VII SEMESTER
ENVIRONMENTAL ENGINEERING – II

Subject Code	**: 10CV71**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1
INTRODUCTION: Necessity for sanitation, methods of domestic waste water disposal, types of sewerage systems and their suitability.

Dry weather flow, factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow, estimation of storm flow, rational method and empirical formulae of design of storm water drain. Time of concentration.

6 Hours

UNIT - 2
DESIGN OF SEWERS: Hydraulic formulae for velocity, effects of flow variations on velocity, self cleansing and non scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full (No derivations).
MATERIALS OF SEWERS: Sewer materials, shapes of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

6 Hours

UNIT - 3
SEWER APPURTENANCES: Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage.

6 Hours

UNIT - 4
WASTE WATER CHARACTERIZATION: Sampling, significance, techniques and frequency. Physical, Chemical and Biological characteristics, Aerobic and Anaerobic activity, CNS cycles. BOD and COD. Their significance & problems

06 Hours

PART – B

UNIT - 5
DISPOSAL OF EFFLUENTS : Disposal of Effluents by dilution, self-purification phenomenon. Oxygen sag curve, Zones of purification, Sewage farming, sewage sickness, Effluent Disposal standards for land, surface water

& ocean. Numerical Problems on Disposal of Effluents. Streeter Phelps equation.

6 Hours

UNIT - 6

TREATMENT OF WASTE WATER: Flow diagram of municipal waste water treatment plant. Preliminary & Primary treatment **:** Screening, grit chambers, skimming tanks, primary sedimentation tanks – Design criteria & Design examples.

6 Hours

UNIT - 7

SECONDARY TREATMENT: Suspended growth and fixed film bioprocess. Trickling filter – theory and operation, types and designs. Activated sludge process- Principle and flow diagram, Modifications of ASP, F/M ratio. Design of ASP.

8 Hours

UNIT - 8

Anaerobic Sludge digestion, Sludge digestion tanks, Design of Sludge drying beds. Low cost waste treatment method. Septic tank, Oxidation Pond and Oxidation ditches – Design. Reuse and recycle of waste water.

8 Hours

REFERENCES

1. **Manual on Waste Water Treatment** : CPHEEO, Ministry of Urban Development, New Delhi.
2. **Water and Wastewater Engineering Vol-II** :- Fair, Geyer and Okun : John Willey Publishers, New York.
3. **Waste Water Treatment, Disposal and Reuse** : Metcalf and Eddy inc : Tata McGraw Hill Publications.
4. **Water Technology**.- Hammer and Hammer
5. **Environmental Engineering**: Howard S. Peavy, Donald R. Rowe, George Tchnobanoglous McGraw Hill International Edition.

DESIGN OF STEEL STRUCTURES

Subject Code	**: 10CV72**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART-A

UNIT-1

INTRODUCTION: Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications and section classification. **6 Hours**

UNIT-2

BOLTED CONNECTIONS: Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections, Simple Connections, Moment resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections 6 **Hours**

UNIT-3

WELDED CONNECTIONS: Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices, Tubular connections

6 **Hours**

UNIT-4

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse, Methods of Plastic analysis, Plastic analysis of continuous beams. **7 Hours**

PART-B

UNIT-5

Design of Tension Members: Introduction, Types of tension members, Design of strands, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets.

6 Hours

UNIT-6

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members.

8 Hours

UNIT-7

Design of Column Bases:, Design of simple slab base and gusseted base

6 Hours

UNIT-8

Design of Beams: Introduction, Beam types, , Lateral stability of beams, factors affecting lateral stability, Behaviour of simple and built-up beams in bending(without vertical stiffeners), Design strength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins

7 Hours

Note: Study of this course should be based on **IS: 800-2007**

Reference Books

1) Design of Steel Structures, N.Subramanian, Oxford, 2008

2. Limit State Design of Steel Structures. Duggal. TATA Megra Hill 2010

3) Bureau of Indian Standards, IS800-2007, IS875-1987
4) Steel Tables

ESTIMATION & VALUATION

Subject Code	**: 10CV73**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

ESTIMATION: Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost – center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, sloped RCC roofs with all Building components.

16 Hours

PART - B

ESTIMATE: Different type of estimates, approximate methods of estimating buildings, cost of materials. Estimation of wooden joineries such as doors, windows & ventilators.

5 Hours

ESTIMATES: Steel truss (Fink and Howe truss), manhole and septic tanks, RCC Culverts.

6 Hours

SPECIFICATIONS: Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.

5 Hours

PART - C

RATE ANALYSIS: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

6 Hours

MEASUREMENT OF EARTHWORK FOR ROADS: Methods for computation of earthwork – cross sections – mid section formula or average

end area or mean sectional area, trapezoidal & prismoidal formula with and without cross slopes.

6 Hours

CONTRACTS: Types of contract – essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Valuation- Definitions of various terms, method of valuation, Freehold & Leasehold properties, Sinking fund, depreciation and method of estimating depreciation, Outgoings.

8 Hours

REFERENCE BOOKS:

1. **Estimating & Costing**, B. N. Dutta, Chand Publisher
2. **Quantity Surveying**- P.L. Basin S. Chand : New Delhi.
3. **Estimating & Specification** - S.C. Rangwala :: Charotar publishing house, Anand.
4. **Text book of Estimating & Costing**- G.S. Birde, Dhanpath Rai and sons : New Delhi.
5. **A text book on Estimating, Costing and Accounts**- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.
6. **Contracts and Estimates,** B. S. Patil, University Press, 2006.

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

Subject Code	**: 10CV74**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MATERIALS: High strength concrete and steel, Stress-Strain characteristics and properties.

2 Hours

BASIC PRINCIPLES OF PRESTRESSING: Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages.

4 Hours

UNIT - 2

ANALYSIS OF SECTIONS FOR FLEXURE: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles.

8 Hours

UNIT - 3

LOSSES OF PRE-STRESS: Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.

6 Hours

UNIT - 4

DEFLECTIONS: Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection

6 Hours

PART - B

UNIT - 5

LIMIT STATE OF COLLAPSE: Flexure -IS Code recommendations – Ultimate flexural strength of sections.

5 Hours

UNIT - 6

LIMIT STATE OF COLLAPSE (cont…): Shear - IS Code recommendations, shear resistance of sections, shear reinforcement. Limit state of serviceability – control of deflections and cracking.

7 Hours

UNIT - 7

DESIGN OF END BLOCKS: Transmission of prestress in pretensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement.

6 Hours

UNIT - 8

DESIGN OF BEAMS: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of prestressing force and eccentricity, limiting zone of pre-stressing force cable profile.

8 Hours

REFERENCE BOOKS:

1. **Pre-stressed Concrete**- N. Krishna Raju - Tata Mc. Graw Publishers.
2. **Pre-stressed Concrete**- P. Dayarathnam : Oxford and IBH Publishing Co.

3. **Design of pre-stressed concrete structures**- T.Y. Lin and Ned H. Burns - John Wiley & Sons, New York.
4. **Fundamental of pre-stressed concrete**- N.C. Sinha & S.K. Roy
5. IS : 1343 : 1980
6. **Pre-stressed Concrete**- N. Rajgopalan

MATRIX METHODS OF STRUCTURAL ANALYSIS

Subject Code	**: 10CV751**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces.

6 Hours

UNIT - 2

Analysis of axially rigid continuous beams by flexibility method using Force Transformation Matrix

6 Hours

UNIT - 3

Analysis of rigid plane frames with axially rigid members by flexibility method using Force Transformation Matrix.

6 Hours

UNIT - 4

Analysis of trusses by flexibility method Using Force Transformation Matrix.

6 Hours

PART - B

UNIT - 5

Fundamentals of the stiffness method, equivalent joint loads, DisplacementTransformation matrix. Member stiffness matrix, Total or System stiffness matrix, Truss analysis by stiffness method using Displacement Transformation Matrix.

8 Hours

UNIT - 6

Continuous Beam and rigid frame analysis with axially rigid members by stiffness method using Displacement Transformation Matrix.

8 Hours

UNIT - 7

Introduction to direct stiffness method, Local and global co-ordinate system, Transformation Of variables, Transformation of the member displacement matrix, Transformation of the member Force matrix, Transformation of the

member stiffness matrix, Transformation of the stiffness Matrix of the member of a truss, Transformation of the stiffness matrix of the member of the Rigid frame, Overall stiffness matrix, Boundary conditions, Computation of internal forces.

4 Hours

UNIT - 8

Analysis of trusses and continuous beams by direct stiffness method.

8 Hours

REFERENCE BOOKS:

1. **Matrix, finite elements, Computer and Structural analysis**- M Mukhopadhyay - Oxford &IBW,1984
2. **Matrix Analysis of framed structures**- W. Weaver J.M. Gere - CBS publishers and Disributers,1986
3. **Computational structural Mechanics**- S Rajshekharan. G Sankara Subramanian - PHI, 2001
4. **Structural Analysis A Matrix Approach**- G.S Pandit & S P Gupta Tata Mc Graw-Hill, 1981
5. **Basic structural Analysis**- C.S Reddy - Tata Mc Graw-Hill, 1996
6. **Structural Analysis**- L S Negi and R S Jangid - Tata Mc Graw-Hill, 1997
7. **Introduction to Matrix Methods of Structural analysis -** H C Martin -International text book Company, 1996

ADVANCED DESIGN OF RC STRUCTURES

Subject Code	**: 10CV752**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Design of RCC overhead circular and rectangular water tanks with supporting towers.

8 Hours

UNIT - 2

Design of silos, bunkers using Janssen's Theory and Airy's Theory.

7 Hours

UNIT - 3

Design of RCC Chimneys.

