

SEMESTER VI

SUBJECT CODE	COURSE TITLE	L	P	M
THEORY				
	Structural Analysis II	3	0	100
	Structural Design II	3	0	100
	Transportation Engineering II	3	0	100
	Environmental Science and Engineering	3	0	100
	Foundation Engineering	3	0	100
	Elective I	3	0	100
PRACTICALS				
	Computer Aided Design and Drawing	0	3	100
	Concrete and Construction Technology Lab	0	3	100
	Survey Camp	-	-	-

SEMESTER VI STRUCTURAL ANALYSIS II

UNIT -1 DEFLECTION OF DETERMINATE STRUCTURES

9

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid plane frames –Williott diagram.

UNIT -2 FLEXIBILITY METHOD FOR INDETERMINATE FRAMES

9

Equilibrium and compatibility - Determinate vs indeterminate structures –Indeterminacy - primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT -3 SLOPE DEFLECTION METHOD

9

Continuous beams and rigid frames (with and without sway) - Symmetry and unsymmetrical – Simplification for hinged end - Support displacements.

UNIT -4 MOMENT DISTRIBUTION METHOD

9

Stiffness and carry over factors – Distribution and carry over of moments - Analysis of continuous Beams - Plane rigid frames with and without sway - Naylor's simplification.

UNIT -5 MATRIX STIFFNESS METHOD

9

Element and global stiffness matrices– Co-ordinate transformations – Rotation matrix – transformations of stiffness matrices, load vectors and displacement vectors – Analysis of Continuous Beams – Analysis of pin-jointed plane frames and rigid frames.

Total Hours = 45

Text Books

1. Theory of structures – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 1999
2. Indeterminate Structural Analysis – S.J. Kinney, Oxford IBH Publishing Co., 1999.

References

1. Matrix analysis of framed structures – William Weaver, Jr & James M.Gere, CBS Publishers

& Distributors, Delhi, 1995

2. Structural Analysis – A Matrix Approach – G.S.Pandit & S.P.Gupta, Tata McGraw-Hill, 1998

**SEMESTER VI
STRUCTURAL DESIGN II**

UNIT -1 METHODS OF DESIGN OF CONCRETE STRUCTURES

9

Concept of elastic method ultimate load method and limit state method- advantages of limit state method over other methods-design codes and specification-limit state philosophy as detailed in current IS code- design of flexural members and slabs by working stress method and ultimate load method- design of water retaining structures-un cracked section (resistance to cracking)- moment of resistance (limited stress approach)

UNIT -2 LIMIT STATE DESIGN FOR FLEXURE

9

Analysis and design of one way and two way slabs – rectangular slab subjected to uniformly distributed and concentrated loads – boundary conditions and corner effects – singly and doubly reinforced rectangular and flanged beams - design aids for flexure-deflection and crack width control

UNIT -3 LIMIT STATE DESIGN FOR SHEAR TORSION BOND AND ANCHORAGE

9

Behaviour of RC beams in shear and torsion-shear and torsion reinforcement-limit state design of R C members for combined bending shear and torsion- use of design aids

UNIT -4 LIMIT STATE DESIGN OF COLUMNS

9

Types of columns-analysis and design of short columns for axial un axial and bi axial bending-design of long columns- use of design aids

UNIT -5 LIMIT STATE DESIGN OF FOOTINGS AND MASONRY STRUCTURES

9

Design of wall footing-design of axially and eccentrically loaded rectangular footing-design of combined rectangular footing for two columns only- design of masonry walls, pillars and footings as per NBC and IS codes

Total Hours = 45

Text Books

1. Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hall of India, Private, Limited New Delhi, 1997
2. Dayaratnam P, Brick and Reinforced Brick Structures, Oxford & IBH Publishing Company Private Limited 1997

References:

1. Mallick and Gupta, Reinforced Concrete Design, Oxford and IBH, Delhi, 1997
2. Design Aides to IS 456-1978 (SP-16)
3. Code of Practice for Plain and Reinforced Concrete – IS456-2000

SEMESTER VI
TRANSPORTATION ENGINEERING II
UNIT -1 RAILWAY PLANNING AND DESIGN

9

Role of Indian Railways in National Development. Engineering Survey for Track Alignment. Permanent Way, its Components and Functions of Each Component, Gauges in Railway Tracks. Coning of Wheels. Geometric Design of Railway Tracks – Gradient, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Vertical Curves and Grade Compensation (Derivations of formulae and Problems)

