

**ANNA UNIVERSITY COIMBATORE
REGULATION 2008**

BE - (CIVIL ENGINEERING)

SEMESTER V

(Applicable to students admitted from the Academic year 2008-2009 onwards)

Code No	Course Title	L	T	P	C
THEORY					
	Irrigation Engineering	3	0	0	3
	Railways and Airport Engineering	3	0	0	3
	Water Supply Engineering	4	0	0	4
	Structural Analysis –I	3	1	0	4
	Foundation Engineering	3	1	0	4
	Basic Structural Design	3	1	0	4
PRACTICAL					
	Environmental Engineering Laboratory	0	0	3	2
	Soil Mechanics Laboratory	0	0	3	2
	Communication Skills and Technical Seminar	0	0	2	0
TOTAL		19	3	8	26

SEMESTER VI

Code No	Course Title	L	T	P	C
THEORY					
	Remote Sensing and GIS	3	0	0	3
	Design of RC Elements	3	1	0	4
	Structural Analysis-II	3	1	0	4
	Design of Steel Structures	3	1	0	4
	Waste water Engineering	3	0	0	3
	Elective-I	3	0	0	3
PRACTICAL					
	Concrete and Highway Laboratory	0	0	3	2
	Irrigation and Environmental Engg Drawing	0	0	3	2
	Presentation Skill and Techniques	0	0	2	0
TOTAL		18	3	8	25

LIST OF ELECTIVES --SEMESTER VI

Code No	Course Title	L	T	P	C
	Hydrology	3	0	0	3
	Electronic Surveying	3	0	0	3
	Probability and Statistics	3	0	0	3
	Professional Ethics and Human Values	3	0	0	3
	Traffic Engineering and Management	3	0	0	3
	Housing Planning and Management	3	0	0	3

SEMESTER VII

Code No	Course Title	L	T	P	C
THEORY					
	Design of RC Structures	3	1	0	4
	Estimation and Valuation	3	1	0	4
	Construction Management	3	0	0	3
	Concrete Technology	3	0	0	3
	Elective-I	3	0	0	3
	Elective-II	3	0	0	3
PRACTICAL					
	Computer Aided Design and Drafting	2	0	3	4
	Design Project	0	0	3	2
TOTAL		20	2	6	26

LIST OF ELECTIVES – SEMESTER VII

Code No.	Course Title	L	T	P	C
	Finite Element Techniques	3	0	0	3
	Prestressed Concrete	3	0	0	3
	Bridge Structures	3	0	0	3
	Storage Structures	3	0	0	3
	Tall Buildings	3	0	0	3
	Structural Dynamics	3	0	0	3
	Prefabricated Structures	3	0	0	3
	Computer Aided Design of Structures	3	0	0	3
	Industrial Structures	3	0	0	3
	Introduction to Soil Dynamics and Machine Foundations	3	0	0	3
	Smart Materials and Smart Structures	3	0	0	3
	Disaster Resistant Structures	3	0	0	3
	Repair and Rehabilitation of Structures	3	0	0	3

SEMESTER – VIII

Code No.	Course Title	L	T	P	C
THEORY					
	Earthquake Resistant Structures	3	1	0	4
	Building Services	3	0	0	3
	Elective – IV	3	0	0	3
PRACTICAL					
	Project work	0	0	12	6
TOTAL		9	1	12	16

LIST OF ELECTIVES - SEMESTER – VIII

Code No.	Course Title	L	T	P	C
	Contract Laws and Regulations	3	0	0	3
	Ground water Engineering	3	0	0	3
	Management of Irrigation Systems	3	0	0	3
	Coastal Zone Management	3	0	0	3
	Water Resources Engineering	3	0	0	3
	Environmental Impact Assessment of Civil Engineering Projects	3	0	0	3
	Industrial Waste Management	3	0	0	3
	Ground Improvement Techniques	3	0	0	3
	Project formulation and Management	3	0	0	3
	Air Pollution Management	3	0	0	3
	Municipal solid waste Management	3	0	0	3

IRRIGATION ENGINEERING

L	T	P	M	C
3	0	0	100	3

1. Introduction

9

Definition – Need and types of irrigation – Advantages and disadvantages – Crop seasons in India – Consumptive use – Duty – Factors affecting duty – Irrigation efficiencies

2. Irrigation methods

9

Surface irrigation – Flooding methods – Canal irrigation – Lift irrigation – Tank irrigation – Sprinkler irrigation – Drip irrigation

3. Diversion and impounding structures

9

Weirs – Elementary profile – Weirs on pervious soils – Tank surplus weir – Gravity dams – Earth dams – Arch dams – Spillways – Factors affecting location and type of dams – Forces acting on a dam – Hydraulic design of dams

4. Canal irrigation

9

Classification of canals – Canal alignment – Canal drops – Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal head works – Canal regulators – River training works

5. Irrigation water management

9

Need for optimization – Minimizing irrigation losses – On farm development works – Participatory irrigation management – Water users associations – Performance evaluation – Planning & development of irrigation projects

Total : 45 Hours

Text books:

1. Santhosh Kumar Garg – “Irrigation engineering and hydraulic structures,” Khanna Publishers, 1997
2. G.L. Asawa – “Elementary irrigation engineering,” New Age International Publishers, 1999

References:

1. Richard H. Cuenca – “Irrigation system design,” Prentice-Hall, 1989
2. G.V. Skogerboe, G.P. Merkley, & R.F. Rifenburg – “Establishing sustainable farmer-managed irrigation organizations,” www.greatunpublished.com, 2002

RAILWAYS AND AIRPORT ENGINEERING

L	T	P	M	C
3	0	0	100	3

1. RAILWAY PLANNING 9

Role of Indian Railways in National Development - Engineering Surveys for Track Alignment – Obligatory points - Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments) Permanent Way, its Components and Functions of each Component: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers – Functions, Materials, Density Ballasts – Functions, Materials, Ballastless Tracks

2. GEOMETRIC DESIGN 9

Necessity of geometric design-Gradient and grade compensation –speed of train – safe speed on curve – super elevation – cant deficiency –Negative super elevation – Transition curve-Horizontal and Vertical curves-widening of gauges in curves (Derivation of formulae and problems)

3. RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION 9

Points and Crossings - Design of Turnouts, Working Principle Signalling, Interlocking and Track Circuiting

Construction & Maintenance – Conventional, Modern methods and Materials, Track Drainage Track Modernisation– Automated maintenance and upgrading, Technologies, Re-laying of Track, Lay outs of Railway Stations and Yards, Rolling Stock, Track Resistance, Level Crossings

4. AIRPORT PLANNING AND DESIGN 9

Advantages and Limitations of Air Transport, Components of Airports Airport Planning – Air traffic potential, Site Selection, Design of Components, Cost Estimates, Evaluation and Institutional arrangements Runway Design - Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Drainage Taxiway Design – Geometric Design Elements, Minimum Separation Distances, Design Speed, Airport Drainage

Airport Zoning - Clear Zone, Approach Zone, Buffer Zone, Turning Zone, Clearance over Highways and Railways

5. AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL 9

Airport Layouts – Apron, Terminal Building, Hangers, Motor Vehicle Parking Area and Circulation Pattern

Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings Air Traffic Control – Basic Actions, Air Traffic Control Network Helipads, Hangers, Service Equipments.

Total : 45 Hours

Text Books :

1. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 2006.
2. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Brothers, Roorkee, 1994.

References:

1. J.S.Mundrey, Railway Track Engineering, Tata Mc Graw Hill Publishing Company Limited, Third edition-2000”.

WATER SUPPLY ENGINEERING

L	T	P	M	C
4	0	0	100	4

1. PUBLIC WATER SUPPLY SCHEMES AND QUANTITY OF WATER 9

Necessary and objectives of public water supply schemes – planning and financing – report preparation of schemes house treatment of water. Quantity of water – water requirements – continuous and intermittent supply – rate of demand – variations in rate of demand – its effect on design – design periods and capacities of different components – population growth and forecast – estimating the quantity of water required.

2. HYDROLOGICAL CONCEPTS AND SOURCES OF WATER 9

Hydrological concepts – hydrological cycle – precipitation – types of precipitation – rain fall measurements – rain fall indices - estimation of surface runoff. Sources of water – Types of sources - lakes, ponds, rivers - infiltration galleries - storage reservoirs - storage capacity by analytical and mass curve methods - dam height and cost - types of wells - sanitary protection of wells - tests for yield of a well - Estimating yield of wells under steady state condition (No derivations).

3. QUALITY OF WATER AND TRANSPORTATION OF WATER 9

Definitions-Quality of water - portable water, pure water, mineral water, etc. (Physical ,chemical, biological) - impurities in water - sampling - analysis of water - water borne diseases - quality standards of water. Transportation of water - types of conduits - Hydraulics of pipe flow - design - materials of pressure pipes - pipe corrosion - Theories, effect and prevention - Laying and testing of pipe lines. Pumps - Types of pumps - selection of pumps - pumping stations.

4. PURIFICATION OF WATER 9

Treatment of water - working principles, Purpose and Design of all the unit processes of water treatment - Screening - plain Sedimentation - coagulation Sedimentation - filtration - Disinfection - Water softening - Removal of colour, Odour and Tastes - Removal of Iron and manganese - Fluoridation and Defluoridation.

5. DISTRIBUTION OF WATER AND IMPACT OF WATER SUPPLY SCHEMES 9

Intakes - types - intake tower - Distribution of water - requirements of good distribution system - method of distribution system - layouts of distribution system - pressure in the distribution system - Equivalent pipe method - Distribution Reservoirs - purpose - types - locations and height - design aspects - preventive methods to reduce wastage of water. Impact of water supply schemes.

Total : 45 Hours

Text books:

1. Garg. S. K., "Water Supply Engineering", Khannah Publishers, Delhi, September 2001.
2. Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prentice hall of India 2008.

