

CIVIL ENGINEERING (CODE NO. 09)

PAPER - I

1. Structural Analysis

Determinate and Indeterminate Structures, Degrees of Freedom. Static and Kinematic indeterminacy, Principle of Superposition, Virtual Work, Energy theorem, Deflection of Trusses, Redundant Frames.

Analysis of Determinate and Indeterminate Arches, their influence lines.

Rolling loads, influence lines for Determinate Beams and Pin-jointed Frames. Mullar Breslau's Principle and influence lines for Indeterminate Beams and Frames.

Slope Deflection, Moment Distribution and Kani's methods. Column Analogy, Energy Methods for analysis of indeterminate beams and frames. approximate methods for analysis of Rigid Frames.

Matrix Methods of analysis, Stiffness and Flexibility Matrices of Beams. Frames & Trusses, Elements of Plastic analysis.

2. Structural Design

(1) Steel Design

Factors of Safety and Load Factors.

Riveted and Welded connections of Members, Design of Tension, Compression and Flexural members, built-up beams and Plate Girder Slab and Gussseted Bases for Columns, Design of Roof Trusses. Purling and Coverings, Structural Steel tubes and their connections Industrial and Multi-Storyed Buildings Water tank and supporting tower's design. Plastic Design of Continuous Beams & Frames.

(2) R.C. Design

Working Stress and Limit State methods for design of Rectangular, T and L Beams, Slabs and Columns.

Isolated and Combined footings, Raft Foundations.

Overhead, Resting on ground and Underground Water Tanks.

Design of Bunkers and Silos.

Methods and Systems of Prestressing, Anchorages. Losses in Prestress, Design of Prestressed Concrete Beams.

3 Construction Planning and Management

Detailed estimates, specifications, analysis and rates of various works in civil engineering .

Construction activity , work break down structures , scheduling through CPM and PERT analysis , cost optimization through network construction, Float times, Bar charts , Project control and supervision , cost reduction measures,

Cost analysis and resource allocation ,

Fundamentals of engineering economics , methods of appraisal , present work, annual costs , benefit cost analysis, Types of tenders and contract conditions .

4. Environmental Engineering

Water Demand – Per capita Demand, Population Estimation methods

Water Quality Criteria for various uses viz. Domestic & Non-Domestic, Irrigation effects & significance of important parameters and permissible concentration as per relevant standards.

Transmission of Water- relative merits & demerits of various pipes viz C.I. G.I. Mild Steel.

A.C. Pressure Pipes. Corrosion of Pipes-types & Methods of control System of distribution & layouts of distribution.

Unit Processes & Operations for Water Treatment viz, Objectives and Design criteria of Sedimentation, Coagulation, Flocculation, Chemical Sedimentation. Filtration (slow sand & rapid sand), Disinfection, Softening.

Quantity & Characterization of Domestic Sewage-significance of B.O.D., C.O.D., D.O. ,Solids. T.O.C. , N.O.D.

Effluent Standards, River Standards.

Sewage System-Design of Sewer & Storm Sewer, Sewage Pumps.

Design of Screens, Grit Chamber.

Design of Primary Sedimentation tank.

Design of Biological Treatment Units viz Trickling filters, Activated Sludge Treatment and Secondary Sedimentation tank.

Waste Stabilization Ponds- Aerobic, Anaerobic & Facultative Ponds, design criteria and principles.

Sludge Treatment- Digestion & Sludge Disposal.

Septic Tanks-design criteria & working

Self Purification of Streams- oxygen sag curve.

Types of Pollution-Sources & effects of various pollution viz., Water, Air, Land & Noise, Relevant standards.

Rural Sanitation, Solid Waste- collection & disposal.

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PAPER - II

1. Water Resources Engineering

Water Resources in the Globe, Available Fresh Water. Need for Optimum use of Available water, Schemes for Drinking, Irrigation, Hydro Power, Multipurpose Schemes.

Irrigation - Necessity, Scope, Benefits & Effects.

Methods & Systems of Irrigation, their efficiencies. Water Distribuion & Scheduling techniques.

Crop Water Requirements, Evapotranspiration, Consumptive Use, Duty, Delta, Base Period their relation, Crop Rotation, Quality of Irrigation Water.

