beams.

b) Shear stresses in beams: concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution for various cross sections, maximum and average shear stress for circular and rectangular sections. Shear connectors. (08 hours)

## SECTION II

### Unit 4: Torsion and Strain Energy.

a) Torsion of circular shafts: theory of torsion, assumptions, derivation of torsion formula. Stresses, strains and deformations in determinate and indeterminate shafts of hollow, solid, homogenous and composite cross-sections subjected to twisting moments. Power transmitted by shafts, twisting moment diagrams,

b) Strain energy and impact: concept of strain energy, expression of strain energy for axially loaded member under gradual, sudden and impact loads. Strain energy due to self weight, bending and torsion. (08 hours)

### Unit 5: Principal Stresses and Strains.

a) Principal stresses and strains: concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress. Mohr's circle for plane stresses.

b) Combined effect of axial stress, bending moment, shear and torsional moments. Theories of failure: maximum normal stress, maximum shear stress and maximum strain theory. (08 hours)

**Unit 6: Axially and Eccentrically Loaded Columns.**

**a)** Axially loaded columns: concept of critical load and buckling, derivation of Euler's formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine's formula, safe load on column and limitations of Euler's formula.

**b)** Direct and bending stresses for eccentrically loaded short column and other structural components such as retaining walls, dams, chimney's etc. Effect of lateral force and self-weight. Resultant stress diagrams due to axial loads, uni-axial, and biaxial bending. Concept of core of section for rectangular and circular sections. **(08 hours)**

**Term Work**

It shall consist of the following experiments and assignments.

**a) Any eight experiments from the following.**

1. Tension test on mild and TMT steel.
2. Shear test on mild and TMT steel.
3. Torsion test on mild steel and aluminum.
4. Impact test on mild steel, aluminum, brass.
5. Hardness test on mild steel, copper, aluminum, brass.
6. Bending test on timber and plywood.
7. Compression test on timber.
8. Compressive strength, water absorption and efflorescence test on bricks.
9. Flexural strength of flooring and roofing tiles.
10. Abrasion test of flooring tiles: marble and mosaic tiles.

**b) Assignment:**

At least one problem on each unit to be solved using either computer programming language or spreadsheets or solvers or any other similar tool.

**Oral examination will be based on the term work.**

**Reference Books**

- 1) Strength of Material - F. L. Singer and Andrew Pytel, Harper and Row publication
- 2) Strength of Materials – R Subramanian, Oxford University Press.
3. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd.
4. Mechanics of Materials - Gere and Timoshenko, CHS publishers
5. Mechanics of Material - Beer and Johnston, McGraw Hill publication
6. Mechanics of Materials - Andrew Pytel, Jaan Kiualaas, Thomson Learning
7. Introduction to Mechanics of Solids- E.P. Popov, Prentice Hall publication.
8. Strength of materials by S S Ratan, Tata McGraw Hill.
9. Strength of materials by D S Prakash Rao, University Press.

## **207009: Engineering Geology**

### **Teaching scheme**

Lectures: 04 hour/week  
Practicals: 02 hour/week

### **Examination scheme**

Paper: 100 marks (03 hours)  
Term work: 25 marks

## **SECTION I**

### **Unit 1: Mineralogy, Petrology and General Geology.**

a) Introduction to the subject, object, scope and sub divisions. Introduction to mineralogy, rock forming minerals and their properties, silicate and non silicate minerals, primary and secondary minerals, felsic and mafic minerals, essentials and accessories minerals. Introduction to petrology: rock cycle, main divisions of rocks. Igneous rocks: mineral composition, textures, reasons of textural variation, textures of plutonic, hypabyssal and volcanic rocks. Classification of igneous rocks, study of common rock types prescribed in practical work and their engineering applications. **(04 hours)**

b) Secondary rocks: rock weathering, decomposition and disintegration, classification and grain size classification, textures of secondary rocks, features of shallow water depositions, study of common rock and engineering applications. Metamorphic rocks: agents and types of metamorphism, metamorphic textures and structures, study of common rock types prescribed in practical work and their engineering applications. **(04 hours)**

### **Unit 2: Geomorphology and Historical Geology.**

a) Geomorphology: geological action of river, rejuvenation, land forms resulted due to river erosion, deposition and rejuvenation. **(04 hours)**

b) Historical geology: general principles of stratigraphy, age of the earth, geological time scale, physiographic divisions of India, significance of their structural characters in major civil engineering activities. **(04 hours)**