6 Hours

UNIT - 4

Introduction to shell and folded plate roofs, their forms and structural behaviour. Design of simple cylindrical shell roof by beam theory.

6 Hours

PART - B

UNIT - 5
Yield line analysis of slabs by virtual work.

7Hours

UNIT - 6
Yield line analysis by equilibrium methods.

6 Hours

UNIT - 7
Design of Grid Floors Slabs by approximate method.

6 Hours

UNIT-8
Design of flat slabs by Direct Designer Method (with and without drops)

6 Hours

REFERENCE BOOKS:

1. **Reinforced Concrete Structures, Vol-II**- B C Punmia : Laxmi Publications (P) Ltd, New Delhi.
2. **Limit State Design of Reinforced Concrete Vol-II**- P C Varghese: Prentice Hall of India (P) Ltd, New Delhi.
3. **Plain and Reinforced Concrete – Vol-II**- Jai Krishna and Jain,: Nem Chand Bros, Roorkee.
4. **Analysis of Structures- Vol-II** : Vazirani V N & M M Ratwani : Khanna Publishers, New Delhi.
5. **Design Construction of Concrete Shell Roofs** : Ramaswamy G S : CBS Publishers and Distributors, new Delhi.
6. **Advanced Structural Design**- Bensen C
7. IS 456 – 2000 IS 3370 – 1967 (Part I, II and IS 1893)
8. **Advanced RCC Design- Vol-II**,- S. S. Bhavikatti New Age International Publication, New Delhi.

DESIGN OF MASONRY STRUCTURES

Subject Code	**: 10CV753**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION: Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks.

6 Hours

UNIT - 2

STRENGTH AND STABILITY: Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

6 Hours

UNIT - 3

PERMISSIBLE STRESSES: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

6 Hours

UNIT - 4

DESIGN CONSIDERATIONS: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels.

8 Hours

PART - B

UNIT - 5

LOAD CONSIDERATIONS FOR MASONRY: Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, free standing wall.

6 Hours

UNIT - 6

DESIGN OF MASONRY WALLS: Design of load bearing masonry for building up to 3 storeys using IS : 1905 and SP : 20 procedure.

10 Hours

UNIT - 7

REINFORCED MASONRY: Application, flexural and compression elements, shear walls.

5 Hours

UNIT - 8

MASONRY WALLS IN COMPOSITE ACTION: Composite wall-beam elements, infilled frames.

5 Hours

TEXT BOOKS:

1. **Structural Masonry**- Henry, A.W. : Macmillan Education Ltd., 1990.
2. **Brick and Reinforced Brick Structures**- Dayaratnam P. : Oxford & IBH, 1987.

REFERENCE BOOKS:

1. **Design of masonry structures**- Sinha B.P. Davies S.R. : E&FN spon 1997
2. IS 1905–1987 "Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1st revision) BIS, New Delhi.

EARTH & EARTH RETAINING STRUCTURES

Subject Code	**: 10CV754**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

EARTH DAMS AND EMBANKMENTS - Different types of earthen dams with sketches and their suitability. Hydraulic fill and rolled fill methods of construction – Causes of failure of earth dam – Design criteria of earth dams – Stability analysis of earthen dams – Seepage control in earthen dams. Role of Filters in Earth Dam Design.

7 Hours

UNIT - 2

RETAINING WALLS: Types of retaining walls, failure of retaining walls by sliding, overturning and bearing. Stability analysis and Principles of the design of retaining walls – Gravity retaining walls, Cantilever retaining walls, Counterfort retaining walls (no structural design) – Modes of failure of retaining walls – Drainage from the backfill.

7 Hours

UNIT - 3

BULK HEADS: Cantilever sheet pile walls Types of sheet pile walls – Free cantilever sheet pile - cantilever sheet pile in cohesion-less soils – cantilever sheet pile in clay.

6 Hours

UNIT - 4

BULK HEADS: Anchored Sheet Pile Walls: Anchored sheet pile with free earth support in cohesion-less and cohesive soil. bulkheads with fixed earth support method – Types, locations and design of anchors.

6 Hours

PART - B

UNIT - 5

BRACED CUTS: Introduction, Lateral earth pressure on sheeting, Different types of sheeting and bracing systems – design of various components of bracings.

7 Hours

UNIT- 6

ROCK FILL DAMS: Introduction, Origin and usage of rock fill dams, types of rock fill dams, design of rock fill dams and construction of rock fill dams.

6 Hours

UNIT- 7

COFFER DAMS & CELLULAR COFFER DAMS I: Introduction – types of coffer dams - Design of cellular coffer dams on rock by Tennesse Valley Authority (TVA) method – safety against sliding, slipping, overturning, vertical shear and stability against bursting.

7 Hours

UNIT- 8

CELLULAR COFFER DAMS II: Design of cellular coffer dam on soil - safety against sliding, slipping, overturning, vertical shear and stability against bursting.

6 Hours

TEXT BOOKS:

1. **Soil Mechanics and Foundation Engineering** : Dr. K.R. Arora : Pub : Standard Publishers & Distributors.
2. **Soil Mechanics and Foundation Engineering,** : S.K. Garg : Pub : Khanna Publishers.

REFERENCE BOOKS:

1. **Soil Mechanics and Foundation Engineering,**: Dr. B.C. Punmia : Pub : Laxmi Publications Ltd.,
2. **Foundation Engineering.**: Dr. B.J. Kasmalkar
3. **Numericals in Geotechnical Engineering** : A.V. Narasimha Rao & C. Venkataramaiah :Pub : University Press.
4. **Hydraulic Structures**: S.K. Garg : Pub : Khanna Publishers.
5. **Soil Mechanics and Foundation Engineering,** : Dr. V.N.S. Murthy : Pub : Sai Tech.

6. **Geotechnical Engineering,** : Dr. C. Venkataramaiah : Pub : New age publications.
7. **Geotechnical Engineering** : Purushotam Raj .
8. **Theory and Practice of Soil Engineering** : Alum Singh .
9. **Principles of Geotechnical Engineering, Das, B**. M., Cengage Learning, 2009

HIGHWAY GEOMETRIC DESIGN

Subject Code	**: 10CV755**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Geometric Control factors like Topography -design speed – design vehicle – Traffic – Capacity – volume – environment and other factors as per IRC and AASHTO standards and specifications- PCU concept – factors controlling PCU for different design purpose

6 Hours

UNIT - 2

CROSS SECTIONAL ELEMENTS: Pavement surface characteristics – friction – skid resistance – pavement unevenness - light reflecting characteristics – camber – objectives – types of camber – methods of providing cambers in the field – problems – carriage way – kerb – median – shoulder – foot path – parking lanes – service roads – cycle tracks – Driveways – Right of way – Factors influencing right of way – Design of Road humps as per latest I RC provisions.

10 Hours

UNIT - 3

SIGHT DISTANCE: Importants, types, Side distance at uncontrolled intersection, derivation, factors affecting side distance, IRC, AASHTO standards, problems on above.

6 Hours

UNIT - 4

HORIZONTAL ALIGNMENT: Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum and maximum radius, Assumptions – problems – method of providing super elevation for different curves – Extra widening of pavement on curves – objectives – Mechanical widening – psychological widening – Transition curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve – Setting the transition curve in the field, set back distance on horizontal curve and problems on above

8 Hours

PART - B

UNIT - 5

VERTICAL ALIGNMENT: Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Design standards for hilly roads – problems on the above.

5 Hours

UNIT - 6

INTERSECTION DESIGN: Principle – Atgrade and Grade separated junctions – Types – channelization – Features of channelising Island – median opening – Gap in median at junction.

6 Hours

UNIT - 7

ROTARY INTERSECTION: Elements – Advantages – Disadvantages – Design guide lines – problem on the above – Grade separated intersection – Three legged inter section – Diamond inter change – Half clover leaf – clover leaf- Advantages- Disadvantages only

6 Hours

UNIT - 8

HIGHWAY DRAINAGE: Importance – sub surface drainage –surface drainage – Design of road side drives – Hydrological – Hydraulical considerations and design of filter media, problems on above.

5 Hours

TEXT BOOKS:

1. **Principle and practice of Highway Engineering**- L R KADIYALI & N B LAL : Khanna publications
2. **Highway Engineering** – Khanna S K & Justo, Nemchand & Bros.
3. **Highway Engineering** by Srinivas Kumar.

REFERENCE BOOKS:

1. **Highway Engineering**- Kadiyali L R : Khanna publications
2. **Relavent IRC** Publications
3. **Transportation Engineering and Planning**- Papa Coastas and Prevendors PHI, New Delhi.

OPEN CHANNEL HYDRAULICS

Subject Code	**: 10CV756**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors.

8 Hours

UNIT - 2

UNIFORM FLOW: Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow.

8 Hours

UNIT - 3

CRITICAL FLOW: Concept of specific Energy – Classification of flow. Design of channel, Section Factor, Hydraulic exponent for critical flow critical depth as a flow measurement.

6 Hours

UNIT - 4

GRADUALLY VARIED FLOW: Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification.

6 Hours

PART - B

UNIT - 5

Analysis of flows profiles, Method of singular point and transitional depth, Methods of computation, Practical problems.

6 Hours

UNIT - 6

Gradually Varied Flow Computations: Different methods, direct integration method, Bress's Solution, Chow's solution, direct method, standard step method.

8 Hours

UNIT - 7

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump – length location height, application of hydraulic jump stilling basins, shape type-2 and type-4.

