

CIVIL ENGINEERING

PAPER - I

(A) Theory and Design of Structures

(B) Theory

Principles of superposition, reciprocal theorem, unsymmetrical bending.

Determinate and indeterminate structures, simple and space frames, degree of freedom, virtual work energy theorem deflection of trusses, redundant frames, three moment equation, slope deflection and moment distribution methods, column analogy, Energy methods, approximate and uncommercial methods.

(a) Moving loads :

Shearing force and Bending moment diagrams, Influence lines for simple and continuous beams and frames.

Analysis of determinate and indeterminate arches, spandrel graced arch.

Matrix methods of analysis, stiffness and flexibility matrices, Elements of plastic analysis.

(b) Steel Design :

Factors of safety and load factors. Design of tension, Compression and flexural members, Built up beams and plate girders, Semi-rigid and rigid connections.

Design of stanchions, slab and gussated bases, crane and gantry girders, roof trusses, industrial and multistroyed buildings, water tanks.

Plastic design of continuous frames and portals.

(c) R. C. Design :

Design of slabs, simple and continuous beams, columns, footings — single and combined , raft foundation, elevated water tanks, encased beams and column, ultimate load design.

Methods and systems of prestressing, anchorages, losses in prestress.

Design of prestressed girders, ultimate load design.

(B) Fluid Mechanics and Hydraulic Engineering :

Dynamics of fluid flow — Equation of continuity, energy and momentum, Bernoulli's theorem, Cavitation velocity potential and stream function, rotational and irrotational flow, Free and forced vortices , flow net.

Dimensional analysis and its application to practical problems.

Viscous flow-Flow between static and moving parallel plates, flow through circular tubes, film lubrication, velocity distribution in Laminar and turbulent flow, boundary layer.

Incompressible flow through pipes- Laminar and turbulent flow, critical velocity, losses, Stanton diagram. Hydraulic and energy grade lines, siphons, pipe network , forces on pipe bends.

Compressible flow Adiabatic and isentropic flow, Subsonic and supersonic velocity, Mach number shock waves, Water Hammer.

Open channel flow — uniform and non-uniform flow, best hydraulic cross-section, Specific energy and critical depth gradually varied flow, Classification of surface profiles, Control sections, Standing wave flume, Surges and waves, Hydraulic jump.

Design of canals — Un-linked channel in alluvium, the critical tractive stress, principles of sediment transport regime theories, lined channels, hydraulic design and cost analysis, drainage behind lining.

Canal structures- Designs of regulation work, cross drainage and communication works — cross regulators, head regulator canal falls aqueducts, maturing flumes etc., canal outlets.

Diversion Head works — principles of design of different parts of impermeable and permeable foundations, Khosle's theory, Energy dissipation- sediment exclusion.

Dams – Design of rigid dams, earth dams, force acting on dams, stability analysis.

Design of spillways.

Walls and Tube Wells.

(C) Soil Mechanics and Foundation Engineering : soils, Mechanics— Origin and Classification of soils, Atterburg limits void ratio, moisture contents, permeability, laboratory and field tests, Seepage and flow nets, flow under hydraulic structures, uplift and quic and conditon, Unconfined and direct shear tests, triaxial test, earth pressure theories, stability of slopes, Theories of soils consolidation, rate of settlement. Total and effective stress analysis, pressure distribution in soils, Boussinesque and wasterguard theories. Soil stabilization.

Foundation Engineering, Bearing capacity of folltings, piles and wells, design of retaining walls, sheet res end caissons.

CIVIL ENGINEERING

PAPER -II

Note : A candidate shall answer questions only from any two parts.

Part A : Building Constructions :

Building Materials and Constructions – timber, stone, brick, sand surkhi, mortar concrete, paints and varnishes plastics etc.

Detailing of walls, floors , roofs, ceilings, stair cases, doors and windows, finishing of building plastering, pointing painting, etc. Use of building codes, ventilation, air conditioning, lighting and acoustics.

Building estimates and specifications, Construction scheduling - PERT and CPM methods.

Part B : Railways and Highways Engineering :

(A) Railways : Permanent way ballast, sleeper, chairs and fastenings, points and crossing different types of turn outs cross-over sitting out of points.

Maintenance of track super elevating, creep of rain, ruling gradients, track resistance, tractive effort, curve resistance.

Station yards and machinery, station buildings, platform sidings, turn tables.

Signals and interlocking, level crossing.

(B) Roads and Runways : Classification of roads, Planning geometric design.

Design of flexible and rigid pavements, subbase and wearing surfaces.

Traffic engineering and traffic surveys, intersection road signs, signals and markings.

Part C : Water Resources Engineering

Hydrology-Hydrologic Cycle, Precipitation, evaporation, transpiration and infiltration, hydrographs, unit hydrograph, flood estimation and frequency.

Planning for water Resources - Ground and surface water resources, surface flows, Single and multi-purpose projects storage capacity, reservoir losses, reservoir silting, flood routing, Benefit cost ratio, General principles of optimisation.

Water requirements for crops— quality of irrigation, water, consumptive use of water, water depth and frequency of irrigation, duty of water irrigation methods and efficiencies.

Distribution system for canal irrigation, Determination of required channel capacity, channel losses, Alignment of main and distributory channels.

Water-logging— Its causes and control, design of drainage system, soil salinity.

River training— Principles and Methods.

Storage Works —Types of dams (including earth dams) and their characteristics, Principles of design, criteria for stability, Foundation treatment, Joints and galleries, Control of seepage.

Spillways— Different types and their suitability and energy dissipation, Spillway crest gates.

Part D : Sanitation and Water Supply :

Sanitation: Site and Orientation of buildings, ventilation and damp proof course, house drainage conservancy and waterborne system of waste disposal sanitary appliances latrines and urinals.

Disposal of sanitary sewage industrial waste, storm sewage- separate and combined system. Flow through-sewers, design of sewers, sewer appertenances manholes, inlets, junctions, syphon ejection etc.

Sewer treatment— working principles, units, chambers, sedimentation tank etc., Activated sludge process, septic tank, disposal of sludge.

Rural sanitation, Environmental pollution and ecology.

Water supply—Estimation of water resources, ground water hydraulics predicting demand of water, Impurities of water, physical, chemical and bacteriological analysis, water borne diseases.

In take of water— Pumping and gravity schemes.

Water treatment— Principles of settling, coagulation, flocculation and sedimentation, Slow, rapid and pressure filters, softening, removal of taste, odour and salinity. Water Distribution — Layouts, storage, hydraulic pipelines, pipe fitting, pumping station and their operations.