### **Unit 3: Structural Geology and Plate Tectonics.**

a) Structural geology: out crop, dip and strike, conformable series, unconformity and over lap, faults and their types, folds and their types, inliers and outlier. **(04 hours)**

b) Structural features resulted due to igneous intrusions, concordant and discordant igneous intrusions, joints and their types, stratification and lamination, mountain building activity and introduction to plate tectonics. **(04 hours)**

## **SECTION II**

### **Unit 4: Preliminary Geological Studies and Remote Sensing.**

a) Preliminary geological explorations: surface survey, reconnaissance survey, subsurface survey, test pits, trenches, exploratory tunnels, shafts, adits, drifts, drill holes, preservation of cores. Compilation and interpretation of information obtained from these, comparative reliability of data obtained by drilling and excavation. **(04 hours)**

b) Correlation of surface data with results of subsurface exploration, limitations of drilling, engineering significance of geological structures i.e. stratification, dips, folds, faults, joints, fractures, crush zones, fault zones, dykes, and case studies. Remote sensing and geographical information system, application of remote sensing and geographical information system in Civil Engineering. **(04 hours)**

### **Unit 5: Geological Hazards, Ground Water and Building Stones.**

a) Geological hazards: interior of the earth, volcanism, earthquakes, earthquake zones, geological considerations for choosing sites of building in seismic area and slides and stability



of hill slopes, its causes, role of water, stability of slopes in consolidated material, influence of dip and slope, safe and unsafe slopes, prevention of landslides, keeping slopes free from water, retaining walls vegetation, slope treatment, precautions to be taken while aligning roads across the slopes of the hills and making cuts in hill slides and case studies. **(03 hours)**

**b) Groundwater:** types of ground water, water table and depth zones of saturation, relation between surface relief and water table, influence of textures and structures of rocks on groundwater storage and movement, pervious and impervious rocks, geological work of groundwater, effects of solution and deposition, geological conditions favorable for natural springs and seepages, depression and contact springs, hot springs and geysers, wells and drill holes, fluctuations in water table levels, effects of dams and canals, effect of pumping, cone of depression, circle of influence, conservation of groundwater, role of geology in watershed development, artesian wells, geological conditions that produce artesian pressure, water bearing capacity of common rocks, locating groundwater supplies. **(04 hours)**

**c) Building stones:** requirements of good building stone, dependence of strength, durability, ease of dressing, availability of blocks of suitable size and appearance on mineral composition textures and field structures, suitability of common rocks as building stone. **(01 hour)**

#### **Unit 6: Role of Engineering Geology in Reservoirs, Dams and Tunneling.**

**a) Geology of dam site:** dependence of strength, stability and water tightness of foundation rocks and their physical characters and geological structures, influence of geological condition on the choice of type and design of dams, preliminary geological work on dam sites, favorable and unsuitable geological conditions for locating a dam, precaution to be taken to counteract unsuitable condition, treatment of leaky rocks faults, dykes, crush zones, joints, fractures, unfavorable dips, etc., earth quakes in regions of dams and case studies. **(03 hours)**

**b) Geology of reservoir sites:** dependence of water tightness on physical properties and structure of rocks, geological conditions suitable and unsuitable for reservoir sites, conditions likely to cause leakage through reservoir rims, importance of ground water studies and effects of rising of the water table and case studies. **(02 hours)**

**c) Tunneling:** influence of geological conditions on design and construction methods, preliminary geological investigations for tunnels, important geological considerations while choosing alignment, difficulties during tunneling as related with litho logy, nature and structures of material to be excavated, role of groundwater, geological conditions likely to be troublesome, suitability of common rock types for excavation and tunneling, unlined tunnels and case studies. **(04 hours)**

#### **Term Work**

Following experiments are to be performed. Term work shall consist of journal giving details of the experiments performed.

1. Identification of the following minerals in hand specimens.
2. Physical properties of minerals.
3. Study of different mineral families.
4. Identification of the different rock types in hand specimens.
5. Construction of geological sections from contoured geological maps.
6. Interpreting geological features without drawing section.
7. Solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps.
8. Logging of drill core and interpretation of drilling data with graphical representation of core log.
9. One site visit is desirable to study geology and its engineering applications.