UNIT -2 RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION

9

Points and Crossings, Signaling, Interlocking and Track Circuiting, Construction and Maintenance – Conventional and Modern methods (Remote Sensing, GIS & GPS) for Railway Alignment, Track Construction, Maintenance and Materials - Track Drainage. Lay outs of Railway Stations and Yards

UNIT -3 AIRPORT PLANNING AND DESIGN

9

Airport Planning, Components of Airports, Airport Site Selection Runway Design-Orientation, Geometric Design and Correction for Gradients Terminal area, Airport Layout, Airport Buildings, Passenger Facilities, Parking Area and Airport Zoning

UNIT -4 HARBOUR ENGINEERING & OTHER MODES OF TRANSPORT

9

Definition of Terms - Harbours, Ports, Docks, Tides and Waves. Harbours – Requirements, Classification – Site Investigation for Locations, Planning and Layouts Concept of Satellite Ports. Terminal Facilities – Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Mooring Accessories, Navigational Aids Coastal Structures- Piers, Breakwaters, Wharves, Jetties, Quays, Spring Fenders Coastal Shipping, Inland Water Transport and Container Transportation. Pipe Ways, Rope Ways

UNIT -5 ECONOMIC EVALUATION OF TRANSPORT PROJECTS

9

Evaluation of Highway and Railway Projects- Cost Benefit Analysis (Benefit Cost Ratio, Net Present Value, Internal Rate of Returns (Problems) Environmental Impact Assessment, Financial Appraisal Build, Operate and Transfer for Highway and Railway Projects (Basic Concepts only)

Total Hours = 45

Text Books:

1. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.
2. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Brothers, Roorkee, 1994.

References:

1. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
2. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
3. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publication,
Delhi, 1992

SEMESTER VI
ENVIRONMENTAL SCIENCE AND ENGINEERING

UNIT -1 INTRODUCTION AND COMPONENTS OF ENVIRONMENT

9

Definition - Scope and Role of Environmental Engineer - Components – Water, air and land – Inter-relationship between components – Subcomponents; Ecosystem – Structure and functional components of ecosystem – Development and evolution of ecosystem – Energy flow and material cycling in ecosystem.

UNIT -2 ENVIRONMENTAL IMPACTS OF DEVELOPMENT

9

Natural and man made impacts on water, air and land; Environment and development – Concept of sustainable development - Environmental impacts of Development – sustainable development – Environmental pollution – Water, Air and Land.

UNIT -3 PLANNING FOR WATER SUPPLY AND SEWERAGE SYSTEMS

9

Public water supply and sewerage systems – Objectives – Design period – Population forecasting – Water demand – Sources of water – Source Selection – Water quality – Characterization – Water quality standards – Sources of wastewater – Quantity of sanitary sewage – Estimation of storm runoff – Characteristics and composition of sewage and their significance – Effluent standards.

UNIT -4 CONVEYANCE SYSTEM

9

Water supply – intake structures – Pipe materials - Hydraulics of flow in pipes – Transmission main design – Laying, jointing & testing of pipes – appurtenances – Pumps – Sewerage – Hydraulics of flow in sewers – Design of sanitary and storm sewers – Computer applications – Laying, jointing & testing of sewers – appurtenances – Pumps.

UNIT -5 WATER SUPPLY AND DRAINAGE IN BUILDINGS

9

Principles of design of water supply and drainage in buildings – House service connection – Sanitary fixtures and fittings – Systems of sanitary plumbing – House drainage – House sewer connection.

Total Hours = 45

Text Books:

1. Garg, S.K., Environmental Engineering, Vols. I and II, Khanna Publishers, New Delhi, 1994

2. C.S.Shah, Water Supply and Sanitation, Galgotia Publishing Company, New Delhi, 1994.

References:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993
3. H.S.Peavy, D.R.Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company, New Delhi, 1995.

**SEMESTER VI
FOUNDATION ENGINEERING**

UNIT -1 SITE INVESTIGATION AND SELECTION OF FOUNDATION

9

Introduction – Scope and objectives – Method of exploration boring – Sampling – disturbed and undisturbed sampling – sampling techniques – Bore log and report – Penetration tests (SPT and SCPT) – Data interpretation – Selection of foundation based on soil condition.

