

Fifth Semester

BTCE 501 Design of Steel Structures – I

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 2 0

Note: Relevant Indian Codes of Practice are permitted in Examination.

- 1. Introduction:** Properties of structural steel, I.S. rolled sections, I.S. specifications.
- 2. Connections:** Riveted, bolted and welded connections for axial and eccentric loads.
- 3. Tension members:** Design of members subjected to axial tension.
- 4. Compression members:** Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens.
- 5. Flexural members:** Design of laterally restrained and un-restrained rolled and built-up sections, encased beams.
- 6. Column bases:** Design of slab base, gusseted base and grillage foundation.
- 7. Roof truss:** Design loads, combination of loads, design of members (including purlins) and joints, detailed working drawings.

BOOKS & CODES RECOMMENDED:

- 1) Limit state design of steel structures: S K Duggal, Mc Graw Hill
- 2) Design of steel structures: N Subramanian Oxford Higher Education
- 3) Design of steel structures (Vol. 1): Ram Chandra Standard Book House - Rajsons
- 4) Design of steel structures (by limit state method as per IS: 800-2007): S S Bhavikatti / K International Publishing House
- 5) IS 800: 2007 (General construction in steel-Code of practice)*
- 6) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*

* permitted in Examination

BTCE-502 Geotechnical Engineering

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 2 0

- 1. Basic Concepts:** Definition of soil and soil mechanics, common soil mechanics problems in Civil Engineering. Principal types of soils. Important properties of very fine soil. Characteristics of main Clay mineral groups. Weight volume relationship and determination of specific gravity from pycnometer test. Field density from sand replacement method and other methods.
- 2. Index Properties:** Grain size analysis. Stokes's law and Hydrometer analysis. Consistency and sensitivity of Clay, Atterberg Limits, Flow Index and Toughness Index. Underlying theory of shrinkage limit determination. Classification of coarse and fine grained soils as per Indian Standard.
- 3. Compaction:** Definition and object of compaction and concept of O.M.C. and zero Air Void Line. Modified proctor Test. Factors affecting compaction Effect of compaction on soil properties and their discussion. Field compaction methods- their comparison of performance and relative suitability. Field compactive effort, Field control of compaction by proctor.
- 4. Consolidation:** Definition and object of consolidation, Difference between compaction and consolidation. Concept of various consolidation characteristics i.e. a_v , m_v and c_v , primary and secondary consolidation. Terzaghi's Differential equation and its derivation. Boundary conditions for Terzaghi's solution for one dimensional consolidation concept of c_v , t_v & U . consolidation test determination of c_v from curve fitting methods, consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over-consolidation. Effect of disturbance on e - $\log \sigma$ curves of normally consolidated clays, importance of consolidation settlement in the design of structures.
- 5. Permeability and Seepage:** Concept of effective stress principal, seepage pressure, critical hydraulic gradient and quick sand condition. Capillary phenomenon in soil. Darcy's Law and its validity, seepage velocity, co-efficient of permeability (k) and its determination in the laboratory. Average permeability of stratified soil mass, factors affecting 'k' and brief discussion.
- 6. Shear Strength:** Stress analysis of a two dimensional stress system by Mohr circle. Concept of pole. Coulomb's law of shear strength coulomb - Mohr strength theory. Relation between principal stresses at failure. Direct, triaxial and unconfined shear strength tests. Triaxial shear tests based on drainage conditions typical strength envelopes for clay obtained from these tests. Derivation of skempton's pore pressure parameters. Stress strain and volume change characteristics of sands.
- 7. Stability of Slopes:** slope failure, base failure and toe failure - Swedish circle method - $\phi=0$ analysis and $c=0$ analysis - friction circle method - Taylor's stability number - stability charts - sliding block analysis

Books:-

1. Soil Mech. & Foundation Engg, by K.R.Arora Standard *Publishers* Distributors
2. Geotechnical Engineering, by P. Purshotama Raj *Tata Mcgraw Hill*
3. Soil Mech. & Foundation Engg., by V.N.S.Murthy CBS *Publishers* & Distributors.
4. Principle of Geotechnical Engineering by B.M.Das Cengage Publisher
5. Basic and applied Soil Mechanics by Gopal Ranjan and A.S.R.Rao New Age International Publishers
6. Geotechnical Engineering by Gulati and Datta, Tata McGraw Hill
7. Problems in Soil mechanics and Foundation Engineering by B.P.Verma, Khanna Publishers.

BTCE-503 Structural Analysis-II

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 2 0

Pre-requisite: Structural Analysis-1

Indeterminate Structures: Concept of indeterminate /redundant structures; Static and kinematic indeterminacies; stability of structures; internal forces; Conditions of stress-strain relationships, equilibrium and compatibility of displacements; Solution of simultaneous algebraic equations.

Indeterminate Structural Systems: Pin-jointed and rigid-jointed structural systems; Deformation of redundant structures-sway and non-sway frames, elastic curve; Static equilibrium and deformation compatibility checks; Effects of support settlement and lack of fit; Fixed-end moments—member loading, sinking of supports, temperature; Analysis of redundant beams, frames, trusses, arches using following methods:

- a) **Conventional Methods: Slope deflection method; Moment distribution method; Rotation contribution method (Kani's Method).**
- b) **Classical Methods:** Methods of consistent deformation; Theorem of three moments.
- c) **Approximate Methods:** Portal method; Cantilever method; Substitute frame method.