**Text/Reference Books**

1. A Text Book of Engineering Geology by R.B. Gupte -P.V.G. Publications, Pune.
2. A Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy- 2<sup>nd</sup> Edition B S Publication.
3. A Text Book of Engineering Geology by N. Chenna Kesavulu.
4. Principles of Remote Sensing by S.K.Garg.
5. Principles of Engineering Geology by S.K.Garg.
6. Geology and Engineering by R.Legget- McGraw Hill Book Co., London.
7. Physical Geology by Arthur Holmes-ELBS Publication.
8. Principles of Petrology by G.W. Tyrrel.

## **201003: Geotechnical Engineering**

**Teaching Scheme**  
**Lectures: 4Hrs/week**  
**Practical: 2Hrs/week**

**Examination Scheme**  
**Paper: 100marks**  
**Term Work: 25 marks**  
**Oral: 50 marks**

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### **SECTION I**

#### **Unit 1: Introduction and Index Properties.**

- a) Introduction to Geotechnical Engineering and its applications to Civil Engineering, Complexity of soil structure, major soil deposits of India. Field identification of soils. Introduction to soil exploration.
- b) Three phase soil system, weight -volume relationships, Index properties of soil-methods of determination and their significance. IS and Unified Soil classification systems.

**(08 hours)**

#### **Unit 2: Permeability and Seepage.**

- a) Capillarity in soil, permeability of soils and necessity of its study, Darcy's law, factors affecting permeability. Laboratory measurement of permeability – Constant head method and Falling head method as per IS 2720. Field test for determination of permeability- Pumping in test and Pumping out test as per IS 5529 part-I.
- b) Seepage and Seepage Pressure, quick sand phenomenon , critical hydraulic gradient, General flow equation for 2-D flow (Laplace equation), Flow Net, its properties and application, Flow Net construction for flow under sheet pile and earthen dam. **(08 hours)**

#### **Unit 3: Compaction and Stress Distribution**

- a) Compaction- Introduction, compaction tests- Standard Proctor test, Modified Proctor test, Zero air void line. Field compaction methods and compaction equipments for different types of soil, Placement water content, Field compaction control- use of compaction test result, Proctor needle in field compaction control. Factors affecting compaction. Effect of compaction on soil properties.
- b) Stress Distribution in Soils: Geostatic stress, Boussinesq's theory with assumptions for point load and circular load (with numerical), line load and strip load, Pressure Distribution diagram on a horizontal and vertical plane, Pressure bulb and its significance. Westergaard's theory, equivalent point load method, Approximate stress distribution method. **(08 hours)**

### **SECTION II**

#### **Unit 4: Shear Strength of Soil**

- a) Introduction- Shear strength an Engineering Property. Mohr's stress circle, Mohr-Coulomb failure theory. The effective stress principle- Total stress, effective stress and neutral stress / pore water pressure. Peak and Residual shear strength, factors affecting shear strength. Stress-strain behavior of sands and clays.
- b) Measurement of Shear Strength- Direct Shear test, Triaxial Compression test, Unconfined Compression test, Vane Shear test. Their suitability for different types of soils, advantages and disadvantages. Different drainage conditions for shear tests. Sensitivity and thixotropy of cohesive soils. **(08 hours)**

### **Unit 5: Earth Pressure.**

- a) Earth Pressure- Introduction, Rankine's state of Plastic Equilibrium in soils- Active and Passive states due to wall movement, Earth Pressure at rest. Rankine's Theory- Earth pressure on Retaining wall due to submerged backfill,
- b) Backfill with uniform surcharge, backfill with sloping surface, layered backfill. Coulomb's Wedge theory. Poncelet and Cullman's graphical method of determination of earth pressure. **(08 hours)**

### **Unit 6: Stability of Slopes and Introduction to Rock Mechanics**

- a) Stability of Slopes- Classification of slopes and their modes of failure, Taylor's stability number, Infinite Slopes in cohesive and cohesion less soil, Landslides- Causes and remedial measures.
- b) Index Properties of Rocks- porosity, density, permeability, strength, slaking, durability and sonic velocity. Classification of rocks- Goodman and Geological classifications. Modes of failure of rocks. Tests for determination of index properties of rocks. **(08 hours)**

### **TERM WORK**

**Term work should consist of the following**

**A) List of Experiments to be conducted as per relevant IS Code (any 10)**

- 1. Determination of water content by any two methods
- 2. Specific gravity determination by Pycnometer /density bottle.
- 3. Sieve analysis, particle size determination and IS classification.
- 4. Determination of Consistency limits and use in soil classification.
- 5. Field density test by a) Core cutter b) Sand Replacement and c) Clod method
- 6. Determination of coefficient of permeability by
  - a) constant head and b) variable head method.
- 7. Direct shear test.
- 8. Unconfined compression test.
- 9. Vane Shear test.
- 10. Standard Proctor test / Modified Proctor test.
- 11. Differential free swell test.
- 12. Triaxial test