Reference Books:

1. Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 1985.
2. Fair. G. M., Geyer. J. C., "Water Supply and Waste Water disposal", John Wiley & Sons, 1954.
3. Babbit. H. E., and Donald. J. J., "Water Supply Engineering", McGraw Hill book Co, 1984
4. Steel E. W. et.al, "Water Supply Engineering", McGraw Hill International Book Co,1984
- 5 Duggal. K.N., "Elememts of public Health Engineering", S.Chand and Co,1985.
6. Jain Publishers, CPHEECO MANUAL.

STRUCTURAL ANALYSIS – I

L	T	P	M	C
3	1	0	100	4

1. DEFLECTION OF DETERMINATE STRUCTURES 9

Principles of virtual work for deflections – Deflections of pin-jointed plane frames and rigid plane frames – Willot diagram - Mohr's correction

2. MOVING LOADS AND INFLUENCE LINES 9 (DETERMINATE & INDETERMINATE STRUCTURES)

Influence lines for reactions in statically determinate structures – influence lines for members forces in pin-jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads.

Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures

3. ARCHES 9

Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches, parabolic and semi-circular arches – Settlement and temperature effects.

4. SLOPE DEFLECTION METHOD 9

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

5. MOMENT DISTRIBUTION METHOD 9

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

Total : 45 HourS

Text Books:

1. "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Vaidyanadhan, R and Perumal, P, Laxmi Publications, New Delhi, 2003
2. "Structural Analysis", L.S. Negi & R.S. Jangid, Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003

References:

1. Analysis of Indeterminate Structures – C.K. Wang, Tata McGraw-Hill

FOUNDATION ENGINEERING

L	T	P	M	C
3	1	0	100	4
				9

1. SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and objectives – Methods of exploration-averaging and boring – Water boring and rotatory drilling – Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Selection of foundation based on soil condition.

2. SHALLOW FOUNDATIONS

Introduction – Location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula (only)– factors affecting bearing capacity – problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) – Allowable bearing pressure, Settlement – Components of settlement – Determination of settlement of foundations on granular and clay deposits – Allowable settlements– Methods of minimising settlement, differential settlement.

3. FOOTINGS AND RAFTS

Types of foundation – Contact pressure distribution below footings & raft - Isolated, combined footings and mat foundation – types – proportioning (no structural design) – floating foundation.- foundations on expansive soil. Identification of expansive soil

4. PILES

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse Labarra formula and block failure criterion) – Settlement of pile groups –pile load test-under reamed piles.

5. RETAINING WALLS

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil - Coloumb's wedge theory – Earth pressure on retaining walls of simple configurations – Graphical methods (Culman's method only)– Stability of retaining walls.

Total: 45 Hours

Text Books:

1. Murthy, V.N.S, Text book of "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi, 2007.
2. Gopal Ranjan and Rao, A.S.R. "Basic and Applied Soil Mechanics", New Age International (P) It, New Delhi,2007.

References:

1. Das, B.M. "Principles of Foundation Engineering (Fifth edition), Thomson Books / COLE, 2003
2. Kaniraj, S.R, "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2007
3. Bowles J.E, "Foundation analysis and design", McGraw-Hill, 1994
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi publications pvt. Ltd., New Delhi, 2005.
5. Venkatramaiah, C."Geotechnical Engineering", New Age International Publishers, New Delhi, 2009
6. Arora.K.R "Soil Mechanics and Foundation Engineering" Standard Publishers and Distributors,Pvt. Ltd., New Delhi, 2000

BASIC STRUCTURAL DESIGN

L	T	P	M	C
3	1	0	100	4
				9

1. STRUCTURE AND DESIGN CONCEPTS

Classification of structures – function, material and shape- different structural systems – requirements of structures – basic structural requirements- stability, strength and stiffness. Design process – codes of practice. Working Stress Method – Limit State Method of Design – Probabilistic approach to design – load and resistance – factor design – design for strength, stiffness and stability considerations- choice between different structural materials – concrete, timber, masonry and steel.

Structural Loads : Dead load – live load – wind load – calculation of wind load for a structure – seismic load.

2. RIVETTED AND BOLTED CONNECTIONS

9

Types of connections – type of riveted joints – modes of failure of riveted joint – strength of riveted joint – design of riveted joint subjected to axial load – joint subjected to moment – joint in framed structures.

Types of bolts – black bolts – turned and fitted bolts – high strength friction grip bolts – proof loads – types of bolted connections – design of bolted shear connections – subjected to shear and tension – pinned connections.

3. WELDED CONNECTION :

9

Types – advantages- defects – butt weld – fillet weld – stresses in welds – design of fillet weld for axial load – design of butt weld – plug and slot weld – eccentrically loaded fillet weld joints– eccentrically loaded butt welded joints.

4. DESIGN OF MASONRY WALLS AND COLUMNS:

9

Brick masonry – brick walls – allowable stresses – design of load bearing wall – walls with opening – bed stones – axially loaded square and rectangular column with uniaxial eccentricity.

Laterally Loaded masonry Structures: Structures and load s- stability of masonry – middle third rule – masonry dams – trapezoidal dam – retaining wall.

5. TIMBER STRUCTURES:

9

Knots, Wanes, Checks and Shakes – slope of grain – classification and grading – factors of safety – permissible stresses – flexural members – flitched beam – timber columns and strut – members subjected to bending and axial stresses

**Tutorialal : 15 Hours
Total : 60 Hours**

Text Books :

1. Bhavikatti,S.S Design of Steel Structures, I.K International Publishing House Pvt. Ltd,NewDelhi. 2009
- 2.Anand S. Arya – Masonry & Timber Structures– Nem Chand Brothers, Roorkee. Reprint 1992

Reference Books:

- 1.Subramanian,N. Design of Steel Structures. Oxford University Press, NewDelhi,2008

ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	M	C
0	0	3	100	2

LIST OF EXPERIMENTS

Determination of pH

Determination of Turbidity

Determination of Chlorides

Determination of Sulphates

Determination of Dissolved Oxygen (DO)

Determination of BOD

Determination of COD

Determination of Acidity

Determination of Alkalinity

Determination of Hardness

Determination of Total Solids (TS), Suspended Solids, Settleable Solids (SS) and Volatile Solids(VS)

Determination of Available chlorine in Bleaching powder

Determination of Microbial Colony count

Determination of Faecal coliforms as Indicators

Total :45 hours

SOIL MECHANICS LABORATORY

L	T	P	M	C
0	0	3	100	2

1. Grain size distribution - Sieve analysis
 2. Specific gravity of soil grains
 3. Relative density of sands
 4. Atterberg limits test
 5. Determination of moisture - Density relationship using standard Proctor test.
 6. Permeability determination (constant head and falling head methods)
 7. Determination of shear strength parameters.
Direct shear test on cohesionless soil
Unconfined compression test on cohesive soil
 8. Field density test (Core cutter and sand replacement methods)
 9. Demonstration on Triaxial compression test
 10. Demonstration on consolidation test
 11. Demonstration on Hydrometer Analysis
- Total : 45 Hours**

REFERENCES

1. "Soil Engineering Laboratory Instruction Manual", Published by the Engineering College Co-operative Society, Chennai, 2002.
2. Head, K.H, "Manual of Soil Laboratory Testing (Vol-1 to 3)", John Wiley & Sons, Chichester, 1998.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.
4. "I.S.Code of Practice (2720) Relevant Parts", as amended from time to time.
5. Saibaba Reddy, E. and Rama Sastri, K., "Measurement of Engineering Properties of Soils", New Age International Publishers, New Delhi, 2002.

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl. No.	Description of Equipments	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor compaction apparatus	2 sets
6.	UTM of minimum of 20KN capacity	1
7.	Direct shear apparatus	1
8.	Thermeometer	2
9.	Field density measuring device	2
10.	Triaxial shear apparatus	1
11.	Three gang consolidation test device	1

L	T	P	M	C
3	0	0	100	3
				9

1. GIS TECHNIQUE AND DATA INPUT

MAP – Types of Maps – Development of GIS – Components of GIS – Hardware, software and organization – Types of data – Spatial and non-spatial data – Point, Line and Polygon – Vector and Raster data – Database concepts – Files and data formats – Vector and Raster data structures, Data compression, Edge matching.

2. DATA ANALYSIS AND MODELLING

Data Retrieval – Query – Simple Analysis – Spatial Analysis – Overlay – Vector Data Analysis – Raster Data Analysis – Modeling using GIS – Digital Elevation Model – DTM - 3D GIS - Cost and path analysis – Expert Systems – Artificial Intelligence – Integration with GIS

3. DATA OUTPUT AND ERROR ANALYSIS

Data Output – Types – Devices used – Raster and Vector Display Devices – Printers – Plotters – Photos write Devices – Sources of Errors – Types of Errors – Elimination – Accuracies

4. GIS APPLICATIONS IN RESOURCE MANAGEMENT

Fields of Applications – Natural Resources – Agriculture – Soil – Water Resources – Wasteland Management - Social Resources - Cadastral Records – LIS

5. ADVANCED GIS APPLICATION

AM/FM – Utility Network Management – Integration with Remote Sensing – Knowledge based techniques - Multi criteria Techniques- Internet GIS – Introduction to Object Oriented Data base Models

Total : 45 Hours

Text Books:

1. Burrough P A, Principles of GIS for Land Resources Assessment, Oxford Publication, 2000
2. Michael N Demers, Fundamentals of Geographical Information Systems, Second Edition, John Wiley Publications, 2002
3. Kang-Tsung Chang, “ Introduction to geographical Information Systems”, Tata McGraw Hill, 2002

References:

1. Paul A Longley, Michael F Goodchild etal, Geographical Information Systems Volume I and II, Second Edition, John Wiley Publications, 1999.
2. Elangovan K, “GIS: Fundamentals, Applications and Implementation”, New India Publishing agency, New Delhi, 2006
3. Clarke K C, “Getting started with Geographic Information systems”, 3rd Edition, Prentice Hall, 2001

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.