Influence Line Diagrams: Concept and application in the analysis of statically indeterminate structures; Influence line for bar forces in the statically indeterminate trusses, beams and frames.

RECOMMENDED BOOKS :

1. Basic structural analysis - C.S. Reddy Tata McGraw-Hill
2. Intermediate structural analysis - C . K. Wang. McGraw Hill
3. Indeterminate structural analysis - J. Sterling Kinney Addison-Wesley Educational Publishers
4. Theory of structures - B.C. Punima, Laxmi Publications
5. Structural Analysis, Devdas Menon, Narosa Publishers.

BTCE-504 Transportation Engineering – I

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 1 0

Highway Engineering

1. **Introduction:** Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.
2. **Highway Development & Planning:** Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys.
3. **Highway Alignment:** Requirements, Alignment of Hill Roads, Engineering Surveys.
4. **Highway Geometric Design:** Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves.
5. **Highway Materials:** Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.
6. **Highway Construction:** Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.
7. **Highway Drainage and Maintenance:** Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.
8. **Highway Economics & Financing:** Total Transportation Cost, Economic Analysis, Sources of Highway Financing.

Traffic Engineering

9. **Traffic Characteristics:** Road User Characteristics, Driver Characteristics, Vehicular Characteristics.
10. **Traffic Studies:** Volume Studies, Speed Studies, O-D Survey, Parking Study.
11. **Traffic Safety and Control Measures:** Traffic Signs, Markings, Islands, Signals, Cause and Type of Accidents, Use of Intelligent Transport System.
12. **Traffic Environment Interaction:** Noise Pollution, Vehicular Emission, Pollution Mitigation Measures.

Books Recommended:

1. Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee, 1998.
2. Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.
3. Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
4. Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.
5. Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, New Delhi.

BTCE-505 Environmental Engineering - I

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 1 0

- 1. Introduction:** Beneficial uses of water, water demand, per capita demand, variations in demand, water demand for fire fighting, population forecasting and water demand estimation.
- 2. Water sources and development:** Surface and ground water sources; Selection and development of sources; Assessment of potential; Flow measurement in closed pipes, intakes and transmission systems.
- 3. Pumps and pumping stations:** Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.
- 4. Quality and Examination of Water:** Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.
- 5. Water treatment:** Water treatment schemes; Basic principles of water treatment; Design of plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and defluoridation, and water desalination and demineralization, taste and odour removal.
- 6. Transportation of Water:** Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.
- 7. Rural water supply:** Principles, selection of source, rain water harvesting, quantitative requirements, low cost treatment techniques.

Books:-

1. Water Supply Engineering- Environmental Engg. (Vol. – I) by B.C. Punmia, Ashok Jain, Arun Jain, Laxmi Publications, New Delhi.
2. Environmental Engg. - A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi.
3. “Environmental Engg.” By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
4. Water Supply Engineering- Environmental Engg. (Vol. – I) by S.K. Garg, Khanna Publishers, Delhi.
5. Water Supply and Sewerage by Steel EW and McGhee, Terence J.; McGraw Hill.

BTCE-506 Transportation Engineering Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

I Tests on Sub-grade Soil

1. California Bearing Ratio Test

II Tests on Road Aggregates

2. Crushing Value Test
3. Los Angles Abrasion Value Test
4. Impact Value Test
5. Shape Test (Flakiness and Elongation Index)

III Tests on Bituminous Materials and Mixes

6. Penetration Test
7. Ductility Test
8. Softening Point Test
9. Flash & Fire Point Test
10. Bitumen Extraction Test

IV Field Tests

11. Roughness Measurements Test by Roughometer
12. Benkelman Beam Pavement Deflection Test

Books/Manuals Recommended :

1. Khanna S.K., and Justo, C.E.G. "Highway Material & Pavement Testing", Nem Chand and Brothers, Roorkee.

BTCE-507 Geotechnical Engineering Lab

Internal Marks: 30

External Marks: 20

Total Marks: 50

L T P

0 0 2

1. Determination of in-situ density by core cutter method and Sand replacement method.
2. Determination of Liquid Limit & Plastic Limit.
3. Determination of specific gravity of soil solids by pycnometer method.
4. Grain size analysis of sand and determination of uniformity coefficient (C_u) and coefficient of curvature (C_c).
5. Compaction test of soil.
6. Determination of Relative Density of soil.
7. Determination of permeability by Constant Head Method.
8. Determination of permeability by Variable Head method.
9. Unconfined Compression Test for fine grained soil.
10. Direct Shear Test
11. Triaxial Test
12. Swell Pressure Test

Books Recommended:-

Soil Testing Engineering, Manual By Shamsheer Prakash and P.K. Jain. Nem Chand & Brothers

BTCE-508 Computer Aided Structural Drawing

Internal Marks: 30

External Marks: 20

Total Marks: 50

L T P

0 0 3

- 1) Structural Drawings of Reinforced Concrete Elements such as Beams, Slabs.
- 2) Structural Drawings of Steel Elements such as Connections, Tension Members, Compression Members, Beams, Column Base, and Roof Trusses.

BTCE-509 Survey Camp

Internal Marks: 100

External Marks: 50

Total Marks: 150

Survey Camp of 4 weeks duration will be held immediately after IVth semester at a Hilly Terrain. The students are required to prepare the Topographical Map of the area by traditional method. Students should also be exposed to modern Survey Equipment and practices, like Total Station, Automatic Level, GPS etc.