**B) To conduct any one of the following experiments.**

- 1. Swelling Pressure test
- 2. Hydrometer/ Pipette method

**C) Any one of the following assignments using software/programming -**

- 1. Classification of Soils.
- 2. Construction of Pressure bulb.
- 3. Graphical determination of Lateral Earth Pressure

**Part D: Assignments on the following topics**

- 1. Poncelet's and Cullman's graphical method for determination of earth pressure.
- 2. Solution of problems on shear strength parameters using graph.

**Note:-Oral examination should be based on the above Term Work done.**

### **Text/Reference books:**

- 1. Soil Mechanics and Foundation Engineering by Dr.B.C.Punmia, Laxmi Publications
- 2. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta, Tata McGraw Hill
- 3. Geotechnical Engineering by Purushottama Raj
- 4. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers

5. Rocks Mechanics by B.P.Verma
6. Geotechnical Engineering – Principles & Practices by Donald. P. Coduto, Pearson Education
7. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R.Rao, Newage International
8. Physical and Geotechnical Properties of Soils by Joseph.E.Bowles, International Students Edition
9. Rocks Mechanics by Goodman.

## 201004: Fluid Mechanics I

### Teaching Scheme

Lectures: 04 hours/week

Practicals: 02 hours/week

### Examination Scheme

Paper: 100 Marks

Oral: 50 Marks

Term work: 25 Marks

## SECTION I

### Unit 1: Properties of Fluids & Dimensional Analysis.

- Definition of fluid and fluid mechanics: examples and practical applications involving fluids at rest and in motion, physical properties of fluids: density, specific weight, specific volume, relative density and viscosity. Newton's law of viscosity, classification of fluids, rheological diagram, Dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure, problems involving use of above fluid properties.
- Dimensions of physical quantities, dimensional homogeneity, dimensional analysis using Buckingham's  $\pi$  theorem method, geometric kinematic and dynamic similarity, important dimensionless parameters, Reynold's No., Froude No. and their significance.

(08 hours)

### Unit 2: Fluid Statics, Buoyancy, Relative Equilibrium.

- The basic equation of hydrostatics, concept of pressure head, measurement of pressure (absolute, gauge), application of the basic equation of hydrostatics, simple manometers, differential manometers and precision manometers. Introduction to pressure transducers. Centre of pressure, total pressure on plane and curved surfaces, pressure diagrams, practical applications.
- Principle of floatation and buoyancy, equilibrium of floating bodies, stability of floating bodies. Metacentre and metacentric height and its determination (experimental & analytical). Relative Equilibrium, uniform linear acceleration, rotation about a vertical axis.

(08 hours)

### Unit 3: Fluid Kinematics.

- Methods of describing the motion of fluid, velocity and acceleration, and their components in Cartesian co-ordinates, stream line, stream tube, path line, and streak line, control volume. Classification of flow, steady and unsteady, uniform and non-uniform, laminar and turbulent. One, two, and three-dimensional flows.
- Equation of continuity for three dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and irrotational motion, velocity potential, stream function and flow net, methods of drawing flow net, uses and limitations of flow net.

(08 hours)

## SECTION II

### Unit 4: Fluid dynamics, Bernoulli's equation

- Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, assumptions of Bernoulli's equation, kinetic energy correction factor. Hydraulic grade line and total energy line. Linear momentum equation and momentum correction factor.
- Venturimeter, orificemeter, nozzle meter, Flow through sharp edged circular orifice discharging free, partially & fully submerged orifices, mouthpiece, pitot tube. (08 hours)

### Unit 5: Laminar flow & boundary layer theory.

- Reynolds experiment, laminar flow through a circular pipe, flow between two parallel plates, Stokes' law, methods of measurement of viscosity, flow through porous media, Darcy's law. Transition from laminar to turbulent flow.