Hydrology - Hydrological Cycle, Precipitation – Types, Measurement, Raingauge Network, Analysis of Precipitation Data, Dependability Analysis, Unit Hydrograph, Summation & Synthetic Hydrographs, Design Flood by UH & Frequency Studies.

Ground Water - Class & Availability of Soil Moisture. Aquifers- Confined & Unconfined. Open & Tube Wells, Radial Flow in Wells,

Dupuit's Theory. Darcy's Law, Seepage Analysis using Flow Nets. Yield of Wells, determination.

Storage Scheme - Reservoir Planning, Capacity, Yield, Life. Gravity & Earthen Dams. Forces Acting, Modes of Failure, Stability Criteria, Design. Galleries. Shafts. Joints in Gravity Dams. Foundation Treatment.

Spillways, Types, Design of Ogee & Siphon Spillways. Energy Dissipating Devices, Design of Stilling Basins.

Diversion Schemes - Structures on Pervious Formations, Bligh's & Khosla's Theory, Hydraulic Jump, Design of Vertical Drop Weir & Barrage.

Distribution System - Canals - Classification, Layout, Alignment, Capacity, Design of Canals. Silt Theories, Canal Regulation Structures. Design of Head & Cross Regulators, Canal Falls, Cross Drainage Works, and Outlets, Escapes.

Water Logging - Causes, Effects, Remedial Measures, Losses in Canals, Canal Lining, Types. Advantages, Conjunctive use of Surface & Ground Water.

River Training - Objective & Methods, Concepts of Hydro Power Projects.

2. Transportation Engineering

Railways - Permanent Way, Sleepers, Rail Fastenings, Ballast, Points and Crossings, different types of Turn Outs.

Stations and Yards, Turn Tables, Signals and Interlocking, Level Crossing.

Maintenance of Track, Super-elevation, Creep of Rails, Ruling Gradients, Track Resistance. Tractive Efforts, Curve Resistance .

Highways & Airports - Principles of Highway Planning, Highway Alignments.

Geometrical design, Cross-section. Camber, Super-elevation. Horizontal and Vertical curves. Classification of Roads.

Design and Construction of Flexible and Rigid pavements for Highway and Airfields.

Evaluation of Pavement Failure and Strengthening, Drainage of Roads.

Traffic Engineering : Traffic Surveys, Highway Capacity, Intersections, Rotary Design Elements, Signs, Signals and Markings.

Selection of Airport Sites, Windrose Diagram & Runway Orientation. Runway and Taxiway Geometric and Lighting.

Bridge Engineering - Selection of Site, Design Data collection, Hydraulic Design, Scour Depth for Bridge Foundation, Economic Span.

Type of Road and Railway Bridges, Design Loads and Forces, Impact Factor, Indian Loading Standards.

Super Structure & Sub Structure, Abutments, Piers, Wing Walls, Return Approaches.

3. Geotechnical Engineering

Index Properties of Soil, Classification of Soils. Clay Minerals.

Capillary Water, Permeability, Factors Affecting Permeability, Lab and field methods. Permeability of stratified soil deposits.

Seepage Pressure, Quick Sand Condition, Flow Net, its properties & uses.

Stress distribution in soils, Boussinesq's theory. Newmark's Chart.

Consolidation and Settlement : Terzaghi's theory, Consolidation test. Settlement computation. Time Settlement curve.

Compaction tests & their significance, factors affecting compaction.

Shear Strength Parameters, Shear Tests, Mohr Coulomb's failure theory, Skempton's Pore Pressure coefficients.

Earth Pressure at rest, Active and Passive Pressures, Rankine's and Coulomb's theory.

Bearing capacity, Terzaghi's analysis, factors affecting Bearing Capacity, Plate Load Test.

Stability of Slopes, Swedish Slip Circle method and Bishop's simplified method. Stability Number.

Sub-surface exploration. Methods, sampling, SPT, DCPT and Static Cone Penetration Test, Electrical Resistivity and Seismic method.

Essential features of Foundation , types, design criteria, Rafts.

Pile Foundation, Types of Piles, Pile Capacity, Pile Load Test. Group Action. Static/Dynamic formulae.

Elements of Machine Foundation, Natural frequency, Amplification and Resonance.

Ground Improvement Techniques, Sand Drains, Soil Stabilization, Geotextiles.