2. LIMIT STATE DESIGN FOR FLEXURE 9

Singly and doubly reinforced rectangular and flanged beams - Design aids- Analysis and design of one way and two way rectangular slab subjected to uniformly distributed load for various boundary conditions and corner effects

3. LIMIT STATE DESIGN FOR SHEAR, TORSION ,BOND AND ANCHORAGE 9

Behaviour of RC members in shear and torsion – shear and torsion reinforcement –limit state Design of RC members for combined bending shear and torsion -requirements as per current code.

4. LIMIT STATE DESIGN OF COLUMNS 9

Types of columns – Braced and unbraced columns – Design of short column for axial, uniaxial and biaxial bending – Design of long columns.-Use of design aids

5. LIMIT STATE DESIGN OF FOOTING 9

Design of wall footing – Design of axially and eccentrically loaded square, rectangular and circular footings – Design of combined rectangular footing for two columns only .

Tutorial :15 Hours

Total :60 Hours

Text Books:

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2008. 2nd Edition.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi.

References:

1. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Rourkee
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi
3. Unnikrishna Pillai, S., Devadas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi

1. 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).

2. MATRIX STIFFNESS METHOD**9**

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames.

3. FINITE ELEMENT METHOD**9**

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain Triangular elements

4. PLASTIC ANALYSIS OF STRUCTURES**9**

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

5. SPACE AND CABLE STRUCTURES**9**

Analysis of Space trusses using method of tension coefficients – Beams curved in plan - Suspension cables - cables with two and three hinged stiffening girder

Tutorial :15 Hours**Total: 60 Hours****Text Books:**

1. Vaidyanathan, R. and Perumail, P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003
2. Coates R.C, Coutie M.G. and Kong F.K., "Structural Analysis", ELBS and Nelson, 1990
3. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2003

References:

1. Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" –5th edition. Spon Press, London and New York, 2003.
2. Vazirani V.N, & Ratwani, M.M, "Analysis of Structures", Khanna Publishers, Delhi
3. Structural Analysis – A Matrix Approach – G.S. Pandit & S.P. Gupta, Tata McGraw Hill
4. Matrix Analysis of Framed Structures – Jr. William Weaver & James M. Gere, CBS Publishers and Distributors, Delhi.

(Limit State Design)

L	T	P	M	C
3	1	0	100	4
				9

1. INTRODUCTION

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using rivets, welding, bolting – Design of bolted, riveted and welded joints – Eccentric connections – Efficiency of joints – High Strength Friction Grip Joints.

2. TENSION MEMBER**9**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Design of tension splice.

3. COMPRESSION MEMBERS**9**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening – Design of column bases – Gusseted base.

4. BEAMS**9**

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders riveted and welded – Intermediate and bearing stiffeners – Design of beam columns.

5. ROOF TRUSSES AND INDUSTRIAL STRUCTURES**9**

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss – Design of gantry girder.

Tutorial : 15 Hours**Total: 60 Hours****Text Books:**

1. Bhavikatti, S.S., Design of Steel Structures . I.K International Publishing House Pvt Ltd ,New Delhi, 2009
2. Subramanian, N. Design of Steel Structures, Oxford University Press, New Delhi, 2008

References:

1. "Teaching Resources for Structural Steel Design - Vol. I & II", INSDAG, Kolkatta.
2. Gaylord, E.H., Gaylord, N.C., and Stallmeyer, J.E., "Design of Steel Structures", 3rd Edition, McGraw-Hill Publications, 1992.

1. QUANTITY, COLLECTIONS AND CONVEYANCE**9**

Necessity and objectives of sanitary engineering projects - Definitions - Design Periods-systems of sewerage - quantity of sewage - Fluctuations in flow pattern - Estimation of storm runoff - DWF and WWF - Design flow for separate and combined systems - Hydraulics of sewers - Self cleansing velocities - full flow / partial flow conditions - sewer sections - sewer appurtenances - Design principles and procedures - materials for sewers - sewer joints - sewer laying - sewer cleaning and maintenance - sewage pumping - types of pumps.

2. QUALITY OF SEWAGE AND PRIMARY TREATMENT**9**

Characteristics and composition of sewage - physical and chemical analysis - DO, BOD, COD and their significance - cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment - screens - Grit chamber - settling tank - principles of sedimentations - Design of settling tanks.

3. BIOLOGICAL TREATMENT OF SEWAGE**9**

Basic principles of biological treatment - Filtration - contact beds - Sand Filters - trickling filters - Description and principles of operation of standards / high rate filters - recirculation - activated sludge process - Effective micro organisms - diffuser / Mechanical aeration - Conventional, high rate and extended aeration process - oxidation pond - stabilization ponds - aerated lagoons.

4. SLUDGE MANAGMENT**9**

Objectives of sludge treatment - properties and characteristics of sludge - Thickening - sludge digestion - sludge- drying beds - conditioning and dewatering - sludge disposal - Eutrophication - recycle & reuse of waste effluents - elutriation

4. SEWAGE DISPOSAL AND HOUSE DRAINAGE**9**

Methods - dilution method - self purification of streams - oxygen sag curve - land disposal - sewage farming. House drainage - Sanitary fixtures / fittings - plumbing- one pipe system, two pipe system, etc. -traps- General layout of house drainage - street connections. Water seals-Septic tanks and effluent disposal system

Total : 45 Hours**Textbooks:**

1. Garg. S. K., "Environmental Engineering", Vol I & Vol II, Khannah Publishers, New Delhi, 1994.
2. Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prentice hall of India 2008
3. Hussain. S. K., "Text Book of Water Supply and Sanitary Engineering", Oxford and IBH Publishing.
4. Duggal. K.N., "Elememts of public Health Engineering", S.Chand and Company Ltd, New Delhi. 1998.

Reference Books:

1. *Manual on wastewater and treatment CPHEEC, Ministry of Urban Affairs and Employment, Govt. of India, New Delhi, 1990.*
2. *Shah.C. S., "Water supply and Sanitation", Galgotia publishing company, New Delhi, 1994.*

LIST OF EXPERIMENTS**A. TESTS ON CONCRETE**

1. Concrete Mix Design – ACI Method and IS Method
2. Workability test on concrete- Slump, Compaction factor and Vee –Bee test
3. Strength test on concrete – Compressive strength ,Split tensile strength test and Flexural strength test
4. Determination of Modulus of Elasticity of Concrete.

B. TESTS ON AGGREGATES

1. Flakiness Index and Elongation Index
2. Crushing Value and Impact Value
3. Abrasion test- Los Angeles abrasion test

C. TESTS ON BITUMEN

1. Penetration test
2. Viscosity test
3. Ductility test

IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING (Manual Design and Drawing)

L	T	P	M	C
0	0	3	100	2

Irrigation Engineering Drawing

1. Tank surplus weir
2. Tank sluice with tower head
3. Canal drop (Notch Type)
4. Canal regulator
5. Siphon aqueduct

Environmental Engineering Drawing

1. General layout of water and waste treatment plants
2. Sedimentation aided with coagulation
3. Slow sand filter
4. Rapid sand filter
5. Trickling filter
6. Septic tank

Total :45 Hours

Text Books:

1. Garg, S.K, "Irrigation Engineering and Design of Structures"
2. Satyanarayana Murthy, "Irrigation Design and Drawing", Published by Mrs. L. Banumathi, Tuni, East Godavari District, A.P. 1998
3. Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002

References:

1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999
2. Manual of Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993
3. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987
4. Peary, H.S., Rowe, D.R., and Tchobanoglous, G., "Environmental Engineering", McGraw-Hill Book Co., New Delhi, 1995
5. Metcalf & Eddy, "Wastewater Engineering (Treatment and Reuse)", 4th Edition, Tata McGraw-Hill, New Delhi, 2003

**ELECTIVES --SEMESTER VI
HYDROLOGY**

L	T	P	M	C
3	0	0	100	3
9				

1. Precipitation

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement – Adequacy of raingauges – Check for consistency – Mean precipitation – Intensity, duration, frequency relationship – Probably maximum precipitation

2. Abstractions from precipitation

9

Interception – Depression storage – Evaporation – Measurement – Infiltration – Measurement – Infiltration indices

3. Hydrographs

9

Components of hydrograph – Factors affecting hydrograph – Base flow separation – Unit hydrographs – Derivation of unit hydrographs – S-Curve – Synthetic unit hydrograph

4. Floods and Flood routing

9

Flood peak estimation – Flood frequency studies – Gumbel's method – Reservoir routing – Channel routing – Flood control

5. Groundwater hydrology

9

Distribution of subsurface water – Darcy's law – Aquifer properties – Types of aquifers – Theim equation – Dupit-Forcheimer assumptions – Specific capacity – Pumping test – Recuperation test

Total – 45 Hours

Text books:

1. K. Subramanya – “Engineering hydrology,” Tata McGraw-Hill, 2005
2. H.M. Raghunath – “Hydrology,” New Age International Publishers, 2006

References:

1. K.N. Mutreja – “Applied hydrology,” Tata McGraw-Hill, 1986
2. A.K. Rastogi – “Numerical groundwater hydrology,” Penram International Publishing (India) Pvt. Ltd., 2007

ELECTRONIC SURVEYING

L	T	P	M	C
3	0	0	100	3
15				

1. BASICS

Methods of measuring distance, historical development, basic principles, classifications, applications and comparison with conventional surveying. Fundamental of electronics, resonant circuits, semiconductors, Lasers, Cathode ray tube, photo multiplier tube, transducers, oscillators, frequency mixing, modulation and demodulation, Kerrcell modulator, measurement of phases difference, reflectors and power sources.