- b) Development of boundary layer on a flat plate, nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sublayer, Local and mean drag coefficients, hydrodynamically smooth and rough boundaries. Boundary Layer separation and its control. **(08 hours)**

### **Unit 6: Turbulent flow & Flow through Pipes**

- a) Characteristics of flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing length theory, velocity distribution in turbulent flow.
- b) Flow through pipes: energy losses in pipe flow( major losses and minor losses), Darcy Weisbach Equation, variation of friction factor for laminar flow and for turbulent flow, smooth and rough, Nikuradse's experiments on artificially roughened pipes, friction factor for commercial pipes, Moody's diagram, explicit equation for friction factor, flow through pipes such as simple, compound, series parallel, branched pipes, siphon, Dupuit equations. **(08 hours)**

### **Term Work**

**Term work will consist of a journal giving the detailed report of experiments**

#### **A] Experiments (any eight)**

1. Measurement of viscosity
2. Study of pressure measuring devices
3. Study of stability of floating bodies
4. Flow net by electrical analogy for flow below weir (with & without sheet pile)
5. Study of Bernoulli's theorem with reference to loss of energy
6. Calibration of Venturimeter / Orificemeter
7. Calibration of orifice / notch
8. Study of laminar flow using Reynolds apparatus or Hele-Shaw's apparatus
9. Study of laminar & turbulent flow through pipes

#### **B ] Assignments**

1. Graphical method of drawing flow net
2. At least two problems to be solved by computer

#### **Oral Examination**

Oral Examination shall be based on term work of the candidate

#### **Reference Books**

1. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.
2. Fluid Mechanics by Garde Mirajgaonkar, SCITECH Publication
3. Fluid Mechanics by Dr A. K.Jain
4. Hydraulics & Fluid Mechanics by Modi and Seth, Standard Book House
5. Introduction to Fluid Mechanics by S K Som and G Biswas, Tata McGraw Hill.
6. Fluid Mechanics with Engineering Applications by Daugherty, Franzini & Fennimore, SI Metric Edition by K Subramanya, McGraw Hill.
7. Fluid Mechanics by White, McGraw Hill.
8. Mechanics of Fluids by Irving Shames, McGraw Hill.
9. Fluid Mechanics: Fundamentals & Applications by Cengel, Cimbala, McGraw Hill Higher Education.

## 202005: Building Planning

### Teaching Scheme

Lectures: 03 hours/week

Practices: 04 hours/week

### Examination Scheme

Paper: 100 marks (04 hours)

Term Work: 25 marks

Oral: 50 marks.

## SECTION I

### Unit 1 : Town Planning and Planning of Buildings

- a) Necessity of Towns for safety, amenities and services and buildings of different types for activities-living, working and leisure. Land – zoning : Introduction to different zones of land in town planning, Requirements of residential zone, commercial industrial and agricultural zone, open areas, green belts and parks, Importance of development plan. Role of Plan Sanctioning Authority for Townships, co-op Housing societies and apartments. Ownership of land, plot, 7/12 abstract, meanings of different terms of 7/12 abstract, 6-D form, list of documents to be submitted along with building Plan for sanction from the authority.
- b) Planning of Building – Principles of Architectural Planning and Design, Function/Utility, form, planning for utility and aesthetics, submission drawings, working drawings. Planning concepts of green buildings, eco friendly and cost effective buildings, rain harvesting systems. **(6 hours)**

### Unit: 2 Building bye Laws and Design of Buildings

- a) **Building rules and Bye laws** : Necessity of building rules and bye laws, plot sizes, road widths, open spaces, floor area ratio of (FAR), marginal distances, building line, control line, heights regulations, room sizes, Area calculations for Built up area, floor area, carpet area, rules for ventilation, lighting drainage, sanitation and parking of vehicles, rules for layout plans. TDR, certificate of commencement and completion, various no objection certificates to be produced, format of permissions from pollution control board, MSEB, Water Supply and Drainage Department, State or National Highway Department. Design of buildings for different climatic conditions, comfort standards and safety measures.
- b) **Ventilation** – Necessity of Ventilation, Natural ventilation stack effect, wind effect, orientation with respect to ventilation, mechanical ventilation, objectives, selection of ventilation system, air conditioning: necessity, design data, comfort factors, calculation of air conditioning cooling load, air distribution, air conditioning system.
- Lighting** – Principles, day lighting design of windows, artificial illumination, solar energy systems for lighting. **(06 hours)**