6 Hours

UNIT - 8

Hydraulic jump in rectangular channels, Sloping channels, Jump in non rectangular channels, application of hydraulic jump as energy desipator

4 Hours

TEXTBOOKS:

1. **Open Channel Hydraulics** : Subramanya : Tata Mc Graw Hill Publishing Co Ltd, New Delhi
2. **Open Channel Flow** – Madan Mohan Das, Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition.
3. **Flow Through Open Channels** – Rajesh Srivastava, Oxford Press, New Delhi 2008 Edition.

REFERENCE BOOKS:

1. **Open Channel Hydraulics** : French : Mc Graw Hill Book Company, New Delhi.
2. **Fluid Mechanics** : Modi and Seth : Standard Book Home, New Delhi.
3. **Open Channel Hydraulics** : Henderson : Mr. Millan Publishing Co. Ltd., New York.
4. **Open Channel Hydraulic** : Ven Te Chow : Mc Graw Hill Book Company, New Delhi.

SOLID WASTE MANAGEMENT

Subject Code	**10CV757**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition, Land Pollution – scope and importance of solid waste management, functional elements of solid waste management.

SOURCES: Classification and characteristics – municipal, commercial & industrial. Methods of quantification.

08 Hours

UNIT - 2

COLLECTION AND TRANSPORTATION: Systems of collection, collection equipment, garbage chutes, transfer stations – bailing and compacting, route optimization techniques and problems.

06 Hours

UNIT - 3

TREATMENT / PROCESSING TECHNIQUES: Components separation, volume reduction, size reduction, chemical reduction and biological processing problems.

6 Hours

UNIT - 4

INCINERATION: Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolsis, design criteria for incineration.

7 Hours

PART - B

UNIT - 5

COMPOSTING: Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.

6 Hours

UNIT - 6

SANITARY LAND FILLING: Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills.

8 Hours

UNIT - 7

DISPOSAL METHODS: Open dumping – selection of site, ocean disposal, feeding to hogs, incineration, pyrolsis, composting, sanitary land filling, merits and demerits, biomedical wastes and disposal.

6 Hours

UNIT - 8

RECYCLE AND REUSE: Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

5 Hours

REFERENCES

1. **Integrated Solid Waste Management:** Tchobanoglous : M/c Graw Hill.
2. **Solid Waste Management in developing countries.** Bhide and Sunderashan
3. **Hand book on Solid Waste Disposal**.: Pavoni J.L.
4. **Environmental Engineering**.: Peavy and Tchobanoglous
5. **Environmental Engineering – Vol II.**: S.K. Garg
6. **Biomedical waste handling rules** – 2000.
7. **Solid Waste Engineering by** Vesilind.Pa Worrell & Reinhart.D. – 2009, Cengage Learning India Private Limited, New Delhi.

NUMERICAL METHODS IN CIVIL ENGINEERING

Subject Code	**: 10CV761**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART -A

UNIT - 1

INTRODUCTION: Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering

1 Hour

DEVELOPMENT OF ALGORITHM/ FLOW CHARTS FOR FOLLOWING METHODS FOR SOLUTION OF LINEAR SIMULTANEOUS EQUATION:

a) Gaussian elimination method,
b) Gauss-Jordan matrix inversion method,
c) Gauss-Siedel method and
d) Factorization method **6 Hours**

UNIT - 2

APPLICATION OF SOLUTION OF LINEAR SYSTEM OF EQUATIONS TO CIVIL ENGINEERING PROBLEMS : Construction planning, slope deflection method applied to beams, frames and truss analysis.

5 Hours

UNIT - 3

APPLICATION OF ROOT FINDING TO CIVIL ENGINEERING PROBLEMS: Development of algorithm for a) Bisection method and b) Newton-Raphson method and its applications for solution of non linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.

6 Hours

UNIT - 4

APPLICATION OF NUMERICAL INTEGRATION FOR SOLVING SIMPLE BEAM PROBLEMS: Development of algorithm for a) Trapezoidal rule and b) Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

6 Hours

PART -B

UNIT - 5

New Marks method for computation of slopes and deflections in statically determinate beams.

6 Hours

UNIT - 6

DEVELOPMENT OF ALGORITHM AND APPLICATION OF SOLUTION OF ORDINARY DIFFERENTIAL EQUATION TO CIVIL ENGINEERING PROBLEMS BY: a) Euler's method b) Runge Kutta 4^{th} order method

7 Hours

UNIT - 7

APPLICATION OF FINITE DIFFERENCE TECHNIQUE IN STRUCTURAL MECHANICS: i. Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences. ii. Application of finite difference method for analysis of
a) statically determinate beams, b) statically indeterminate beams

8 Hours

UNIT - 8

Application of Finite difference technique in structural mechanics (Contd..)
a) Buckling of columns, b) Beams on elastic foundation.

7 Hours

REFERENCE BOOKS:

1. **Numerical Methods for Engineers**- Chapra S.C. & R.P.Canale : McGraw Hill, 1990.
2. **Numerical methods in Engineering Problem-** N.Krishna Raju, K.U.Muthu : MacMillan Indian Limited, 1990.
3. **Numerical methods for Engineers and Scientists**- Iqbal H.Khan, Q. Hassan : Galgotia, New Delhi, 1997.
4. **Numerical methods in Computer Programs in C^{++}"** - Pallab Ghosh : Prentice Hall of India Private Limited, New Delhi, 2006.
5. **Numerical methods for engineers using MATLAB and C – I** Edition SCHILLING " Thomson Publications"

ROCK MECHANICS

Subject Code	**: 10CV762**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition, Importance, History of Rock Mechanics, Distribution of rocks – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks, Palaeozoick Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps, Steriographic presentation of Geological data – Representation and plotting line and plane

6 Hours

UNIT - 2

LABORATORY TESTS ON ROCK.S Tests for Physical Properties, Compressive strength, Tensile strength, Direct shear, Triaxial Shear, Slake Durability, Schmidt Rebound Hardness, Sound Velocity, Swelling Pressure & Free Swell, Void Index

6 Hours

UNIT – 3

STRENGTH, MODULUS AND STRESS STRAIN BEHAVIOUR OF ROCKS

Factors influencing rock behaviour, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Compressive strength and

modulus from SPT, Stress Strain models – Elastic model, Elasto plastic model, Visco elastic model

6 Hours

UNIT - 4

ENGINEERING CLASSIFICATION OF ROCK AND ROCK MASS – RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRS and RSR System. Classification based on strength and modulus, Clasification based on strength and failure strain, rock discontinuity qualitative description, friction in rocks – Amonton's law of friction,

8 Hours

PART - B

UNIT - 5

FIELD TESTS ON ROCKS AND ROCK MASS Geophysical methods Seismc Refraction method, Electrical Resistivity method, Deformability tests – Plate Jack Test, Goodman Jack Test, Field shear test - Field Permeability Test – Open end Test, Packers Test.

6 Hours

UNIT - 6

STABILITY OF ROCK SLOPES Modes of failure – Rotational, Plane and wedge failures, Plane failure method of Analysis, Wedge method of Analysis, Toppling failure, Protection against slope failure.

6 Hours

UNIT - 7

ROCK FOUNDATION Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Factor of Safety, Sliding sability of dam foundation, Settlement in rocks, Bearing capacity of piles in rock, Measures for strengthening rock mass – Concrete shear keys, Bored concrete piles, Tensioned cable anchors, concrete block at toe

6 Hours

UNIT - 8

MISCELLANEOUS TOPICS Drilling, Blasting and underground open excavation, Mining and other Engineering applications, criteria for design of underground excavations, tubular excavations, pillars and ribs support multiple excavations. Structural defects in Rock masses, their improvement by rock bolting, grouting and other methods. Rock grouting, Rock Reinforcement

8 Hours

TEXT BOOKS:

1. **Foundation of Rock masses** - Joegar and Cook : 3rd Edition Chapman and Hall, London.
2. **Engineering in Rocks for Slopes foundations and Tunnels – Ramamurthy, T., PHI Publishers, 2007**
3. **Introduction to rock mechanics**- Goodman : : Wiley International.

REFERENCE BOOKS:

1. **Rock Mechanics and the design of structures in Rock**- : John Wiley, New York.
2. **Rock Mechanics in Engineering practice**- Ziekiewicz. O.C. and Stagg K.G. : John, Wiley, New York.

PAVEMENT MATERIALS AND CONSTRUCTION

Subject Code	**: 10CV763**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A
PAVEMENT MATERIALS

UNIT - 1

AGGREGATES: Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

6 Hours

UNIT - 2

BITUMEN AND TAR: Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

4 Hours

UNIT - 3

BITUMINOUS EMULSIONS AND CUTBACKS: Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.

8 Hours

UNIT - 4

BITUMINOUS MIXES: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (no Hveem Stabilometer & Hubbar – Field Tests) bituminous mix, design methods using Rothfuch's Method only and specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.

6 Hours

PART - B

PAVEMENT CONSTRUCTION

UNIT - 5

EQUIPMENT IN HIGHWAY CONSTRUCTION: Various types of equipment for excavation, grading and compaction – their working principle,

advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

6 Hours

UNIT - 6

SUBGRADE: Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

6 Hours

UNIT - 7

FLEXIBLE PAVEMENTS: Specifications of materials, construction method and field control checks for various types of flexible pavement layers.

8 Hours

UNIT - 8

CEMENT CONCRETE PAVEMENTS: Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.

8 Hours

TEXT BOOKS:

1. **Highway Engineering**- Khanna, S.K., and Justo, C.E.G., : Nem Chand and Bros. Roorkee
2. **Construction Equipment and its Management**- Sharma, S.C. : Khanna Publishers.
3. **Hot Mix Asphalt Materials, Mixture Design and Construction**- Freddy L. Roberts, Kandhal, P.S. : University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

REFERENCES BOOKS:

1. RRL, DSIR, '**Bituminous Materials in Road Construction**', HMSO Publication.
2. RRL, DSIR, '**Soil Mechanics for Road Engineers**', HMSO Publication.
3. Relevant IRC codes and MoRT & H specifications.