2. PROPAGATION OF ELECTROMAGNETIC WAVES

15

Definition, classification, applications, Propagation properties, wave propagation at lower and higher frequencies. Refractive index, factors affecting, computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions, reference refractive index for microwaves, measurements of atmospheric parameters, mean refractive index, real time application of first velocity correction, second velocity correction and total atmospheric correction.

3. ELECTROMAGNETIC DISTANCE MEASURING SYSTEM

15

Electro-optical system, measuring principle, working principle, sources of error, infrared EDM instruments, Laser EDM instruments and total station. Microwave system measuring principle, working principle, sources of error, microwave EDM instruments, comparison with Electro-optical system, care and maintenance of EDM instruments, Modern Positioning Systems.

Total : 45 Hours

References:

1. Burnside, C.D. Electromagnetic distance measurements Crosby Lock wood staples, U.K.
1991
2. Rueger, J.M. Electronic Distance Measurements, Springer-Verlag Berlin, 1990.
3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc., 1993.
4. Soastamoinen, J.J. Surveyor's guide to electro-magnetic Distance Measurement, Adam Hilger Ltd., 1997.

PROBABILITY AND STATISTICS

L	T	P	M	C
3	0	0	100	3
9				

1. PROBABILITY AND RANDOM VARIABLES

Probability concepts, Random variables, Moments, Moment Generating function, Binomial, Poisson, Geometric, Negative binomial, Exponential, Gamma, Weibull distributions, Functions of random variable, Chebyshev inequality.

2. TWO-DIMENSIONAL RANDOM VARIABLES

9

Marginal and Conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem.

3. RANDOM PROCESSES

9

Classification, Stationary and Markov processes, Poisson process, Pure birth process, Birth and death process, Markov chains, Markovian queuing models.

4. RELIABILITY ENGINEERING

9

Concepts of reliability, Hazard function, Series and parallel systems, Reliability and Availability of Markovian systems, Maintainability, Preventive maintenance.

5. Design of Experiments and Quality Control

9

Completely randomized design, Randomised block design, Latin square design, Process control, Control charts of measurements and attributes, Tolerance limits.

Tutorial : 15 Hours; Total :60 Hours

References:

1. Miller, I.R and Freund, J.E, "Probability and Statistics for engineers", Prentice-Hall, 1995.
2. Kapur, J.N and Saxena, H.C, "Mathematical Statistics", S. Chand & Company Ltd., New Delhi, 1997.
3. Balagurusamy E, "Reliability Engineering", Tata-McGraw-Hill Publishers, New Delhi, 1994.
4. Bhat, U.N, "Elements of applied stochastic processes, Wiley Series in Probability and Mechanical statistics, New York, 1993.

L	T	P	M	C
3	0	0	100	3
				9

I HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Code of Conduct – Valuing Time – Cooperation – Commitment – Empathy – Self – Confidence – Character – Counseling and Appraisal techniques.

II ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's Theory – Gilligan's theory – consensus and controversy – models of professional roles – theories about right action – self-interest – ethics of safety

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated Circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

III**9**

International convention relating to Intellectual Property – Established of WIPO – Mission and Activities – History – General Agreement on trade and Tariff (GATT).

IV**9**

Indian Position Vs WTO and Strategies – Indian IPR legislations – Commitments to WTO – Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy.

V**9**

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Protection against unfair competition.

Total : 45 Hours**Text Books:**

1. Subbaram N.R "Handbook of Indian Patent Law and Practice", S.Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

References:

1. Eli Whitney, United States Patent Number: 72X,,Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, (www.iptoday.com).
3. Using the Internet for Non- patent prior art searches, Derwent IP Matters, July 2000. (www.ipmatters.net/features/000707_gibbs.html).

HOUSING PLANNING AND MANAGEMENT

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments - Objectives of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Local bodies' Bye-laws at Urban and Rural Level and Development Control Regulations, Institutions for Housing at National, State and Local levels

2. HOUSING PROGRAMMES

9

Basic Concepts – Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programme, Role of Public, Private and Non-Government Organisations.

3. PLANNING AND DESIGN OF HOUSING PROJECTS

9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems) – Bye Laws

4. CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS

9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

5. Housing Finance and Project Appraisal

9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems) – Micro finance.

Total : 45 Hours

Text Books:

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

References:

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
3. National Housing Policy, 1994, Government of India.

SEMESTER VII

080100048

DESIGN OF REINFORCED CONCRETE STRUCTURES

	L	T	P	M	C
1. RETAINING WALLS	3	1	0	100	4
Design detailing of cantilever and counter fort RCC retaining walls				9	
2. WATER TANKS					9
Underground rectangular tanks – Domes – Overhead circular and rectangular tanks – Design of staging and foundations-Design as per BIS Codal Provisions					
3. SELECTED TOPICS					9
Design of staircases (ordinary and doglegged) – Design of flat slabs – Design of Reinforced concrete walls – Principles of design of mat foundation-Introduction to prestressed concrete-Principles –types and methods of prestressing- BIS Codal Provisions					
4. YIELD LINE THEORY					9
Application of virtual work method to square, rectangular, circular and triangular slabs					
5. RCC BRIDGES					9
Introduction, Classification of bridges-IRC Loadings- Effective width of load dispersion- Design of solid slab Bridge-Box culverts.					

Tutorial: 15 Hours; Total : 60 Hours

Text Books:

1. Krishna Raju, N., "Design of RC Structures", CBS Publishers and Distributors, New Delhi, 2006
2. Punmia, P.C; Ashok.K.Jain and Arun.K.Jain. "Reinforced Concrete Structures" Vol II, Laxmi Publications, New Delhi, 2000

References:

1. Mallick, D.K. and Gupta A.P., "Reinforced Concrete", Oxford and IBH Publishing Company, 1997
2. Gambhir, M.L. ; "Reinforced Concrete Structures", PHI Learning Private Ltd, New Delhi 2008
3. Syal, I.C and Goel, A.K; "Reinforced Concrete Structures", A.H Wheelers & Co Pvt Ltd. 1994

L	T	P	M	C
3	1	0	100	4
				9

1. INTRODUCTION

General - Units of measurements – Requirements of estimation - Methods of estimates – Advantages – simple problems – Estimation of different foundations, steps and boundary walls.

2. ESTIMATE OF BUILDINGS

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

3. ESTIMATE OF OTHER STRUCTURES

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall.

4. SPECIFICATION AND RATE ANALYSIS

Object of specifications – General and Detailed specifications for various items of work – earth work excavation – lime mortar - cement concrete – damp proof course – form work – brick and stone masonry - Flooring – painting and wood work.
Purpose – requirements - Schedule of rates and Data book – procedure of rate analysis – Requirement of labour and materials for different works – Obtaining rate for different works namely cement mortar – cement concrete – RCC – RR masonry – Brick masonry – DPC – Plastering – flooring – weathering course – pointing – painting.

5. VALUATION

Objects of valuation - definition of various terms such as free and lease hold property – Market value – Book value – Assessed value – Mortgage Value - Replacement Value – Gross and Net Income – Capital cost – Cost Escalation - sinking fund – Depreciation – Methods – Fixation of Rent – calculation of standard rent of Government Building - Principles of Report preparation

Tutorial:15 Hours
Total : 60 Hours

Text Books:

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
2. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd,2004

1. PRINCIPLES OF CONSTRUCTION MANAGEMENT**9**

Definition – importance – function of Construction Management – relevance to govt., Quasi govt. departments private contractors and contracting firms – organization – Types of organizations & Hierarchy of organization.

2. CONSTRUCTION PLANNING & MANAGEMENT**9**

CONSTRUCTION PLANNING: Collection of field data – preliminary estimates – approval and sanction of estimates – budget provision – construction stages – scheduling methods – progress report and charts.

RESOURCE PLANNING: Planning for materials, machines, men and organization – resource allocation.

LABOUR AND LABOUR WELFARE: Relationship between management and labour – problems – labour legislation – minimum wages Act – settlement of disputes – industrial psychology.

3. MANAGEMENT METHODS**9**

Concepts of network – Bar chart (Gantt Chart) network planning methods CPM/PERT – management by network analysis and control – principles of cost control – control by graphical representation by bill of quantities and by network analysis – Resource Levelling.

4. EXECUTION OF WORKS**9**

DEPARTMENTAL WORKS: Procedure – departmental labor – quality control, inspection and duties of personnel – safety requirements.

CONTRACTORS: Contract system – types of contracts – specifications, documents, procedures, conditions, taxes, law of constructions and Legal implications and penalties.

TENDER AND TENDER DOCUMENTS: Definition – calling for tenders – tender documents – submission of tenders – processing of tenders – negotiations and settlement of contracts.

4. ACCOUNTS AND STORES**9**

Measurements of work – recording – check measurements – types of bills – mode of payment – budget estimate – revised estimates – completion of report and certificates – claims and transfer classification of transaction – ledger accounts – interest account – cash book. Suspense classification – stores – maintenance inspection – inventories – transfer of surplus and accounting of shortage – stores – procedures adopted in P.W.D. and C.P.W.D.

Total :45 Hours**Text Books**

1. Seetharaman,S., Construction Engineering and Management, Umesh Publications, 1997.

2. Sengupta,B., and Guha,H., Construction Management and Planning, Tata McGraw-Hill Co, 1995.

References

1. Sanga Reddy,S., and Meyyappan, PL., Construction Management, Kumaran Publications, Coimbatore, 1995.
2. Ranna,V.K., Construction Management Practice, Tata McGraw-Hill Publishing co, 1998
3. Chitkara,K.K., Construction Project Management, Tata McGraw-Hill Publishing co, 1998
- 4 Joseph L.Massie, Essentials of Management, Prentice Hall of India,2009
- 5 C.P.W.D. Manual
6. Public Works Accounts code, PWD, Tamilnadu.