### Unit 3: Design of Buildings

- a) **Noise and Acoustics**: noise control, sound insulation, Acoustics: reverberation, acoustical defects, conditions of good acoustics, sound absorbents.
- Fire Protection**: fire safety, fire load, grading of occupancies by fire loads, consideration in fire protection, properties of fire resistant construction: wall, column, roofs and floors, wall openings, fire escape elements.
- b) **Building Services** – importance of building services, constructional requirements of different building services: Lifts, escalators, telecommunication, electrical, entertainment, use of solar energy for heating of water.
- Plumbing Services** – water storage tanks at Ground level and on terrace, calculation of storage capacity, layout of water supply and drainage systems. **(06 hours)**



## **SECTION II**

### **Unit 4 Planning of Residential Buildings**

Bungalows, Row houses, Ownership flats and Apartments. Detailed working plans, design of a staircase, calculation of built-up area. **(06 hours)**

### **Unit 5 Planning of Residential Buildings**

Bungalows, Row houses, Ownership flats and Apartments: Elevation, detailed sections, specifications and construction notes, foundation details, perspective drawing: one point and two point. **(06 hours)**

### **Unit 6 Planning of Public Buildings**

Planning of Public buildings: educational buildings, buildings for health care, industrial buildings and commercial buildings. Dimensioned line plans of various public buildings. **(06 hours)**

**Note: 1. There will be no internal option for questions in Section II**

**2. Answers to questions in Section II will be drawn on drawing sheets only.**

#### **Term work:**

A) Students should prepare working drawings of any one type of building (either residential or public). Individual project to be planned. Submission of working drawing on 1:50 or suitable scale.

1. Layout Plan
2. Typical floor plan (by hand as well as by using computer software)
3. Elevation (by hand as well as by using computer software)
4. Foundation Plan (on tracing paper)
5. Structural Plan (on tracing paper)
6. Sectional Elevation
7. Axonometric view (on tracing paper)
8. Water Supply and Drainage layout. (On tracing paper)

B) Detailed line plans of any four public buildings to be drawn on graph papers.

C) Collection of brochures/information/literature for housing schemes,

#### **Text/Reference Books**

1. Building Drawings with an integrated Approach to Built-Environment – Shah, Kale and Patki- Tata McGraw Hill co. 4<sup>th</sup> edition.
2. National Building Code (latest)
3. Building Design and construction by Merrit Tata McGraw Hill
4. Times Saver standards of Architectural Design Data by Callender – Tata McGraw Hill
5. Building science and planning by Dr. S. V. Deodhar.
6. Building services by S.M.Patil

## 201006: Surveying

### Teaching Scheme

Lectures: 04 hours/week  
Practicals: 02 hours/week  
Drawing: 02 hours/week

### Examination Scheme

Paper: 100 marks (03 hours)  
Term Work: 25 marks  
Practical: 50 marks

## SECTION I

### Unit 1: Compass and Plane Table Surveying.

- a) Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction and correction for local attraction, dip, declination and calculation of true bearings.
- b) Equipment required for plane table surveying and their uses, advantages and disadvantages, errors and precisions in plane table surveying, methods of plane table survey: radiation, intersection, traversing and simple resection. **(08 hours)**

### Unit 2: Leveling and Contouring.

- a) Construction and use of dumpy level, auto level, digital level and laser level, principle axes of dumpy level, testing and permanent adjustments, reciprocal leveling, curvature and refraction corrections, distance to the visible horizon.
- b) Contouring: direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications. **(08 hours)**

### Unit 3: Theodolite Surveying

- a) Study of vernier transit 20" theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite, elevation of inaccessible objects by trigonometrical leveling using a 20" transit theodolite.
- b) Theodolite traversing: computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table, omitted measurements, area calculation by independent co-ordinates, open traverse and its uses, measurement of deflection angles using transit theodolite, open traverse survey, checks in open traverse. **(8 hours)**

## SECTION II

### Unit 4: Permanent Adjustments of a Transit Theodolite and Tachometry.

- a) Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite.
- b) Tachometry: application and limitations, principle of stadia tachometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points. **(8 hours)**

### Unit 5: Curves

- a) Introduction to horizontal and vertical curves, different types and their applications, simple circular curves, elements and setting out by linear methods, offsets from long chord and offsets from chords produced, angular method, Rankine's method of deflection angles.
- b) Transition curves: necessity and types, elements of cubic parabola, computation of data required for setting out a combined curve, setting out a transition curve by linear and deflection angle methods. **(8 hours)**

### **Unit 6: Construction Survey and Electronic Measurement Techniques.**

- a)** Introduction to construction survey, establishing of horizontal and vertical controls, setting out of buildings, maintaining verticality of tall buildings, survey for roads, drainage lines, tunnels
- b)** Surveying using total station – Construction, types, principle features, field equipment, method of use, introduction to various special functions available in a total station. **(8 hours)**