PHOTOGRAMMETRY AND REMOTE SENSING

Subject Code	**: 10CV764**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

Part A

Unit 1: Photogrammetry – Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic

measurements, elevation of ponts by photographic measurements, determination of focal length. **8Hours**

Unit 2: Aerial Photogrammetry- advantages, vertical, tilted and oblique photographs, geometry of vertical photographs, scale of vertical photograph over flat and variable terrain, ground coordinates, computation of length of a line, computation of flying height, relief displacement, overlaps, flight planning, computation of required number of photographs for a given area, ground control in photogrammetry **9 Hours**

Unit 3: Basics of stereoscopy, stereoscopes, uses, parallax. Basic elements in photographic interpretation. Introduction to digital photogrammetry 6Hours

Part B:

Unit 4: Remote sensing:

Introduction, Ideal remote sensing system, basic principles of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth- surface materials, spectral reflectance of earth surface materials 6Hours

Unit 5:

Remote sensing platforms and sensors: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) 6Hours

Unit 6: Properties of digital image data, data formats,

Basics of digital image processing- radiometric and geometric corrections, image enhancements, image transforms based on arithmetic operations, image filtering 6Hours

Unit 7:

Remote sensing image interpretation, thematic classification (supervised and unsupervised) , maximum likelihood classification, introduction to accuracy assessment of classification 6Hours

Unit 8:

Applications of Remote sensing: applications in land use land cover analysis, change detection, water resources, urban planning, environmental and geological applications. 5Hours

Reference Books:

1. Mikhail E., J. Bethel, and J.C. McGlone, **Introduction to modern photogrammetry**. Wiley, 2001.
2. Wolf P.R, and B.A. Dewitt, **Elements of photogrammetry : with applications in GIS**. 3rd ed, McGraw-Hill, 2000.
3. Lillesand T.M., and R.W. Kiefer, **Remote sensing and image interpretation**. 4th ed, John Wiley & Sons, 2000.
4. Jensen J.R., **Introductory digital image processing: a remote sensing perspective**. 2nd ed Prentice Hall, 1996.
5. Richards J.A., and X. Jia, **Remote sensing digital image analysis: an introduction**. 3rd ed Springer, 1999.
6. Mather P.M., **Computer processing of remotely-sensed images: an introduction.** Wiley,1988.

AIR POLLUTION AND CONTROL

Subject Code	**10 CV765**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition – Classification and Characterization of Air Pollutants,

Emission Sources, Behavior and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog, Air Pollution Inventories.

6 Hours

UNIT - 2

EFFECTS OF AIR POLLUTION: On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

6 Hours

UNIT - 3

METEOROLOGY: Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meterological Models.

8 Hours

UNIT - 4

Factors to be considered in Industrial Plant Location and Planning

Noise pollution – sources, measurement units, effects and control

4 Hours

PART - B

UNIT - 5

SAMPLING, ANALYSIS AND CONTROL: Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement, Air Pollution Control Methods – Particulate, Emission Control, Gravitational Settling Chambers, Cyclone

Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

16 Hours

UNIT - 6

AIR POLLUTION DUE TO AUTOMOBILES: Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

5 Hours

UNIT - 7

BURNING ENVIRONMENTAL ISSUES:

1. Acid Rain
2. Global Warming
3. Ozone Depletion in Stratosphere
4. Indoor Air Pollution

4 Hours

UNIT - 8

ENVIRONMENTAL LEGISLATION: Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards.

3 Hours

REFERENCES

1. Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), **Fundamentals of Air Pollution** –Academic Press.
2. Crawford, M., (1980), **Air Pollution Control Theory** –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
3. Henry. C. Perkins, (1980), **Air Pollution** –McGraw Hill.
4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering** –Mc Graw Hill Book Co.
5. Sincero, A.P and Sincero, G.A., (1999), **Environmental Engineering - A Design Approach** –Prentice Hall of India.
6. Wark, K., Warner, C.F. and Davies, W.T., (1998), **Air Pollution- Its Origin and Control** –Harper & Row Publishers, New York.

DESIGN AND DRAWING OF BRIDGES

Subject Code	**: 10CV766**	IA Marks	: 25
No. of Lecture Hours/Week	: 02 (T) + 3 (D)	Exam Hours	: 04

Total No. of Lecture Hours : 26 (T) + 39 (D) Exam Marks : 100

PART - A

UNIT - 1

BRIDGE PRELIMINARIES: Classification of bridges and standard loads, Bridge-definition, components of bridges, various classification, types of bridges, forces to be considered for the design, IRC standards.

HYDRAULIC DESIGN: Methods of finding design discharge, natural, artificial and linear water ways, afflux, economic span.

SUBSTRUCTURES AND FOUNDATIONS: Types of abutments, piers and wing walls, forces to be considered for the design, Types of foundations and forces to be considered for the design, depth of scour.

6 Hours

UNIT - 2

DESIGN AND DRAWING OF RC SLAB CULVERT for IRC class-AA loading, & class A loading. Design of pipe culvert. Empirical design of bank connections. Drawing slab culvert & pipe culvert for given site particulars.

6+12 Hours

PART - B

UNIT - 3

DESIGN AND DRAWING OF RC T BEAM BRIDGE with cross beams by Piegaud's and Courbon's method for class-AA loading, empirical design of substructures and foundations.

5+12 Hours

UNIT - 4

DESIGN OF COMPOSITE BRIDGE: Design of composite bridge for EUDL, Shear connectors-design requirments for shear connectors. Drawing of composite bridge.

5+9 Hours

UNIT - 5

Typical Design and detailing of approach slab, Hand rails- Typical design and detailing of slab culverts and girder bridges as per MOT standards

4+6 Hours

TEXT BOOKS:

1. **Essentials of Bridge Engineering** : Johnson – victor : Oxford IBH Publications, New Delhi.
2. **Design of Bridges** : Krishna Raju N : Oxford IBH Publications, New Delhi.

REFERENCE BOOK:

1. **Design of Bridge Structures** : Jagadish T. R. & Jayaram M. A. : Prentice Hall of India, New Delhi.

STRUCTURAL DYNAMICS

Subject Code	**: 10CV767**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction to structural dynamics, Brief history of vibration and Earthquakes, Major earthquakes, Earthquakes zones, some basic definitions, Vibration of single degree of freedom system, undamped, damped, free vibrations, logarithmic decrement.

6 Hours

UNIT - 2

Forced vibrations of single degree freedom systems, response of undamped and damped systems subjected to harmonic loading, rotation unbalance, reciprocating unbalance.

6 Hours

UNIT - 3

Duhamel's integral, response due to general system of loading, dynamic load factor, response spectrum, response of SDOF subjected to harmonic base excitation, vibration isolation.

7 Hours

UNIT - 4

Free vibration of multi degree of freedom systems, natural frequencies, normal modes, orthoganality property of normal modes, eigen values.

7 Hours

PART - B

UNIT - 5

Shear buildings modeled as multi degree of freedom systems, free vibrations, natural frequencies.

6 Hours

UNIT - 6

Forced vibration motion of shear builings, modal super position method, response of shear buldings to base motion, harmonic forced excitation.

6 Hours

UNIT - 7

Damped motion of shear buildings, equations for damped shear buildings, uncoupled damped equations, conditions for damping uncoupling.

7 Hours

UNIT - 8

Dynamic analysis of beams stiffness matrices, lumped mass and consistent mass formulation equations of motion.

7 Hours

REFERENCE BOOK:

1. **Vibrations, structural dynamics**- M. Mukhopadhaya : Oxford IBH
2. **Structural Dynamics**- Mario Paz : CBS publishers.
3. **Structural Dynamics**- Anil Chopra : PHI Publishers.
4. **Structural Dynamics**- Clough & Penzen : TMH.

ENVIRONMENTAL ENGINEERING LABORATORY

Subject Code	**10CVL77**	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. Determination of Solids in Sewage: Total Solids, Suspended Solids,Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.
2. Electrical conductivity. Determination of Chlorides and Sulphates.
3. Determination of Alkalinity, Acidity and pH.
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen. Determination of BOD.
6. Determination of COD.
7. Determination of percentage of available chlorine in bleaching powder, Residual Chlorine and Chlorine Demand.
8. Jar Test for Optimum Dosage of Alum, Turbidity determination by Nephelometer.
9. Determination of Iron. Phenanthroline method.
10. Determination of Fluorides SPANDS Method.

11. MPN Determination

12. Determination Nitrates by spectrophotometer.

13. Determination of sodium and potassium by flame photometer.

REFERENCES

1. **Manual of Water and Wastewater Analysis** – NEERI Publication.
2. **Standard Methods for Examination of Water and Wastewater** (1995), American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. **IS Standards :** 2490-1974, 3360-1974, 3307-1974.
4. **Chemistry for Environment Engineering**. Sawyer and Mc Carthy,

CONCRETE AND HIGHWAY MATERIALS LABORATORY

Subject Code	**: 10CVL78**	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

PART - A

CEMENT: Normal Consistency, Setting time, Soundness by Autoclave method, Compression strength test and Air permeability test for fineness, Specific gravity of cement.

FRESH CONCRETE: Workability – slump, Compaction factor and Vee Bee tests.

HARDENED CONCRETE: Compression strength and Split tensile tests. Test on flexural strength of RCC beams, Permeability of concrete.

PART - B

SOIL: Density of Soil by Sand replacement method, CBR Text.

AGGREGATES: Crushing, abrasion, impact and Shape tests (Flaky, Elongation, Angularity number) Specific gravity and water absorption.