1. CONSTITUENT MATERIALS 9

Cement-Different types-Chemical composition and Properties-Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS-Grading requirements-Water- Quality of water for use in concrete

2. CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers- Mineral Admixtures like Fly Ash, Silica Fume , Ground Granulated Blast Furnace Slag and Metakaoline-Their effects on concrete properties

3 PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design-Design Mix and Nominal Mix-BIS and ACI Methods of Mix Design-Mix Design Examples

4. FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS-Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus

5. SPECIAL CONCRETES 9

Light weight and Heavy weight concretes-High strength concrete-Fibre reinforced concrete-Ferrocement-Ready mix concrete-SIFCON-Shotcrete-Polymer concrete-High performance concrete-Their production, properties and applications

Total : 45 Hours**Text Books:**

1. Santhakumar,A.R; Concrete Technology , Oxford University Press, New Delhi, 2007
2. Shetty,M.S; Concrete Technology, S.Chand and Company Ltd, New Delhi 2003

References:

1. Neville, A.M; Properties of Concrete, Pitman Publishing Limited, London,1981
2. Gambir, M.L; Concrete Technology, Tata McGraw Hill Publishing Co Ltd, New Delhi,2007,Third Edition
3. IS: 10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi

Design and Drafting of the following Structures using Design and Drafting Software (Manual Design and Drafting by Software)

1. RCC Cantilever Retaining Wall
2. RCC Counterfort Retaining Wall
3. RCC Underground Water Tank
4. RCC Ground level Water Tank
5. RCC Overhead Circular and Rectangular Water Tanks
6. RCC Solid Slab Bridge for IRC Loading
7. RCC Tee Beam Bridge for IRC Loading
8. Prestressed Steel Water Tank including staging
9. Welded Plate Girder Bridge (live load as Equivalent UDL)
10. Truss Girder Bridge (live load as Equivalent UDL)

Text Books:

1. Krishna Raju, N; Structural Design and Drawing (Concrete and Steel) CBS Publishers, New Delhi
2. Krishnamoorthy, D; Structural Design and Drawing-Concrete Structures, Vol II, CBS Publishers and Distributors, New Delhi

Reference Books:

1. Punmia, P.C; Ashok Kumar Jain and Arun Kumar Jain ;Design of Steel Structures. Laxmi Publications Pvt Ltd, New Delhi
2. Krishnamoorthy, D; Structural Design and Drawing- Steel Structures. Vol III, CBS Publishers and Distributors Pvt Ltd, New Delhi

**ELECTIVES – SEMESTER VII
FINITE ELEMENT TECHNIQUES**

L	T	P	M	C
3	0	0	100	3

1. INTRODUCTION – VARIATIONAL FORMULATION 9

General field problems in Engineering – Modelling – Discrete and Continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, Boundary and initial value problems – Gradient and divergence theorems – Functionals – Variational calculus – Variational formulation of VBPS. The method of weighted residuals – The Ritz method.

2. FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 9

One dimensional second order equations – discretisation of domain into elements – Generalised coordinates approach – derivation of elements equations – assembly of elements equations – imposition of boundary conditions – solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – time dependant problems and their solutions – example from heat transfer, fluid flow and solid mechanics.

3. FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 9

Second order equation involving a scalar-valued function – model equation – Variational formulation – Finite element formulation through generalised coordinates approach – Triangular elements and quadrilateral elements – convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices – boundary conditions – solution techniques.

4. ISOPARAMETRIC ELEMENTS AND FORMULATION 9

Natural coordinates in 1, 2 and 3 dimensions – use of area coordinates for triangular elements in - 2 dimensional problems – Isoparametric elements in 1,2 and 3 dimensional – Lagrangean and serendipity elements – Formulations of elements equations in one and two dimensions - Numerical integration.

5. APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSIONALS 9

Equations of elasticity – plane elasticity problems – axisymmetric problems in elasticity – Bending of elastic plates – Time dependent problems in elasticity – Heat – transfer in two dimensions – incompressible fluid flow.

**Tutorial: 15 Hours
Total : 60 Hours**

Text Books:

1. Chandrupatla, T.R., and Belegundu, A.D., “Introduction to Finite Element in Engineering”, Third Edition, Prentice Hall of India Learning Pvt Ltd,2009, 3rd Edition
2. J.N.Reddy, “An Introduction to Finite Element Method”, TATA McGraw-Hill, Education Pvt ltd, Noida, 2005,3rd Edition.

References:

1. Seshu,P." Text Book of Finite Element Analysis", PHI ,2009
2. S.S.Rao, "The Finite Element Method in Engineering", Pergaman Press, 2003.
3. C.S.Desai and J.F.Abel, "Introduction to the Finite Element Method", Affiliated East West Press, 1972.
4. G.R.Buchaman,and R.Rudramoorthy, "Finite Element Analysis "(Sechaum's out line series)Tata McGraw-Hill, Education Pvt Ltd, Noida, 2005,3rd Edition

PRESTRESSED CONCRETE

L	T	P	M	C
3	0	0	100	3

9

Basics of Prestressed Concrete

Basic principles of prestressing – Historical development – classification and types – advantages over ordinary reinforced concrete – materials – necessity of high strength concrete and high tensile steel. Mechanical systems of prestressing – Freyssinet, Magnel Blaton, Lee McCall and Killick Anchorage systems. Losses due to deformation and slip of anchorage units – Elastic shortening – shrinkage and creep of concrete – relaxation of steel – friction losses.

Flexure

9

Basic assumptions – permissible stresses in steel and concrete as per IS 1343-1980 code – Design of sections of post-tensioned and pre-tensioned beams (Type I and II) – check for strength limit state based on IS 1343 – 1980 code – Layout of cables in post-tensioned beams – location of wires in pre-tensioned beams.

Shear and Deflection

9

Design for shear based on IS 1343 – 1980 code – Factors influencing deflections – short term deflections of uncracked members – prediction of long term deflections – check for serviceability limit state of deflection.

Anchorage Zone and Bond

9

Determination of anchorage zone stresses in post-tensioned beams by Magnel's method and IS 1343 – 1980 code method – Design of anchorage zone reinforcement – check for transfer bond length.

PRESTRESSED CONCRETE TANKS AND PIPES

9

Circular prestressing – General features of prestressed concrete tanks – analysis and design of prestressed concrete tanks – types of prestressed concrete pipes – design of prestressed concrete pipes (non cylinder type).

PRESTRESSED CONCRETE CONTINUOUS BEAMS

9

Methods of achieving continuity in prestressed concrete beams – analysis for secondary moments in continuous beams – concordant cable profile and linear transformation – calculation of stresses in continuous beams.

MISCELLANEOUS

9

Design of prestressed concrete tension and compression members – uses of non prestressed reinforcement – principles, methods of achieving, merits and demerits of partial prestressing.

Total : 45 Hours

Text Books:

1. Krishna Raju N, "Prestressed Concrete", Tata McGraw Hill Publishing Company,Ltd. New Delhi, 2007.Fourth Edition.
2. Rajagopalan N, "Prestressed Concrete", Narosa Publishing House, NewDelhi, 2002.

References:

1. Sinha N C and Roy S K, "Fundamentals of Prestressed Concrete", S Chand & Co, 1985.
2. Lin T Y and Ned H Burns, "Design of Prestressed Concrete Structures", John Wiley Sons, NewYork, 1982.
3. Nilson A H, "Design of Prestressed Concrete", John Wiley Sons, NewYork, 1978.
4. Edward G Nawy, "Prestressed Concrete", A Fundamental Approach, 3rd Edition, Prentice Hall, Upper Saddle river, NewJersy, 2000.
5. Mallik S K and Gupta A P, "Prestressed Concrete", Oxford & IBH Publishing Co., Pvt. Ltd., India, 2nd Edition, 1986.

BRIDGE STRUCTURES

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION

Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders - Design of deck type steel highway bridges for IRC loading - Design of main girders

2. STEEL BRIDGES

Design of pratt type truss girder highway bridges - Design of top chord, bottom chord, web members - Effect of repeated loading - Design of plate girder railway bridges for railway loading - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

3. REINFORCED CONCRETE SLAB BRIDGES

Design of solid slab bridges for IRC loading - Design of kerb - Design of tee beam bridges - Design of panel and cantilever for IRC loading

4. REINFORCED CONCRETE GIRDER BRIDGES

Design of tee beam - Courbon's theory - Pigeaud's curves - Design of balanced cantilever bridges - Deck slab - Main girder - Design of cantilever - Design of articulation.

5. PRESTRESSED CONCRETE BRIDGES

Design of prestressed concrete bridges - Preliminary dimensions - Flexural and torsional parameters - Courbon's theory - Distribution coefficient by exact analysis - Design of girder section - Maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - cable zone in girder - Check for stresses at various sections - Check for diagonal tension - Diaphragms - End block - Short term and long term deflections.

Total : 45 Hours

Text Books:

1. Krishna Raju.N " Design of Bridges" , Oxford and IBH Publishing Co., New Delhi, 2009, IV th Edition
2. Jagadeesh, T.R and Jayaram, M.A " Design of Bridge Structures". PHI Learning Private Ltd
New Delhi, 2009.
3. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.
4. Ponnuswamy S., " Bridge Engineering ", Tata McGraw Hill, New Delhi, 1996.