### **Term work**

**It shall consist of practical exercises and projects as detailed below.**

1. Study of prismatic compass, measurement of magnetic bearings of sides of a triangle, correction for local attraction and conversion into true bearings.
2. Radiation, intersection and traversing methods in plane table survey.
3. Study and use of auto level/ digital/ laser level, compound leveling and fly leveling, reduction of levels by rise and fall method and plane of collimation method.
4. Study of vernier transit theodolite and measurement of horizontal angles (by repetition method) and measurement of vertical angles.
5. **Project I:** Theodolite traverse Survey project of a closed traverse with at least four stations, computation of area of the traverse.
6. Computation of horizontal distances and elevations by tacheometry.
7. **Project II:** Tachometric contouring project with at least two instrument stations about 60 m to 100 m apart.
8. Setting out a circular curve by Rankine's method of deflection angles or by offsets from chords produced.
9. **Project III:** Road project for a minimum length of 200 m including fixing of alignment, profile leveling, cross-sectioning, plotting of L section and Cross Section.
10. Study of Total Station, traversing using a total station.
11. Setting out a building from a given foundation plan.
12. Writing a computer program for any one of the exercises listed above.

### **Text/Reference books:**

1. Surveying and Levelling by Vol. I and Vol. II – T.P.Kanetkar and S.V.Kulkarni
2. Surveying and Levelling by Subramanian, Oxford University Press.
3. Surveying, Vol. I & II by Dr.B.C.Punmia, Ashok K. Jain, Arun K.Jain
4. Surveying and Levelling by N. N. Basak
5. Surveying Vol. I & II by Dr.K. R. Arora
6. Surveying, Vol. I & II by S. K. Duggal
7. Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail
8. Surveying theory and practices by Devis R. E., Foot F. S.
9. Plane and Geodetic surveying for Engineers. Vol. I by David Clark
10. Principles of Surveying. Vol. I by J.G.Olliver, J.Clendinning

## **201007: Concrete Technology**

### **Teaching scheme:**

Lecturers: 03 hour/week

Practical: 02 hour/week

### **Examination scheme**

Paper: 100 marks

Term work: 25 marks

## **SECTION I**

### **Unit 1: Introduction to Concrete as a Construction Material: General Perspective**

#### **Ingredients of Concrete.**

a) Cement – manufacture of Portland cement, basic chemistry of cement, hydration of cement, classification of cement, types of cement, tests on cement. Fly Ash: properties of fly ash, tests on fly ash.

b) Aggregate and water – classification, mechanical properties, physical properties, deleterious materials, soundness, alkali-aggregate reaction, sieve analysis: fineness tests on aggregates, artificial and recycled aggregate, mixing water, curing water, tests on water.

c) Admixture – functions, classification, types: mineral and chemical, IS: specifications (9103 and 456), compatibility of admixture.

**(06 hours)**

#### **Unit 2: Properties, Production and Placement of Concrete**

a) Fresh concrete: workability – factors affecting workability, cohesion and segregation, bleeding, workability tests, mixing- handling, placing and compaction of concrete, curing methods, influence of temperature, maturity rule.

b) Hardened concrete: strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, other strength properties, relation between tensile and compression strengths, impact strength, abrasion resistance, elasticity and creep, shrinkage and swelling.

**(06 hours)**

#### **Unit 3: Concrete Mix Design.**

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control, methods of Mix Design- IS (10262, 456) and DOE. **(06 hours)**

## **SECTION II**

### **Unit 4: Testing of Concrete and Formwork**

a) Testing of concrete: analysis of fresh concrete, strength tests, test cores. Non destructive testing: Rebound hammer, Ultrasonic pulse velocity, Pullout test and Impact echo test, marsh cone test

b) Formwork: Types, basic members in form work and principles of design. **(06 hours)**

#### **Unit: 5 Special Concretes and Special Concreting Techniques.**

a) Introduction to concrete related equipment: batching plants, hauling, pumps, mixers and vibrators

b) Special concrete: light weight concrete, polymer concrete, types of fibers, fiber reinforced concrete, high density concrete, self compacting concrete and applications.

c) Special concreting techniques: pumping of concrete, under water concreting, ready mixed concrete, roller compacted concrete and Ferro cement. **(06 hours)**

#### **Unit: 6 Deterioration and repairs.**

a) Deterioration: permeability and durability, chemical attack and sulphate attack by seawater, acid attack, chloride attack, carbonation of concrete and its determination, corrosion of reinforcement.