BITUMINOUS MATERIALS AND MIXES: Specific Gravity, Penetration,Ductility, Softening point, Flash and fire point, Viscosity, proportioning of aggregate mixes by Rothfutch Method, Marshall Stability tests.

REFERENCE BOOK:

1. Relevant IS Codes and IRC Codes.

2. **Highway Material Testing Laboratory Manual** by Khanna S K and Justo, – CEG Nemi Chand & Bros.
3. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi.

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VIII -SEMESTER

ADVANCED CONCRETE TECHNOLOGY

Subject Code	**: 10CV81**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

7 Hour

UNIT - 2

CHEMICAL ADMIXTURES- Mechanism of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation superplasticiser.

MINERAL ADMIXTURE-Fly ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state.

6 Hours

UNIT - 3

MIX DESIGN - Factors affecting mix design, design of concrete mix by BIS method using IS10262 and current American (ACI)/ British (BS) methods. Provisions in revised IS10262-2004.

6 Hours

UNIT - 4

DURABILITY OF CONCRETE - Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability.

7 Hours

PART - B

UNIT - 5

RMC concrete - manufacture, transporting, placing, precautions, Methods of concreting- Pumping, under water concreting, shotcrete, High volume fly ash concrete concept, properties, typical mix

Self compacting concrete concept, materials, tests, properties, application and Typical mix.

6 Hours

UNIT - 6

Fiber reinforced concrete - Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages, behavior in flexure and shear, Ferro cement - materials, techniques of manufacture, properties and application

7 Hours

UNIT - 7

Light weight concrete-materials properties and types. Typical light weight concrete mix High density concrete and high performance concrete-materials, properties and applications, typical mix.

6 Hours

UNIT - 8

Test on Hardened concrete-Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. Tests on composition of hardened concrete-cement content, original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity methods.

7 Hours

TEXT / REFERENCE BOOKS:

1. **Properties of Concrete**- Neville, A.M. - ELBS Edition, Longman Ltd., London
2. **Concrete Technology**- M.S. Shetty
3. **Concrete Technology**- A.R. Santhakumar,-Oxford University Press.
4. **Concrete**- P.K. Mehta, P J M Monteiro,- Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute Chennai)
5. ACI Code for Mix Design
6. IS 10262-2004
7. **Concrete Mix Design**- N. Krishna Raju - Sehgal Publishers
8. **Concrete Manual**- Gambhir M.L.- Dhanpat Rai & Sons, New Delhi
9. **Advanced Concrete Technology Processes**- John Newman, Ban Seng Choo, - London.
10. **Advanced Concrete Technology Constituent materials**- John Newman, Ban Seng Choo- London
11. **Non-Destructive Test and Evaluation of Materials**- J.Prasad, C G K Nair,-Mc Graw Hill.
12. **High Performance Concrete**- Prof Aitcin P C- E and FN, London.
13. **Properties of Fresh Concrete**- Power T.C.- E and FN, London

DESIGN AND DRAWING OF STEEL STRUCTURES

Subject Code	**:10CV82**	IA Marks	: 25
No. of Lecture Hours/Week	: 02 (T) + 3 (D)	Exam Hours	: 04
Total No. of Lecture Hours	: 26 (T) + 39 (D)	Exam Marks	: 100

PART - A

(DRAWINGS TO BE PREPARED FOR GIVEN STRUCTURAL DETAILS)

UNIT - 1

CONNECTIONS: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

UNIT - 2

COLUMNS: Splices, Column-column of same and different sections. Lacing and battens.

UNIT - 3

COLUMN BASES: Slab base and gusseted base, grillage foundation.

08 (T) + 15 (D)

PART - B

UNIT - 4

Design and drawing of

i) Bolted and welded plate girder
ii) Roof Truss (Forces in the members to be given)
iii) Gantry girder

18 (T) + 24 (D)

Note : i. In part A, Two questions to be set, out of which one question to be answered (30% weightage).
ii. In part B, Two questions to be set, out of which one question to be answered (70% weightage).

TEXT / REFERENCE BOOKS:

1. **Structural Design & Drawing** – N.Krishna Raju, Unversities Press, India.
2. **Design of Steel Structures** - N. Subramanian : Oxford University, Press.
3. **Design of Steel Structures** - Negi - Tata Mc Graw Hill Publishers.
4. **Design of Steel Structures** - Arya and Ajaman- Nem Chand & Bros. Roorkee.
5. **Design of Steel Structures.-** Raghupati
6. IS : 800 – 2007,
7. SP 6 (1) – 1984 or Steel Table.

ADVANCED PRESTRESSED CONCRETE STRUCTURES

Subject Code	**: 10CV831**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

ANCHORAGE ZONE STRESSES IN POST-TENSIONED MEMBERS: Introduction, stress distribution in end block, investigations on Anchorage zone stresses, Magnel and Guyon's Methods, Comparative Analysis, Anchorage zone reinforcement.

6 Hours

UNIT - 2

SHEAR AND TORSIONAL RESISTANCE: Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, Torsion, Design of reinforcement for torsion.

6 Hours

UNIT - 3

COMPOSITE BEAMS: Introduction, types of composite beams, analysis for stresses, differential shrinkage, serviceability limit state. Design for flexural and shear strength.

8 Hours

UNIT – 4

TENSION MEMBERS: Introduction, Ties, Pressure pipes – fabrication process, analysis, design and specifications. Cylindrical containers - construction techniques, analysis, design and specifications.

6 Hours

PART - B

UNIT - 5

STATICALLY INDETERMINATE STRUCTURES: Introduction, Advantages of continuous members, effect of prestressing in indeterminate structures, methods of analysis for secondary moments, concordant cable profile, Guyon's theorem, Ultimate load analysis, Design of continuous beams and portal frames.

8 Hours

UNIT - 6

COMPRESSION MEMBERS: Introduction, Columns, short columns, long columns, biaxially loaded columns, Design specifications.

6 Hours

UNIT - 7

SLAB AND GRID FLOORS: Types of floor slabs, Design of one way ,two way and flat slabs. Distribution of prestressing tendons, Analysis and design of grid floors.

5 Hours

UNIT - 8

PRECAST ELEMENTS: Introduction, Prestressed concrete poles-manufacturing techniques, shapes and cross sectional properties, design loads, design principles. Railway sleepers-classification and Manufacturing techniques, design loads, analysis and design principles. Prestressed concrete pavements, slab and wall panels.

7 Hours

TEXT / REFERENCE BOOKS:

1. **Design of Prestressed concrete structures** - Lin T.Y. and H. Burns - John Wiley & Sons, 1982.
2. **Prestressed Concrete**- N. Krishna Raju - Tata Megrahill, 3rd edition, 1995.
3. **Prestressed Concrete Structures**- P. Dayaratnam - Oxford & IBH, 5th Edition, 1991.
4. **Prestressed Concrete**- G.S. Pandit and S.P. Gupta - CBS Publishers, 1993.
5. IS : 1343 : 1980.

ADVANCED FOUNDATION DESIGN

Subject Code **: 10CV832** IA Marks : 25
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

PART - A

UNIT - 1

BEARING CAPACITY & SETTLEMENT: Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations, Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements, Factors influencing settlement, Safe Bearing Capacity and Allowable Bearing Pressure.

6 Hours

UNIT - 2

SHALLOW FOUNDATIONS: Principles of Design of foundation, Definition for Shallow and Deep foundation, Requirements for geotechnical and structural aspects of design, Proportioning of isolated footing, combined footing, Strap footing, Strip footing and Raft foundation.

6 Hours

UNIT - 3

PILE FOUNDATIONS – SINGLE PILE: Historical Development, Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests, Laterally Loaded Pile.

6 Hours

UNIT - 4

PILE FOUNDATIONS – GROUP EFFECT: Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, Under reamed piles.

7 Hours

PART - B

UNIT - 5

WELL FOUNDATIONS: Historical Development, Different shapes and characteristics of wells, Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies for tilts and shifts.

6 Hours

UNIT - 6

DRILLED PIERS & CAISSONS: Construction, advantages and disadvantages of drilled piers. Design concepts and Advantages and disadvantages of open, pneumatic and floating caissons.

7 Hours

UNIT - 7

FOUNDATIONS ON EXPANSIVE SOILS: Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and Swell pressure, Free swell, Tests on expansive soils, foundation treatment for structures in expansive soil, CNS layer.

6 Hours

UNIT - 8

MACHINE FOUNDATIONS: Basic definitions in vibration, free and forced vibrations, determination of natural frequency, types of Machine foundations, general criteria for design of machine foundation.,vibration

analysis of a machine foundation, degrees of freedom of a block foundation, vibration isolation and control,

8 Hours

TEXT BOOKS:

1. **Soil Mechanics & Foundation Engineering** - V.N.S. Murthy - Pub: Sai Tech.
2. **Foundation Engineering** - Braja M. Das – Cengage Learning.
3. **Soil Mechanics Foundations** - Dr. B.C. Punmia - Pub : Laxmi publications, pvt. Ltd.

REFERENCE BOOKS:

1. **Foundation Analysis and Design** - Bowles J.E. (1996) - 5th Ed, McGraw Hill Pub. Co., New York.
2. **Advanced Foundation Engineering** - V.N.S. Murthy - Pub : Sai Tech.
3. **Pile Foundation**.- Chellies
4. **Geotechnical Engineering.-** P. Purushotham Raj
5. **Geotechnical Engineering** - Dr. C. Venkataramaiah - Pub : New age Publications.
6. **Foundation Engineering** - Dr. P.C. Varghese :- Pub : Prentice Hall of India.