References

1. Phatak D.R., " Bridge Engineering ", Satya Prakashan, New Delhi, 1990.
2. Raina ,V.K. "Concrete Bridge Practice" ,Tata McGraw Hill Publishing Co. New Delhi. 199

STORAGE STRUCTURES

	L	T	P	M	C
1. STEEL WATER TANKS	3	0	0	100	3
Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging and foundation.					9
2. CONCRETE WATER TANKS					9
Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.					
3. STEEL BUNKERS AND SILOS					9
Design of square bunker – Jansen’s and Airy’s theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.					
4. CONCRETE BUNKERS AND SILOS					9
Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction.					
5. PRESTRESSED CONCRETE WATER TANKS					9
Principles of circular prestressing – Design of prestressed concrete circular water tanks.					

Total : 45 Hours

Text Books:

1. Rajagopalan K., Storage Structures, Tata McGraw-Hill, New Delhi, 1998.
2. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers and Distributors, New Delhi, 1998.

TALL BUILDINGS

L	T	P	M	C
3	0	0	100	3

1. INTRODUCTION

9

The Tall Building in the Urban Context - The Tall Building and its Support Structure - Development of High Rise Building Structures - General Planning Considerations. Dead Loads - Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads- Seismic Loading –Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes of Material - Impact and Dynamic Loads - Blast Loads -Combination of Loads.

2. THE VERTICAL STRUCTURE PLANE

9

Dispersion of Vertical Forces- Dispersion of Lateral Forces - Optimum Ground Level Space - Shear Wall Arrangement - Behavior of Shear Walls under Lateral Loading. The Floor Structure or Horizontal Building Plane Floor Framing Systems-Horizontal Bracing- Composite Floor Systems The High - Rise Building as related to assemblage Kits Skeleton Frame Systems - Load Bearing Wall Panel Systems - Panel – Frame Systems - Multistory Box Systems.

3. COMMON HIGH-RISE BUILDING STRUCTURES AND THEIR BEHAVIOUR UNDER LOAD

9

The Bearing Wall Structure- The Shear Core Structure - Rigid Frame Systems- The Wall - Beam Structure: Interspatial and Staggered Truss Systems - Frame - Shear Wall Building Systems - Flat Slab Building Structures - Shear Truss - Frame Interaction System with Rigid - Belt Trusses - Tubular Systems-Composite Buildings - Comparison of High - Rise Structural Systems Other Design Approaches Controlling Building Drift Efficient Building Forms - The Counteracting Force or Dynamic Response.

4. APPROXIMATE STRUCTURAL ANALYSIS AND DESIGN OF BUILDINGS

9

Approximate Analysis of Bearing Wall Buildings The Cross Wall Structure - The Long Wall Structure The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate Design of Rigid Frame Buildings- Lateral Deformation of Rigid Frame Buildings The Rigid Frame - Shear Wall Structure - The Vierendeel Structure - The Hollow Tube Structure.

5. OTHER HIGH-RISE BUILDING STRUCTURES

9

Deep - Beam Systems -High-Rise Suspension Systems - Pneumatic High -Rise Buildings - Space Frame Applied to High - Rise Buildings - Capsule Architecture.

Total : 45 Hours

Text Books:

1. Bryan Stafford Smith and Alex Coull, " Tall Building Structures ", Analysis and Design, John

Wiley and Sons, Inc., 1991.

2. Taranath.B.S.Structural Analysis in tall buildings,Mc Graw Hill, 1988.

REFERENCES

1. Coull, A. and Smith Stafford, B. " Tall Buildings ", Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, " Structural Concepts and Systems for Architects and Engineers ", John Wiley, 1994.
3. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.

STRUCTURAL DYNAMICS

L	T	P	M	C
3	0	0	100	3

1. Difference between static loading and dynamic loading – Nature of dynamic loads – Wind, Earthquake and Impact Loads – Damping – Viscous and structural damping – single degree of freedom (SDOF) Systems – Formulation of equation of motion – Newton's Law and D'Alembert's principles – Examples of SDOF modeling. **9**
2. Free vibration response of SDOF system – Response of undamped and damped SDOF system to harmonic excitation – characteristic of resonance – Response to impulse and an arbitrary forcing function – Duhamel Integral formulation **9**
3. MDOF systems – examples – Lumped parameter model – Formulation of equation of motion – Free vibration of MDOF systems as Eigen value problem – concept of mode shapes and natural frequencies – 2 DOF example – orthogonal properties of normal modes. **9**
4. Harmonic excitation of 2 DOF system – Principle of mode superposition (principle only) for dynamic analysis – vibration isolation – vibration measuring instruments. **9**
5. Effect of wind and earthquake on structures – Principles of aseismic design – Methods of vibration control – codal provisions for design for wind and earthquake (explanation of provisions only – no design) **9**

Total : 45 Hours

Text Books:

1. Mario Paz, Structural Dynamics Theory and Computation, Van Nostrand Reinhold, 1992
2. Anil K.Chopra, "Dynamics of Structures Theory and Applications to Earthquake Engineering" Prentice Hall of India (P) Ltd., New Delhi 1996.

References:

1. Thomson W.T., Theory of Vibration and Applications, Prentice Hall of India, 1992
2. Clough R.W. and Penzien, J., Dynamics of Structures, McGraw-Hill, 1990
3. Craig R.R. Jr., Structural Dynamics – An Introduction to Computer Methods, John Wiley and Sons, 1981

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

2. PREFABRICATED COMPONENTS

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

3. DESIGN PRINCIPLES

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

4. JOINT IN STRUCTURAL MEMBERS

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

5. DESIGN FOR ABNORMAL LOADS

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Total : 45 Hours

Text Books:

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

References:

1. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
3. B.Lewicki, Building with large prefabricates, Elsevier Publishing Company Amsterdam/London/Newyork.1966.

COMPUTER AIDED DESIGN OF STRUCTURES

L	T	P	M	C
3	0	0	100	3

1. INTRODUCTION

Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.

2. COMPUTER GRAPHICS

Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages

3. STRUCTURAL ANALYSIS

Fundamentals of finite element analysis - Principles of structural analysis -Analysis packages and applications.

4. DESIGN AND OPTIMISATION

Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming.

5. EXPERT SYSTEMS

Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables –Inference mechanisms - Simple applications.

Total : 45 Hours

Text Books:

1. Groover M.P. and Zimmers E.W. Jr., " CAD/CAM, Computer Aided Design and Manufacturing ", Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy .C.S and .Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi 1991.

References :

1. Harrison H.B., " Structural Analysis and Design ", Part I and II Pergamon Press, Oxford, 1990.
2. Rao S.S., " Optimisation Theory and Applications ", Wiley Eastern Limited, New Delhi, 1977.
3. Richard Forsyth (Ed), " Expert System Principles and Case Studies ", Chapman and Hall, London, 1989.

INDUSTRIAL STRUCTURES

	L	T	P	M	C
1. PLANNING	3	0	0	100	3
Classification of Industries and Industrial structures – General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components.					
2. FUNCTIONAL REQUIREMENTS					9
Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.					
3. DESIGN OF STEEL STRUCTURES					9
Industrial roofs – Crane girders – Mill buildings – Design of Bunkers and Silos					
4. DESIGN OF R.C. STRUCTURES					9
Silos and bunkers – Chimneys – Principles of folded plates and shell roofs					
5. PREFABRICATION					9
Principles of prefabrication – Prestressed precast roof trusses- Functional requirements for Precast concrete units					

Total : 45 Hours

Text Books:

1. Kishnaraju.N Advanced Reinforced Concrete design .CBS Publishers and distributors,New Delhi,1998
2. Pasala Dayaratnam – Design of Steel Structures ,S.Chand and Company Ltd.New Delhi,2003.
3. Subramanian.N ,Design of Steel Structures, Oxford University Press,2008.

References:

1. Henn W. Buildings for Industry, Vols.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990
3. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982
4. Koncz, J, Manual of Precast Construction Vol I & II Bauverlay GMBH, 1971.

INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION

Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping

2. WAVES AND WAVE PROPAGATION 9

Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space

3. DYNAMIC PROPERTIES OF SOILS 9

Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil- codal provisions

4. DESIGN PROCEDURES 9

Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines

5. VIBRATION ISOLATION 9

Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location-isolation by barriers- active passive isolation tests.

Total : 45Hours

Text Books:

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd., 1999
2. S.Prakesh & V.K Puri, Foundation for machines, McGraw-Hill 1993
3. Srinivasulu, P & Vaidyanathan, Hand book of Machine Foundations, McGraw-Hill, 1996
4. Kramar S.L, "Geotechnical Earthquake Engineering", Prentice Hall International series, Pearson Education (Singapore) Pvt. Ltd.
5. Kameswara Rao, "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003

References:

1. Kameswara Rao, "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998
2. IS code of Practice for Design and Construction of Machine Foundations, .
3. Moore P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH, 1995.

SMART MATERIALS AND SMART STRUCTURES

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

2. MEASURING TECHNIQUES

9

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

3. SENSORS

9

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques.

Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

4. ACTUATORS

9

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magnetostructure Material – Shape Memory Alloys – Electro rheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

5. SIGNAL PROCESSING AND CONTROL SYSTEMS

9

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.

Total : 45 Hours

Text Books :

1. Brain Culshaw – Smart Structure and Materials ,Artech House – Borton. London-1996.

References:

1. L. S. Srinath – Experimental Stress Analysis – Tata McGraw Hill, 1998.
2. J. W. Dally & W. F. Riley – Experimental Stress Analysis – Tata McGraw Hill, 1998.

DISASTER RESISTANT STRUCTURES

L	T	P	M	C
3	0	0	100	3
				9

1. BEHAVIOUR OF LIFE-LINE STRUCTURES

Philosophy for design to resist earthquake, cyclone and flood, tsunami ,National and International codes of practice ,By-Law of urban and semi-urban areas - Traditional and modern structures.

2. COMMUNITY STRUCTURES

9

Response of dams, bridges, buildings ,Strengthening measures , Safety analysis and rating – Reliability assessment

3. REHABILITATION AND RETROFITTING

9

Testing and evaluation - Classification of structures for safety point of view - methods of strengthening for different disasters - qualification test.