UNIT -2 SHALLOW FOUNDATION

9

Introduction – Location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – bearing capacity from insitu tests – Factors influencing bearing capacity – codal provisions – Settlement – Components of settlement – Settlement of foundations on granular and clay deposits – Allowable and maximum differential settlements of buildings – Codal provision – Methods of minimizing settlement.

UNIT -3 FOOTINGS AND RAFTS

9

Types of foundation – structural design of spread footing – Design aspects of combined and mat foundation – Codal provisions.

UNIT -4 PILES

9

Types of piles – Factors influencing the selection of pile – Carrying capacity in granular and cohesive soils – Static and dynamic formulae – Capacity from insitu tests (SPT and SCPT) – Piles subjected to uplift – Negative skin friction – Group capacity – Settlement of pile groups – Interpretation of pile load test – Pile caps – Codal provisions.

UNIT -5 RETAINING WALLS

9

Earth pressure theory – Plastic equilibrium in soils – active and passive states – Rankine's theory – Coloumb's wedge theory – Classical and limit equilibrium solution – Earth pressure on retaining walls of simple configurations – pressure on the wall due to single line load alone – Graphical method (Culmann's method alone) – Stability of retaining wall.

Total Hours = 45

Text Books:

1. Punmia, B.C., Soil mechanics and foundations, Laxmi publications pvt. Ltd., New Delhi, 1995.
2. Gopal Ranjan and Rao, A.S.R. Basic and applied soil mechanics, Wiley Eastern Ltd., New Delhi (India), 1997.

References:

1. Khan, I.H., A text book of Geotechnical Engineering, Prentice Hall of India, New Delhi, 1999.
2. Arora, K.R. Soil mechanics and foundation engineering, standard publishers and distributors, New Delhi, 1997.
3. Bowles J.E. Foundation analysis and design, McGraw Hill, 1994.

SEMESTER VI

ELECTIVE I

The Elective Subject Can be Selected from Elective List

SEMESTER VI
COMPUTER AIDED DESIGN AND DRAWING

1. Design and drawing of R.C.C. cantilever and counter fort type retaining walls with reinforcement details.
9
2. Design of solid slab and R.C. Tee beam bridges for IRC loading and reinforcement details
9
3. Design of rectangular, pressed and hemispherical bottomed steel tank –staging – riveted joints – detailed drawing
9
4. Design of circular, rectangular and intze type water tank reinforcement details
9
5. Design of plate girder – twin girder deck type railway bridge – through type and deck type highway bridges – Truss girder bridges – detailed drawing – riveted connections.
9

Total Hours = 45

Text Books:

1. Structural design & drawing (concrete & steel) – Krishnaraju, CBS Publishers.
2. Design of steel structures – B.C.Punmia, Ashok kumar jain, Arun kumar jain, Laxmi publications Pvt. Ltd.

References:

1. Krishnamurthy, D, Structural Design and Drawing Vol.II, CBS, Publishers & Distributors, Delhi, 1990
2. Krishnamurthy, D, Structural Design and Drawing Vol.III (Steel Structures), CBS, Publishers & Distributors, Delhi, 1990
3. Vazirani V N and Ratwani N M, Design of Steel Structures, Khanna Publishers, Delhi, 1984

SEMESTER VI

CONCRETE AND CONSTRUCTION TECHNOLOGY LABORATORY

1. TESTS ON BRICKS

Compressive Strength – Water Absorption – Efflorescence.

2. TESTS ON CEMENT

Specific gravity – Soundness – Consistency and Setting Times - Vicat – LeChatelier's and Vee-

bee apparatus – Blain's apparatus.

3. TESTS ON AGGREGATES

Crushing Strength – Impact Resistance – CBR Value –Flakiness Index.

4. TESTS ON CONCRETE

Slump cone – Flow table – Cube and Cylinder strength – Modulus of Rupture.

SEMESTER VI
SURVEY CAMP*

1. Three weeks survey camp using Theodolite, cross staff, leveling staff, tapes and Plane table
 - (i) Triangulation
 - (ii) Trilateration
 - (iii) Star observation to determine azimuth
 - (iv) Rectangulation

* Will be accommodated during winter vacation