PAVEMENT DESIGN

Subject Code	**: 10CV833**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Desirable characteristics of pavement, types and components, Difference between Highway pavement and Air field pavement – Design strategies of variables – Functions of sub-grade, sub base – Base course – surface course – comparison between Rigid and flexible pavement.

6 Hours

UNIT - 2

FUNDAMENTALS OF DESIGN OF PAVEMENTS: Design life – Traffic factors – climatic factors – Road geometry – Subgrade strength and drainage, Stresses and deflections, Boussinesqs theory – principle, Assumptions – Limitations and problems on above - Busmister theory – Two layered analysis – Assumptions – problems on above

6 Hours

UNIT - 3

DESIGN FACTORS: Design wheel load – contact pressure – ESWL concept – Determination of ESWL by equivalent deflection criteria – Stress criteria – EWL concept.

6 Hours

UNIT - 4

FLEXIBLE PAVEMENT DESIGN: Assumptions – McLeod Method – Kansas method – Tri-axial method - CBR method – IRC Method (old) - CSA Method using IRC 37-2001, problems on above.

6 Hours

PART - B

UNIT - 5

STRESSES IN RIGID PAVEMENT: Principle – Factors - wheel load and its repetition – properties of sub grade – propertie Pp ps ppppppconcrete. External conditions – joints – Reinforcement – Analysis of stresses – Assumptions – Westergaard's Analysis – Modified Westergaard equations – Critical stresses – Wheel load stresses, Warping stress – Frictional stress – combined stresses (using chart / equations) - problems on above.

6 Hours

UNIT - 6

DESIGN OF RIGID PAVEMENT: Design of C.C. Pavement by IRC: 38 – 2002 for dual and Tendem axle load – Reinforcement in slabs – Requirements of joints – Types of joints – Expansion joint – contraction joint – warping joint – construction joint – longitudinal joint, Design of joints, Design of Dowel bars, Design of Tie bars – problems of the above

8 Hours

UNIT - 7

FLEXIBLE PAVEMENT FAILURES, MAINTENANCE AND EVALUATION: Types of failures, causes, remedial/maintainance measures in flexible pavements – Functional Evaluation by visual inspection and unevenness measurement by using different technics - Structural Evaluation by Benkelman Beam Deflection Method, Falling weight deflectometer, GPR Method. Design factors for Runway Pavements - Design methods for Airfield pavements and problems on above.

7 Hours

UNIT - 8

RIGID PAVEMENT FAILURES, MAINTENANCE AND EVALUATION: Types of failures, causes, remedial/maintainance measures in regid pavements – Functional Evaluation by visual inspection and

unevenness measurements. Design factors for Runway Pavements - Design methods for Airfield pavements.

7 Hours

TEXT BOOKS:

1. **Highway Engineering**- Khanna & Justo
2. **Principles & Practices of Highway Engineering**- L R Kadiyalli & N B. Lal
3. **Pavement Analysis & Design** - Yang H. Huang- II edition.
4. Relavent IRC codes

REFERENCE BOOKS:

1. **Principles of Pavement Design**- Yoder and Witzack - 2nd edition, John Wileys and Sons
2. **Principles of Pavement Design**- Subha Rao

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Subject Code	**:10CV834**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Earthquake ground Motion, Engineering Seismology, Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India.

6 Hours

UNIT - 2

Seismic Design Parameters. Types of Earthquakes, earthquake ground motion characteristics, response spectra and design spectrum.

6 Hours

UNIT - 3

Structural modelling, Code based seismic design methods. Response control concepts, seismic evaluation and retrofitting methods.

6 Hours

UNIT - 4

Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture – lateral load resistant systems, building characteristics.

6 Hours

PART - B

UNIT - 5

Seismic design philosophy, Determination of design lateral forces - Equivalent lateral force procedure, dynamic analysis procedure.

8 Hours

UNIT - 6

Step by step procedure for seismic analysis of RC buildings (maximum of 4 storeys , without infills) - Equivalent static lateral force method, response spectrum methods.

7 Hours

UNIT - 7

Earthquake resistant analysis and design of RC buildings – Preliminary data, loading data, load combinations, analysis and design of subframes. (maximum of 4 storeys, without infills).

7 Hours

UNIT - 8

Earthquake resistant design of masonry buildings - elastic properties of structural masonry, lateral load analysis, Design of two storied masonry buildings.

6 Hours

TEXT / REFERENCE BOOKS:

1. **Earthquake resistant design of structures** - Pankaj Agarwal, Manish Shrikande - PHI India.
2. **Earthquake Resistant Design of Structures** - S.K. Duggal - Oxford University Press, 2007.
3. **Earthquake Resistant Design**- Anil Chopra
4. **Earth Quake Engineering Damage Assessment and Structural design**- S.F. Borg - (John Wiley and Sons. 1983).

INDUSTRIAL WASTEWATER TREATMENT

Subject Code	**: 10CV835**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Sampling, effluent and stream Standards and Legislation to Control Water Pollution.

5 Hours

UNIT - 2

Stream Quality, Dissolved oxygen Sag Curve in Stream, Streeter– Phelps formulation, Numerical Problems on DO prediction.

6 Hours

UNIT - 3

TREATMENT METHODS-I: Volume Reduction, Strength Reduction, Neutralization, Equalization and Proportioning.

5 Hours

UNIT - 4

TREATMENT METHODS-II: Removal of Inorganic suspended solids, Removal of Organic Solids, Removal of suspended solids and colloids. Treatment and Disposal of Sludge Solids.

6 Hours

PART - B

UNIT - 5

COMBINED TREATMENT: Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams.

6 Hours

UNIT - 6

TREATMENT OF SELECTED INDUSTRIAL WASTE: Process flow sheet showing origin / sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of waste disposal on water bodies

THE INDUSTRIES TO BE COVERED ARE:

1. Cotton Textile Industry
2. Tanning Industry
3. Cane Sugar Industry & Distillery Industry

10 Hours

UNIT - 7
TREATMENT OF SELECTED INDUSTRIAL WASTE-I:
1. Dairy Industry
2. Canning Industry
3. Steel and Cement Industry

7 Hours

UNIT - 8
TREATMENT OF SELECTED INDUSTRIAL WASTE-II:
1. Paper and Pulp Industry
2. Pharmaceutical Industry
3. Food Processing Industry

7 Hours

REFEENCES

1. **Industrial Waste Water Treatment**- Nelsol L. Nemerow.
2. **Industrial Waste Water Treatment**.- Rao MN, and Dutta A.K.
3. **Waste Water Treatment, Disposal and Reuse** - Metcalf and Eddy inc - Tata McGraw Hill Publications, 2003.
4. **Industrial Wastewater Treatment** – Patwardhan A.D., PHI Learning Private Ltd., New Delhi, 2009
5. **Pollution Control Processes in industries-** Mahajan S.P.
6. Relevant IS Codes.

QUALITY MANAGEMENT SYSTEM IN CIVIL ENGINEERING

Subject Code	**: 10CV836**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1
QUALITY MANAGEMENT SYSTEM - QMS: Introduction – Evolution of Quality Management System, Element of Quality, Quality Management System, Concept of Process, Network of Process in an organization, ISO 9000 Family, Applying ISO 9000 in practice, Importance of ISO 9000, Benefits of ISO standards of society, Total Quality Management,

Comparison of ISO 9000 and TQM – Quality related definitions – Leaders in Quality or Quality Gurus – Customer Orientation – Mahatma Gandhi.

5 Hours

UNIT - 2

IMPLEMENTING ISO 9001-2000 QUALITY MANAGEMENT SYSTEM: ISO 9000 – Quality Management Principles, ISO 9000 Documents Content of ISO 9001 : 2000, ISO 9001-2000 Quality Management System Requirements, General Requirements, Documentation Requirements, Management Responsibilities, Resource Management, Product Realization, Measurement, analysis and Improvement Monitoring and Measurement, Non-conforming Product, Analysis of data, Improvement, Implementing ISO 9001-2000 Quality Management System.

5 Hours

UNIT - 3

PREPARING A ISO 9001-200 QUALITY MANAGEMENT SYSTEM FOR CIVIL ENGINEERING: Quality Manual, Introduction, Scope of the Quality Manual, Applicability, Responsibility, Quality Management System, General Requirements, Management Responsibilities, Management Commitment, Customer Focus, Indian Construction Company Quality Policy, Planning Responsibility, Authority and Communication, Management Review, Resource Management, Provision of Resources, Human Resources Product Realization, Planning or Product Realization, Customer Related Processes, Design and Development, Purchasing, Production and Service Provision, Control of Monitoring and Measuring Devices Measurement, analysis and Improvement, Monitoring and Measurement, Non-conforming product, Analysis of data, Improvement

8 Hours

UNIT - 4

QUALITY MANAGEMENT SYSTEM PROCEDURES: Introduction, procedure for management review, Format for writing procedures, procedure for preparing Quality plans/ work instructions, Contract review, Design control, Document and data control, Document numbering system, Change request, procedure for purchasing, procedure for control of customer supplied product, procedure for product identification and traceability, procedure for process control, procedure for inspection and testing, procedure for control of inspection, measuring and test equipments, procedure for inspection and test status, procedure for the control of non-conforming product, procedure for corrective and preventive action, procedure for handling, storage, packaging and delivery, control of quality records, procedure for internal quality audits.

8 Hours

PART - B

UNIT - 5

WORK INSTRUCTIONS: Introduction – Document and Data Control, Material Procurement, Material Handling, Tendering and Estimating, Planning, Design, Training, Plant and Equipment, Bar Bending Schedule, Concrete Works, Earthworks and Compaction, General Soil Investigation works, Survey works, Concrete Repair Works, Road Works, Painting Works, Water Proofing works, Drainage Works, Quality Assurance and Control, Patching and Transportation of Concrete.