4. DETAILING OF STRUCTURES AND COMPONENTS

9

Use of modern materials and their impact on disaster reduction, Use of modern analysis, design and construction techniques optimisation for performance.

5. DAMAGE ASSESSMENT OF STRUCTURES

9

Damage surveys - Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety - Ground improvement techniques.

Total : 45 Hours

Reference Books:

- 1 V.Moskvin, et.all Concrete and Reinforced Concrete - Deterioration and Protection Mir Publishers - Moscow 1980.
- 2 R.T.Allen and S.C.Edwards Repair of Concrete Structures, Blakie and Sons, U.K 1987.
- 3 Proceedings IABSE 14th Congress "Civilisation through Civil Engineering" New Delhi, May 1992.
- 4 Raiker R.N.Learning from failures Deficiencies in Design, Construction and Service,R & D Center (SDCPL) Raiker Bhavan, Bombay, 1987.
- 5 Santhakumar A .R "Concrete Technology, Oxford Higher Education , New

L	T	P	M	C
3	0	0	100	3
				8

1. MAINTENANCE AND REPAIR STRATEGIES

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

2. SERVICEABILITY AND DURABILITY OF CONCRETE**12**

Quality assurance for concrete construction concrete properties – strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking

3. MATERIALS AND TECHNIQUES FOR REPAIR**15**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection.

4. REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES**6**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

5. DEMOLITION TECHNIQUES**4**

Engineered demolition techniques for Dilapidated structures – case studies

Total : 45Hours**Text Books:**

1. Vidivelli,B; Rehabilitation of Concrete Structures, Standard Publishers Distributors, New Delhi,2008
2. Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost Housing, “RHDC – NBO” Anna University, July 1992.

References::

1. Shetty, M.S; Concrete Technology – Theory and Practice, S.Chand and Company, New Delhi, 1992.
2. Raikar, R., Learning from failures – Deficiencies in Design, Construction and Service – R& D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
3. P.K.Guha,Maintenance and Repairs of Buildings,New Central Book Agency (P)Ltd, Kolkata.

SEMESTER – VIII

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EARTHQUAKE RESISTANT STRUCTURES

L	T	P	M	C
3	1	0	100	4

1. BASICS of STRUCTURAL DYNAMICS

5

INTRODUCTION : Introduction to structural dynamics – importance of structural dynamics – types and sources of dynamic loads – distinguishing features of a dynamic problem – methodology for dynamic analysis – types of structural vibration – basic terminology.

2. SINGLE DEGREE OF FREEDOM

10

Linear systems : Equation of motion – components of vibration system – natural frequency – viscous damping – response to undamped & damped free and forced vibration – response to support motion – principle of accelerometers and displacement meters.

TWO DEGREES OF FREEDOM

6

Equations of motion – Eigen value problem – free vibration response – forced vibration response to harmonic excitation – response to support motion – model analysis

3. EARTHQUAKE RESISTANT DESIGN

6

INTRODUCTION : Elements of Engineering seismology – Indian Seismicity – faults seismic waves – earthquake intensity and magnitude – earthquake ground motion – behaviour of structures in the past Earthquakes – basic terminology.

4. EARTHQUAKE RESPONSE

9

Linear systems : Earthquake ground motion – response spectrum – response history analysis – IS code provisions for the determination of lateral loads – modal analysis. Soil liquefaction – soil-structure interaction effects.

5. DESIGN CONCEPTS

9

Seismic Design Concepts – design spectrum – Earthquake Resistant Design of simple framed structures – IS 1893 code provisions – ductile detailing of Reinforced Concrete frames as per IS 13920

Tutorial : 15 Hours
Total : 60 Hours

Text Books:

1. Anil K Chopra, “Dynamics of Structures – Theory and Applications to Earthquake Engineering”, Prentice Hall of India (P) NewDelhi, 2004.
2. Clough R W, and Penzien, “Dynamics of Structures”, McGraw Hill Book Co Ltd, 1993.

3. S.K.Duggal “Earthquake Resistant Structures” Oxford University Press, New Delhi, 2007

References :

1. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design and Structures”, Prentice Hall of India, 2006.
2. Paz Mario, “Structural Dynamics – Theory and Coimputation”, CBS publishers, 2004.
3. Craig, R.R, and Andrew J.K. “Structural Dynamics – An Introduction to computer Methods”, John Wiley & Sons, 2006.
4. Biggs, J.M, “Introduction to Structural Dynamics”, McGraw Hill, Co., 1964.
5. Manickaselvam, V.K, “Elementary Structural Dynamics”, Dhanpat Rai & Sons, 2001.
6. Stefen L Kramer, “Geotechnical Earthquake Engineering”, Pearson Education Publications, 2003.
7. Proceedings of the winter school on “Earthquake Resistant Structural Design”, Department of Civil Engineering, PSG College of Technology, 14-27 November 2004.

L	T	P	M	C
3	0	0	100	3
				9

1. ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

2. PRINCIPLES OF ILLUMINATION & DESIGN

9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lamps of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

3. REFRIGERATION PRINCIPLES & APPLICATIONS

9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

4. FIRE SAFETY INSTALLATION

9

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

5. PLUMBING AND DRAINAGE

9

Plumbing fixtures and fixture fittings – Water conserving fittings – Over flows – Strainers and connectors – Prohibited fixtures – Special fixtures – Installation of water closet – Urinals - Flushing devices – Floor drains – Shower stall – Bath tub – Bidets – Minimum plumbing facilities – Rain water harvesting systems – Necessity – Construction – Different types .

Total: 45 Hours

References

1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
4. R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
5. William H.Seaverns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
6. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 1980.
7. National Building Code.
8. Uniform Plumbing Code (India)

ELECTIVES - SEMESTER – VIII
CONTRACT LAWS AND REGULATIONS

L	T	P	M	C
3	0	0	100	3
				10

1. CONSTRUCTION CONTRACTS

Indian Contracts Act-Elements of Contracts-Types of contracts-Features-Suitability-Design of Contract Documents-International contract document-Standard contract Document-Law of Torts

2. TENDERS**10**

Prequalification-Bidding-Accepting-Evaluation of Tender from Technical, Contractual and commercial points of view-contract formation and interpretation-Potential contractual problems-World Bank Procedures and Guidelines

3. ARBITRATION**5**

Comparison of Actions and Laws-Agreements, subject matter-Violations-Appointment of Arbitrators-Conditions of Arbitrations-Powers and duties of Arbitrator-Rules of Evidence-Enforcement of Award-costs

4. LEGAL REQUIREMENTS**10**

Insurance and Bonding-Laws Governing Sale, Purchase and use of Urban and Rural land-Land Revenue codes- Tax Laws-Income Tax, Sales Tax, Excise and customs duties and their influence on construction costs-Legal requirements for planning-Property Law-Agency Law-Local Government Laws for Approval-Statutory Regulations

5. LABOUR REGULATION**10**

Social Security-Welfare Legislation-Laws relating to wages, Bonus and Industrial Disputes, Labour Administration- Insurance and Safety Regulations-Workmen's Compensation Act-Other Labour laws

Total : 45 Hours**References :**

1. Gajaria G.T., " Laws Relating to Building and Engineering Contracts in India ", M.M.Tripathi Private Ltd., Bombay, 1982.
2. Tamilnadu PWD Code, 1986.
3. Jimmie Hinze, " Construction Contracts ", 2nd Edition, McGraw Hill, 2001.
4. Joseph T. Bockrath, " Contracts and the Legal Environment for Eginers and Architects" 6th Edition, McGraw Hill, 2000.

L	T	P	M	C
3	0	0	100	3
				9

1. FUNDAMENTALS OF GROUND WATER

Introduction – Characteristic of Ground water – Distribution of water - ground water column –Permeability - Darcy's Law - Laboratory permeability test - Types of aquifers - Hydrogeological Cycle – water level fluctuations.

2. HYDRAULICS OF FLOW**9**

Storage coefficient - Specific field - Heterogeneity and Anisotropy -Transmissivity - Governing equations of ground water flow - Steady state flow - Dupuit Forchheimer assumptions - Velocity potential - Flow nets

3. ESTIMATION OF PARAMETERS**9**

Transmissivity and Storativity – Pumping test - Unsteady state flow - Thiess method - Jacob method - Image well theory – Effect of partial penetrations of wells - Collectors wells.

4. GROUND WATER DEVELOPMENT**9**

Infiltration gallery - Conjunctive use - Artificial recharge -Safe yield -Yield test – Geophysical methods – Selection of pumps.

5. WATER QUALITY**9**

Ground water chemistry - Origin, movement and quality - Water quality standards - Saltwater intrusion –Environmental concern.

Total : 45 Hours**Text Books:**

1. Raghunath H.M., “Ground Water Hydrology”, Wiley Eastern Ltd., 2000.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, 2000.

References:

1. Karanth.K. Ground water Assessment and Management.TATA McGraw-Hill, Education Pvt Ltd, Noida, 2004.
2. Walton,C “Ground Water Resource Evaluation”, McGraw-Hill Publications

MANAGEMENT OF IRRIGATION SYSTEMS

L	T	P	M	C
3	0	0	100	3

8

1. DEMAND ASSESSMENT

Introduction – Consumptive and non-consumptive demands – Crop water requirement – Allowable deficit – Effective rainfall – Irrigation requirement – Irrigation frequencies – Other demands – Control and regulating structures – Flow measurements – Calibration of structures.

2. OPERATION PLAN

14

Existing operation practices in India – Objectives of preparing operation plan – Precipitation and runoff – Dependable yield – Seasonal and Intra-season planning – Matching supply and demand – Preparation of operation plan for main canal, distributory - Case studies.

3. MONITORING AND EVALUATION

6

Implementation of operation plan – Monitoring parameters – Feed back from field – Review and revision – Performance indicators – Evaluation of system performance.