- b) Repairs:** symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects, common types of repairs, shotcrete. **(06 hours)**

### **Term Work**

Term Work shall consist of a journal giving a detailed report of experiments and site visits of the following.

#### **A) Experiments.**

1. Fineness, standard consistency, initial and final setting time, soundness and compressive strength on cement.
2. Fineness of fly ash
3. Specific gravity and density, sieve analysis, flakiness and elongation, moisture content, impact Value and crushing Value of aggregate.
4. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
5. Compressive and tensile strength of hardened concrete, Rebound hammer test.
6. Concrete mix design by IS code method.

#### **B) At least one site visit and technical report there on.**

### **Text/Reference Books**

1. Concrete technology by M. L. Gambhir, Tata Mcgraw Hill Publications.
2. Concrete Technology by M.S. Shetty, S. Chand Publications.
3. Concrete Technology by A R Santhakumar, Oxford University Press.
4. Properties of concrete by A. M. Neville, Longman Publishers.
5. Concrete Technology by R.S. Varshney, Oxford and IBH.
6. Concrete, by P. Kumar Metha, Gujrat Ambuja.
7. Concrete technology by A M. Neville, J.J. Brooks, Addison Wesley

## 201208: Structural Analysis I

### Teaching scheme

Lectures: 04 hours/week

### Examination scheme

Paper: 100 marks

### SECTION I

#### Unit 1: Fundamentals of Structure, Slope and Deflection.

- a) Basic concept of structural mechanics - types & classification of structures based on structural forms, concept of indeterminacy- static and kinematics degree of indeterminacy.
- b) Slope and deflection of determinate beams by Macaulay's method, concept of moment area method and conjugate beam method and its application.
- c) Strain energy: Castigliano's first theorem, application to find slope and deflection of simple beams and frames. **(08 hours)**

#### Unit 2: Analysis of Indeterminate Beams and Frames.

- a) Analysis of indeterminate beams: propped cantilever and fixed beams by strain energy method, analysis of continuous beams by three moment theorem (Clapeyron theorem) up to three unknowns.
- b) Castigliano's second theorem, analysis of continuous beams and rectangular portal frames with indeterminacy up to two degrees. **(08 hours)**

#### Unit 3: Analysis of Determinate and Indeterminate Plane Trusses.

- a) Deflection of determinate trusses by Castigliano's first theorem.
- b) Analysis of redundant trusses by Castigliano's second theorem, lack of fit, sinking of support, temperature changes (indeterminacy up to second degrees). **(08 hours)**

### SECTION – II

#### Unit 4: Plastic Analysis of Structure.

- a) True and idealized stress-strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage. Concept of plastic hinge and collapse mechanism, statical and kinematical method of analysis, upper, lower bound and uniqueness theorem.
- b) Plastic analysis of determinate and indeterminate beams, single bay single storied portal frame. **(08 hours)**

#### Unit 5: Influence line diagram.

- a) Influence lines diagram: basic concept, Muller-Breslau's principle, influence line diagram for simply supported, overhanging and compound beams.
- b) Influence line diagram: application of influence line diagram for determination of axial forces in the members of plane determinate trusses under dead load and live load. **(08 hours)**

#### Unit 6: Rolling loads.

- a) Application of influence line diagram for determination of shear force and bending moment in beams due to uniformly distributed load, shorter and longer than span.
- b) Application of influence line diagram for determination of shear force and bending moment in beams due to two concentrated loads at some distance apart, series of concentrated loads, condition of maximum bending moment, absolute maximum bending moment, concept of equivalent uniformly distributed load. **(08 hours)**

### Text/Reference Books

1. Mechanics of Structures Vol. II by S B Junnarkar and DR. H J Shah, Charotar.

2. Structural analysis: a matrix approach by Pandit and Gupta, Tata McGraw Hill.
3. Basic Structural Analysis by C S Reddy, Tata Mc Graw Hill.
4. Structural Analysis by R C Hibbler, Pearson Education.
5. Plastic Methods of Structural Analysis by B. G. Neal, Chapman and Hall.
6. Elementary Structural Analysis by Norris, Wilbur and Utku, TMH.
7. Intermediate Structural Analysis by C K Wang, Mc Graw Hill.