5 Hours

UNIT - 6

METHOD STATEMENT: Introduction, Concrete Works, Earthworks and Compaction, General Soil Investigation works, Survey works, Concrete Repair works, Concrete Demolition works, Road Works, Fencing works etc.

5 Hours

UNIT - 7

1. **JOB DESCRIPTION:** Introduction, Job Description of : Managing Director, Project Manager, Site Manager, Site Engineer, QA/QC Engineer, Foreman, Typist/Clerk, Design Engineer, Planning Engineer.

2. **QUALITY CONTROL PLAN/INSPECTION AND TEST PLANS (ITPS):** Introduction-Preparation of Project Quality Plans, Inspection and Test plant.

8 Hours

UNIT - 8

QUALITY RECORD/FORMATS: Preparation of Standard Formats: Revision Control form, Document Distribution List, Document Master List, Non-Conformance Report, Store Issue/Receipt Voucher, Local Purchase Order, Material Stock Card, Audit Notification, Quality Audit Report, Corrective Action Report, Calibration Record, Calibration Master Sheet, Work Instruction, Job Description, Contract/Tender Review Form, Quantity Survey Estimation/Take off sheet, Material/Plant Requisition, Drawing Schedule, Bar-bending Schedule, Design Calculation Sheet, Request for Inspection, Concrete Inspection Request, Inspection Check List – Drainage, Painting, Request for Inspection-Concrete Repair, Accident Report Form, Concrete Production, Concrete Compressive Strength Test Results, Request to Conduct Cube Test, Quality Awareness Training Record.

8 Hours

REFERENCE BOOKS:

1. **Quality Management System in Civil Engineering** - D.S. Rajendra Prasad - ISO 9001-2000, Sapna Book House, Bangalore.
2. **Productivity and Quality Improvement** - John L. Hardesky - McGraw Hill Book Company.

3. **ISO 9000 Concepts, Methods, Implementation-** Bagchi - Wheeler Publishing.
4. **Training Manual on ISO 9000-2000 and TQM**- Girdhar J. Gyani - Raj Publishing House.
5. **Documenting Quality for ISO 9000 and other Industry Standards -** Gary E. MacLean -Tata McGraw Hill Publishing Company Limited.
6. **Total Quality Management for Engineers** - Mohamed Zairi - Aditya Books Private Limited.
7. **Data Book for Civil Engineers Field Practice** - Elwyn E. Seelye - John Wiley & Sons, Inc.
8. **Properties of Concrete** - A.M. Neville - ELBS Publications.
9. IS : 456-2000 : Indian Standard Specifications for Plain and Reinforced Concrete Code of Practice : 4th Revision, Bureau of Indian Standards.
10. IS : 383-1990 : Indian Standard Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete : Bureau of Indian Standards.
11. **Quality Management -** Kanishka Bedi -(Oxford university press).

FINITE ELEMENT ANALYSIS

Subject Code	**: 10CV841**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Basic Concepts, Background Review: Theory of Elasticity, Matrix displacement formulation, Energy concepts, Equilibrium and energy methods for analyzing structures.

6 Hours

UNIT - 2

Raleigh - Ritz Method, Galerkin's Method, Simple applications in structural analysis.

8 Hours

UNIT - 3

FUNDAMENTALS OF FINITE ELEMENT METHOD: Displacement function and natural coordinates, construction of displacement functions for 2 D truss and beam elements.

5 Hours

UNIT - 4

Applications of FEM for the analysis of plane truss, continuous beam and simple plane frame problems.

7 Hours

PART - B

UNIT - 5

ANALYSIS OF 2D CONTINUUM PROBLEMS: Elements and shape functions, Triangular, rectangular and quadrilateral elements, different types of elements, their characteristics and suitability for application.

7 Hours

UNIT - 6

Polynomial shape functions, Lagrange's and Hermitian polynomials, compatibility and convergence requirements of shape functions.

6 Hours

UNIT - 7

THEORY OF ISOPARAMETRIC ELEMENTS: Isoparametric, subparametric and super- parametric elements, characteristics of isoparametric quadrilateral elements.

7 Hours

UNIT - 8

FEM PROGRAM: Structure of computer program for FEM analysis, description of different modules, pre and post processing.

6 Hours

TEXT / REFERENCE BOOKS:

1. **Finite Element Analysis – Theory and Programming**- Krishnamoorthy – Tata McGraw Hill Co. Ltd., New Delhi.
2. **Finite Element Analysis for Engineering and Technology**- Chadrupatla, Tirupathi R., University Press, India
3. **Introduction to the Finite Element Method**- J.F. Abel and Desai. C.S. - Affiliated East West Press Pvt. Ltd., New Delhi.
4. **Finite Element Methods** - Debatis Deb - Prentice hall of India.
5. **Finite element analysis in engineering design**- Rajasekharan. S. - Wheeler Pulishers.
6. **A First Course on Finite Element Method** – Daryl L Logan, Cengage Learning
7. **The Finite Element Method**- Zienkeiwicz. O.C. - Tata McGraw Hill Co. Ltd., New Delhi.
8. **Finite Element Analysis**- S.S. Bhavikatti, - New Age International Publishers, New Delhi.

REINFORCED EARTH STRUCTURES

Subject Code **: 10CV842**
IA Marks : 25
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

PART - A

UNIT- 1
BASICS OF REINFORCED EARTH CONSTRUCTION: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwitch technique for clayey soil.
06 Hours

UNIT- 2
GEOSYNTHETICS AND THEIR FUNCTIONS
Historical developments, Recent developments, manufacturing process-woven &non-woven, Raw materials – polypropylene (polyolefin), Polyethylene (Polyoefin), Polyester, Polyvinyl chloride, Elastomers, Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics – Geotextiles, Geogrids, Geomembranes, Geocomposites, Geonets, Geofoam, Geomats, Geomeshes, Geowebs etc.
06 Hours

UNIT- 3
PROPERTIES AND TESTS ON MATERIALS
Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties
07 Hours

UNIT - 4
DESIGN OF REINFORCED EARTH RETAINING WALLS
Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, typical design problems
07 Hours

PART-B

UNIT- 5

DESIGN OF REINFORCED EARTH FOUNDATIONS AND EMBANKMENTS

Foundations - Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

Embankments - Concept of Reinforced Embankments, Internal and external stability, Selection of materials, typical design problems

07 Hours

UNIT - 6

SOIL NAILING TECHNIQUES

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

06 Hours

UNIT- 7

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS:

Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability.

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps

07 Hours

UNIT- 8

GEOSYNTHETICS FOR ROADS AND SLOPES

Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements

Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.

06 Hours

TEXT BOOKS:

1. **Design with geosynthetics**- Koerner. R.M. - Prince Hall Publication, 2005.

2. **Construction and Geotechnical Engineering using synthetic fabrics**- Koerner. R.M. & Wesh, J.P.- Wiley Inter Science, New York, 1980.
3. **An introduction to Soil Reinforcement and Geosynthetics** – Sivakumar Babu G. L., Universities Press, Hyderabad, 2006
4. **Reinforced Soil and its Engineering Applications, Swami Saran,** I. K. International Pvt. Ltd, New Delhi, 2006
5. **Engineering with Geosynthetics**- Venkattappa Rao, G., & Suryanarayana Raju., G. V.S. - Tata Mc Graw Hill publishing Company Limited., New Delhi.

REFERENCE BOOKS:

1. **Earth reinforcement and Soil structure**- Jones CJEPButterworths, London, 1996.
2. **Geotextile Hand Book**- Ingold, T.S. & Millar, K.S. - Thomas, Telford, London.
3. **Earth Reinforcement Practices** - Hidetoshi Octial, Shigenori Hayshi & Jen Otani -Vol. I, A.A. Balkema, Rotterdam, 1992.
4. **Ground Engineer's reference Book**- Bell F.G. - Butterworths, London, 1987.
5. **Reinforced Earth**- Ingold, T.S. - Thomas, Telford, London.
6. **Geosynthetics in Civil Engineering**, Editor Sarsby R W, Woodhead Publishing Ltd & CRC Press, 2007

URBAN TRANSPORT PLANNING

Subject Code	**: 10CV843**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Scope of Urban transport planning – Inter dependency of land use and traffic – System Approach to urban planning.

6 Hours

UNIT - 2

STAGES IN URBAN TRANSPORT PLANNING: Trip generation – Trip production - Trip distribution – Modal split – Trip assignment.

6 Hours

UNIT - 3

URBAN TRANSPORT SURVEY - Definition of study area-Zoning-Types of Surveys – Inventory of transportation facilities – Expansion of data from sample.

8 Hours

UNIT - 4

TRIP GENERATION: Trip purpose – Factors governing trip generation and attraction – Category analysis – Problems on above

5 Hours

PART - B

UNIT - 5

TRIP DISTRIBUTION: Methods – Growth factors methods – Synthetic methods – Fractor and Furness method and problems on the above.

5 Hours

UNIT - 6

MODAL SPLIT: Factors affecting – characteristics of split – Model split in urban transport planning – problems on above

6 Hours

UNIT - 7

TRIP ASSIGNMENT: Assignment Techniques – Traffic fore casting – Land use transport models – Lowry Model – Garin Lowry model – Applications in India – (No problems on the above)

8 Hours

UNIT - 8

URBAN TRANSPORT PLANNING FOR SMALL AND MEDIUM CITIES: Introduction – Difficulties in transport planning – Recent Case Studies

8 Hours

TEXT BOOKS:

1. **Traffic Engineering and Transport Planning**- L.R. Kadiyali - Khanna Publishers.
2. **Principles of urban transport system planning** - B.G. Hutchinson - Scripta Book Co., Washington D.C. & McGraw Hill Book Co.
3. **Introduction to transportation engineering**- Jotin Kristey and Kentlal - PHI, New Delhi.