4. MAINTENANCE

7

Physical and social phenomenon causing maintenance problems and their solutions – Diagnostic survey – Development of maintenance plans – Deferred maintenance and rehabilitation.

5. MANAGEMENT

10

Physical and administration control of the system – Water laws – Water user's association (WUA) and their role in-distribution of water below the outlet and maintenance of the system. Role of WUA in system management – Irrigation management transfer – Water cess – Sustainability of irrigation systems.

Total : 45 Hours

References:

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project Technical Report No.33, CWC, New Delhi, 1990.
2. Hand Book for improving Irrigation System Maintenance Practices, Water Resources Management and Training Project, Technical Report No.19A, CWC, New Delhi, 1989.
3. Maloney C and Raju K.V., Managing Irrigation Together, Practice and Policy in India, Stage Publication, New Delhi, India, 1994.
4. Sagardoy J.A., Bottrall A., and Utten Bogaard G.O., Organisation, Operation and Maintenance of Irrigation Schemes, Irrigation and Drainage, Paper No.40, FAQ, Rome, 1986.

5. Preparation of the Operation Plan and Example, Indo-Dutch Training Project Management Unit, Group Report, 1993.
6. Irrigation Management in India Policy, Processes and Performance Oxford – IBH Photography Co. (P) Ltd., New Delhi, 1999.

COASTAL ZONE MANAGEMENT

L	T	P	M	C
3	0	0	100	3

1. COASTAL OCEANS

introduction and Basic concepts – Coastal Waters, Estuaries, Wetlands and lagoons – Pollution Stresses on Coastal water – Marine sediments – Sediment transport – Texture, composition and distribution – Living resources in the coastal zone and their conservation and utilization – Non-living resources and their exploration and exploitation.

2. WAVE DYNAMICS

9

Wave characteristics – Airy's Linear Wave Theory – Deep water waves – Shallow water waves – Transitional waves – Wind generated waves – Sea swell – Surface-wave refraction – Wave reflection – Wave breaking – Storm surge – Tsunami – Internal waves.

3. COASTAL PROCESSES

9

erosion and depositional shore features – change levels of the shoreline – plate tectonics and coasts – Tides and currents – Littoral currents – Renewable ocean energy – Shifting river mouths and delta formation shoreline shifting and need for continuous survey – ocean thermal energy conversion – Wave-tidal engineering structures and other infrastructure in coastal zone – Dykes and Levees

4. ENVIRONMENTAL IMPACTS IN COASTAL ZONE

9

Hydraulic aspects – Ecological aspects – Land use in coastal zone – Coastal aquifers – Sea water intrusion – Desalination – Brackishwater aquaculture and its impact on coastal zone – Coastal zone management – Concepts and development – Data base for coastal zone management – Design and operation of closure works – Sand closure.

5. GIS AND REMOTE SENSING APPLICATION IN COASTAL MANAGEMENT

9

Introduction and basic concepts of GIS – Data entry storage and analysis and modeling – Application in coastal zone – Aquaculture remote sensing – Basic concepts – Application of remote sensing in coastal zone management.

Total : 45 Hours

Text Books;

1. Ippen, Arthur and T. Estuary, Coastline Hydrodynamics, McGraw Hill, New , New York, 1993
2. Dwivedi S. N., Natarajan R and Ramachandran S, Coastal Zone Management in Tamilnadu, 1991

WATER RESOURCES ENGINEERING

L	T	P	M	C
3	0	0	100	3
				9

1. GENERAL

Water Resources Survey - Water ResourceS of India and Tamilnadu - Description of Water Resources Planning - Economics of W.R.Planning - Physical and Socio - economic data - National water Policy - Tamil nadu State Water Policy - Collection of meteorological and hydrological data for water resources development

2. NETWORK DESIGN

9

Hydrologic measurement – Analysis of hydrologic data - Hydrologic station network - Station network design - Statistical techniques in network design.

3. WATER RESOURCE NEEDS

9

Consumptive and non-consumptive water use - Estimation of water requirements for irrigation, for drinking and navigation - Water characteristics and quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget and development plan.

4. RESERVOIR PLANNING AND MANAGEMENT

9

Reservoir - Single and multipurpose - Multiobjective - Fixation of Storage capacity - Strategies for reservoir operation - Sedimentation of reservoirs - Design flood - Levees and flood walls - Channel improvement.

5. ECONOMIC ANALYSIS

9

Estimation of cost and Evaluation of Benefits - Discount rate - Discounting factors - Discounting techniques – Computer Application.

Total : 45 Hours

Text Books:

1. Linsley R.K. and Franzini J.B, Water Resources Engineering, McGraw Hill Inc, 2000.
2. Douglas J.L. and Lee R.R., Economics of Water Resources Planning, Tata McGraw Hill Inc.2000.

References:

1. Chaturvedi M.C., Water Resources Systems Planning and Management, Tata McGraw Hill Inc., New Delhi, 1997.
2. Goodman Alvin S., Principles of Water Resources Planning, Prentice-Hall, 1984.

ENVIRONMENTAL IMPACT ASSESSMENT OF CIVIL ENGINEERING PROJECTS

L	T	P	M	C
3	0	0	100	3
				5

1. INTRODUCTION

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.

2. METHODOLOGIES

5

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies.

3. PREDICTION AND ASSESSMENT

10

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA.

4. ENVIRONMENTAL MANAGEMENT PLAN

10

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000

5. CASE STUDIES

15

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

Total : 45Hours

Text Books:

1. Canter, R.L., "Environmental Impact Assessment", McGraw-Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

References:

1. John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

INDUSTRIAL WASTE MANAGEMENT

L	T	P	M	C
3	0	0	100	3
			7	

1. INTRODUCTION

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

2. CLEANER PRODUCTION

8

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

3. POLLUTION FROM MAJOR INDUSTRIES

10

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

4. TREATMENT TECHNOLOGIES

12

Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering - Disposal

5. HAZARDOUS WASTE MANAGEMENT

8

Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured land fill

Total: 45 Hours

Text Books:

1. M.N.Rao & A.K.Dutta, "Wastewater Treatment", Oxford - IBH Publication, 1995.
2. W .W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, 2000.

References:

1. T.T.Shen, "Industrial Pollution Prevention", Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York, 1998
3. H.M.Freeman, "Industrial Pollution Prevention Hand Book", McGraw-Hill Inc., New Delhi, 1995
4. Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw-Hill, 2000.

GROUND IMPROVEMENT TECHNIQUES

L	T	P	M	C
3	0	0	100	3
				9

1. INTRODUCTION

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, lateric and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

2. DRAINAGE AND DEWATERING

9

Drainage techniques - Well points - Vacuum and electroosmotic methods - Seepage analysis for two dimensional flow fully and partially penetrating slots in homogenous deposits(Simple cases only).

3. INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS

9

Insitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloatation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

4. EARTH REINFORCEMENT

9

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth - Geotextiles in filtration drainage - Separation and road works.

5. GROUTING TECHNIQUES

9

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemical - Stabilisation expansive soils.

Total : 45 Hours

Text Books:

1. Koerner R.M., "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.
3. Purushothama Raj, P."Ground Improvement Techniques", Laxmi Publications (p) Ltd., New Delhi.

References:

1. Moseley M.P., "Ground Improvement" Blackie Academic and Professional, Chapman and Hall, Glassgow, 1993.
2. Jones J.E.P., "Earth Reinforcement and Soil Structure", Butterworths, 1995.
3. Craig, R.F., " Soil Mechanics", Van Nostrand Reinhold Co.,New York, 1993.

PROJECT FORMULATION AND APPRAISAL

L	T	P	M	C
3	0	0	100	3

1. PROJECT FORMULATION

10

Generation and Screening of Project Ideas-Project identification-Preliminary Analysis, Market, Technical, Financial, Economic and Ecological-Pre-Feasibility Report and its Clearance, Project Estimates and Techno - Economic Feasibility Report, Detailed Project Report - Different Project Clearances required

2. PROJECT COSTING

10

Project cash flows-Time value of Money-Cost of Capital

3. PROJECT APPRAISAL

15

NPV-BCR-IRR-ARR-Urgency-pay back period-Assessment of Various Methods-Indian Practice of Investment Appraisal-International practice of Appraisal-Analysis of Risk-Different Methods Selection of a Project and Risk Analysis in Practice

4. PROJECT FINANCING

5

Project Financing-Means of Finance-Financial Institutions-Special schemes-Key Financial Indicators

5. PRIVATE SECTOR PARTICIPATION

5

Private sector participation in Infrastructure Development Projects-BOT, BOLT, BOOT-Technology Transfer and Foreign Collaboration-Scope of Technology Transfer

Total: 45 Hours

References:

1. Prasanna Chandra, " Projects-Planning Analysis Selection Implementation & Review Fourth Edition ", Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 1995.
2. Joy.P.K.,, " Total Project Management - The Indian Context (Chapters 3- 7) ", New Delhi , Macmillan India Ltd., 1992
3. United Nations Industrial Development Organisation (UNIDO) " Manual for the preparation of Industrial Feasibility Studies ", (IDBI Reproduction) Bombay, 1987
4. Barcus,S.W. and Wilkinson J.W., " HandBook of Mangement Consulting Services ", McGraw Hill,New York, 1986.

AIR POLLUTION MANAGEMENT

L	T	P	M	C
3	0	0	100	3

9

1. SOURCES AND EFFECTS OF AIR POLLUTANTS

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

2. DISPERSION OF POLLUTANTS

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

3. AIR POLLUTION CONTROL

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

4. AIR QUALITY MANAGEMENT

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

5. NOISE POLLUTION

Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

Total : 45 Hours

Text Books

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.

References

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 1997

2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi
5. Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw-Hill, New Delhi, 1991