REFERENCE BOOKS:

1. **Urban Transport planning**- Black John - Croom Helm ltd, London.
2. **Urban and Regional models in geography and planning**- Hutchison B G - John Wiley and sons London.

3. **Entropy in urban and regional modeling**- Wilson A G - Pion ltd, London.

GEOGRAPHIC INFORMATION SYSTEM

Subject Code	**: 10CV844**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Geographic Information system concepts and spatial models. Introduction, Spatial information, temporal information, conceptual models of spatial information, representation of geographic information. GIS Functionality – Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction.

7 Hours

UNIT - 2

Computer Fundamentals of GIS and Data storage, Fundamentals of computers vector/raster storage character files and binary files, file organization, linked lists, chains, trees. Coordinate systems and map projection : Rectangular polar and spherical coordinates, types of map projections, choosing a map projection.

8 Hours

UNIT - 3

GIS DATA MODELS AND STRUCTURES – Cartographic map model, Geo-relation model, vector/raster methods, non-spatial data base structure viz., hierarchal network, relational structures.

5 Hours

UNIT - 4

DIGITIZING EDITING AND STRUCTURING MAP DATA – Entering the spatial data (digitizing), the non-spatial, associated attributes, linking spatial and non-spatial data, use of digitizers and scanners of different types.

5 Hours

PART - B

UNIT - 5

DATA QUALITY AND SOURCES OF ERROR – Sources of errors in GIS data, obvious sources, natural variations and the processing errors and accuracy. Principles of Spatial data access and search, regular and object oriented decomposition, introduction to spatial data analysis, and overlay analysis, raster analysis, network analysis in GIS.

10 Hours

UNIT - 6

GIS and remote sensing data integration techniques in spatial decision support system land suitability and multioriteria evaluation, role based systems, network analysis, special interaction modeling, Virtual GIS.

6 Hours

UNIT - 7

Data base positioning systems, desirable characteristics of data base management systems, components of a data base management system, understanding the data conceptual modeling.

6 Hours

UNIT - 8

Global positioning system, hyper spectral remote sensing, DIP techniques, hardware and software requirements for GIS, overview of GIS software.

5 Hours

TEXT BOOKS:

1. **Principles of GIS** - Peter A Burrough Reachael A Mc. Donnel - (Oxford).
2. **The GIS Book** - George B. Korte, P.E. - 5th Edn., Thomson Learning.
3. **Remote sensing and image interpretation** - Lillesand - (John Wiley and Sons).
4. **Geographical Information system**: Bemhard Sen-Wiley publications.
5. **GIS and Computer cartography** - Christopher Jones - (Longman).

REFERENCE BOOKS:

1. **Fundamentals of Remote Sensing –** George Joseph, Universities Press, Hyderabad.
2. **Introduction to GIS – Kang tsuang Chang** – Tata McGraw Hill, New Delhi 2009.
3. **Geographical Information Science** – Narayan Panigrahi, Universities Press, New Delhi 2010.
4. **Geographical Information system & Environmental Modeling**: Keith C. Clarke, Bradley O Parks, Michel P. Crane, PHI Learning, New Delhi 2009 Edition.
5. **Concepts and Techniques of Geographic Information Systems** – C.P.Lo. Albert K.W. Yeung, PHI Learning, New Delhi – 2009 2nd Edition.

ADVANCED DESIGN OF STEEL STRUCTURES

Subject Code	**:10CV845**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03

PART - A

UNIT - 1

INTRODUCTION: Basic principles of design, stress strain relationship for mild steel, shape factors for different cross sections. Evaluation of full plastic moment for mild steel beams, plastic hinges - Fixed, simply supported beams, effect of partial fixity, rectangular portal frames and gable frames.

5 Hours

UNIT - 2

Statement of theorems with examples, application of principles of virtual work, partial and over collapse. Trial error method. Method of combined mechanisms, plastic moment distribution method and other methods of determining plastic collapse load. Estimation of deflection, factors affecting fully plastic moment.

7 Hours

UNIT - 3

Minimum weight theories. Application of theorems and methods of solution. Plastic analysis applied to the design of fixed and continuous beams, portal and gable frames.

8 Hours

UNIT - 4

Design of Built-up beams. Design of encased beams.

6 Hours

PART - B

UNIT - 5

Design of open web structures - Advantages and design methods

7 Hours

UNIT - 6

Small moment resistant connections, large moment resistant connections, semi-rigid and behavior of semi-rigid connections, Beam line method, modified slope deflection method, modified moment distribution method.

8 Hours

UNIT - 7

Principal axes of section, maximum stress due to unsymmetrical bending, the Z-polygon, deflection of beams under unsymmetrical bending, design of purlins subjected to unsymmetrical bending.

5 Hours

UNIT - 8

Tubular structures – Introduction, permissible stresses, tubular columns and compression members, tubular tension members. Design of tubular members roof truss for given member forces and their combination, joints in tubular trusses, design of tubular beams and purlins.

6 Hours

TEXT/REFERENCE BOOKS:

1. **Plastic Analysis**- B.G. Neal.
2. **Introduction to Plastic Analysis of Steel Structures**- J.F. Banker and Heyman
3. **Plastic Analysis of steel structures**.- Beedle
4. **Design of steel structures** – William T.Segui, Cengage Learning, India-2007.
5. **Steel Structures Vol - 1 and 2**- J.F. Baker
6. **Design of Steel Structures**- Ramachandra.
7. **Design of Steel Structures**.- Arya and Ajmani
8. CMERI Design Hand Book for Open Web Structures, Durgapur.
9. SP-6 (6) , IS : 800-2007,Steel Table

WATER RESOURCES ENGINEERING

Subject Code	**: 10CV 846**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

UNIT:1 INTRODUCTION

Introduction, The world's fresh water resources, water use in the world, water management sectors, the water management community, the future of water resources. 06 hrs.

UNIT:2 HYDROLOGIC PROCESS

Introduction to hydrology, hydrologic cycle, atmospheric and ocean circulation.

Precipitation: formation and types, rainfall variability, disposal of rainfall on a watershed, design storms. 06 hrs.

UNIT:3 SURFACE RUNOFF

Drainage basins, hydrologic losses and rainfall excess, rainfall-runoff analysis using unit hydrograph approach, SCS rainfall-runoff relation. 07 hrs.

UNIT:4 WATER WITHDRAWLS AND USES

Water use data: classification of uses, water for energy. Water for agriculture: irrigation trends and needs, irrigation infrastructures, irrigation system selection and performance, water requirement for irrigation, impacts of irrigation Drought management: options, severity, economic aspects of water storage.

Analysis of surface water supply: surface water reservoir systems, storage-firm yield analysis for water supply reservoir simulation.
08 hrs.

UNIT:5 FLOOD CONTROL

Introduction, flood plain management, flood plain definition, hydrologic and hydraulic analysis of floods, storm water management.
Flood control alternatives: structural and non-structural measures.
Flood damage and net benefit estimation: damage relationships, expected damages, risk based analysis.
Operation of reservoir systems for flood control.
08 hrs.

UNIT:6 STORM WATER CONTROL:

Storm water management, storm system: information needs and design criteria. Rational method design. Hydraulic analysis of design, storm sewer appurtenances.
Storm detention: effects of urbanisation, types of surface detention, subsurface disposal of storm water. 07 hrs.

UNIT:7 STORM WATER CONTROL STREET AND HIGHWAY DRAINAGE AND CULVERTS:

Drainage of street and highway pavements: design considerations, flow in gutters, pavement drainage inlets, inlet locations, median, embankment and bridge culvert design.
Hydraulic design of culverts: culvert hydraulics, culver design.
08 hrs.

UNIT:8 DESIGN OF SPILLWAYS FOR FLOOD CONTROL, STORAGE AND CONVEYANCE SYSTEM:

Hydrologic considerations, Dams: types, hazard classification, spillway capacity, criteria, safety of existing dams.
Spillways: functions, overflow and free overfall spillways, ogee spillways, baffled chute spillways, culvert spillways.
Gates and valves: spillway crest gates, gates for outlet works, valves for outlet works. 08 hrs.

Text Books:

1. Water resources engineering: Ralph A Wurbs, Wesley P. James, PHI Learning pvt. Ltd. New Delhi (2009 Ed.).
2. water resources engineering: Chin D.A., Prentice Hall (2009 Ed.).
3. wate resources engineering: Larry W. Mays, John Wiley & sons (2005).

Reference Books:

1. Water resources engineering : Sathya Narayana Murthy Challa, New Age International Publishers, New Delhi, (2002 Ed.).
2. Water resources engineering, lecture notes, IIT Kharagpur.

3. Elements of water resources engineering, Duggal K.N., Soni J.P., New age international publishers, New Delhi.
4. Water resources engineering, David Chin, Pearson Educaion, NJ, (2006 Ed.).

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ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code	**: 10CV847**	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Development Activity and Ecological Factors EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information,

6 Hours

UNIT - 2

Step-by-step procedures for conducting EIA, Limitations of EIA.

6 Hours

UNIT - 3

Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA.

8 Hours

UNIT - 4

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

6 Hours

PART - B

UNIT - 5

EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

6 Hours

UNIT - 6

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.

6 Hours

UNIT - 7

Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices.

4 Hours

UNIT - 8

EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

10 Hours

REFERENCES

1. **Environmental Impact Analysis**-Jain R.K.-Van Nostrand Reinhold Co.
2. **Environment Impact Assessment.-** Anjaneyalu. Y.
3. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
4. **Environment Impact Assessment** - Larry W. Canter - McGraw Hill Publication.