CIVIL ENGINEERING (for both objective and conventional type papers)
PAPER I
1. Building Materials
Timber : Different types and species of structural timber, density-moisture relationship, strength in different directions, defects, influence of defects on permissible stress, preservation, dry and wet rots, codal provisions for designs. Plywood.
Bricks : Types, Indian Standards classification, absorption, saturation factor, strength in masonry, influence of mortar strength on masonry strength.
Cement : Compounds of, different types, setting times strength.
Cement Mortar : Ingredients, proportions, water demand, mortars for plastering and masonry.
Concrete : Importance of W/C Ratio, strength ingredients including admixtures, workability, testing for strength elasticity, non-destructive testing, mix design methods.
2. Solid Mechanics
Elastic constants, stress, plane stress, Mohr's circle of stress, strains, plane strain, Mohr's circle of strain combined stress; Elastic theories of failure; Simple bending, shear; Torsion of circular and rectangular sections and simple members.
3. Structural Analysis
Analysis of determinate structures—different methods including graphical methods.
Analysis of indeterminate skeletal frames—moment distribution, slope-deflection, stiffness and force methods, energy methods. Muller-Breslaie principle and application.
Plastic analysis of indeterminate beams and simple frames—shape factors.
4. Design of Steel Structures
Principles of working stress method/Design of connections, simple members, Built-up sections and frames. Design of Industrial roofs. Principles of ultimate load design. Design of simple members and frames. **5. Design of Concrete and Masonry Structures**
Limit state design for bending, shear, axial compression and combined forces. Codal provisions for slabs, beams walls and footings. Working stress method of design of R.C. members.
Principles of prestressed concrete design, materials, methods of prestressing, losses. Designs of simple members and determinate structures. Introduction of prestressing of indeterminate structures.
Design of brick masonry as per I.S. Codes.
6. Construction Practice, Planning and Management
Concreting Equipment :
Weight Batcher, mixer vibrator, batching plant, concrete pump. Cranes, hoists, lifting equipment. Earthwork Equipment :

Power shovel, hoe, dozer, dumper, trailers and tractor, rollers, sheep foot rollers pumps.

Construction, Planning and Management :

Bar chart, linked bar chart, work-break down structures. Activity-on-arrow diagrams; Critical path, probabilistic activity durations. Event-based networks, PERT network; Time-cost study, crashing; resource allocation.

PAPER II

1. (a) Fluid Mechanics, Open Channel, Flow, Pipe Flow

Fluid Properties, Perssure, Thrust, Buoyancy; Flow kinematics; Integration Flow equations; Flow measurement; Relative Motion, Moment of momentum; Viscosity, Boundary layer and control. Drag, Lift : Dimentional Analysis. Modelling Cavitation; Flow Oscillations; Momentum and Energy principles in open channel flow. Flow controls. Hydraulic jump. Flow section and properties; Normal flow. Gradually varied flow: Surges, Flow development and losses in pipe flows, Measurement, Siphons, Surges and Water hammer. Delivery of Power, Pipe networks.

(b) Hydraulic Machines and Hydropower

Centrifugal pumps, types, performance parameters, scaling pumps in parallel. Reciprocating pumps, air vessels, performance parameters. Hydraulic ram. Hydraulic turbines types, performance parameters/controls, choice, power houses, classification and layout, storage, pondage, control of supply.

2. (a) Hydrology

Hydrological cycle, precipitation and related data analysis, PMP unit and synthetic hydrographs; Evaporation and transpiration; Floods and their management, PMF; Streams and their gauging: River morphology; Routing of floods; Capacity of Reservoirs.

(b) Water Resources Engineering

Water resources of the globe; Multipurpose uses of Water: Soil-Plant-Water relationship, irrigation systems, water demand assessment; Storages and their yields; Ground water yield and well hydraulics; Water-logging, drainage design; Irrigation revenue; Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment transport in canals; Non-overflow and overflow sections of gravity dams and their design. Energy dissipators and tailwater rating; Design of headworks distribution works, falls, cross-drainage works, outlets; River raining.

ENVIRONMENTAL ENGINEERING

3. (a) Water Supply Engineering

Sources of Supply, yields, design of intakes and conductors; Estimation of demand; Water quality standards. Control of Water-borne diseases; Primary and secondary treatment detailing and maintenance of treatment units; Conveyance and distribution systems of treated water, leakages and control; Rural water supply; Institutional and industrial water supply.

(b) Waste Water Engineering

Urban rain water disposal : Systems of sewage collection and disposal; Design of sewers and sewerage systems; pumping. Characteristics of sewage and its treatment. Disposal of products of sewage treatment, stream flow rejuvenation; Institutional and industrial sewage management; Plumbing Systems; Rural and semi-urban sanitation.

(c) Solid Waste Management

Source, classification, collection and disposal; Design and Management of Landfills.

(d) Air and Noise Pollution and Ecology

Sources and effects of air pollution, monitoring of air pollution; Noise pollution and Standards; Ecological chain and balance. Environmental assessment.

4. (a) Soil Mechanics

Properties of soils, classification and inter-relationship. Compaction behaviour, methods of compaction and their choice; Permeability and seepage, flownets. Inverted filters; Compressibility and consolidation; Shearing resistance. Stresses and failure; Soil testing in laboratory and in situ; Stress path and applications; Earth pressure, theories. Stress distribution in soils; Soil exploration, samplers, load tests penetration tests.

(b) Foundation Engineering

Types of foundations. Selection criteria, bearing capacity, settlement, laboratory and field tests; Types of piles and their design and layout. Foundations on expansive soils, swelling and its prevention foundation on swelling soils.

5. (a) Surveying

Classification of surveys, scales accuracy; Measurement of distances—direct and indirect methods; optical and electronic devices; Measurement of directions, prismatic compass, local attraction; Theodolites-types; Measurement of elevations-Spirit and trigonometric levelling. Relief representation-Contours; Digital Monitoring Organisation elevation modelling concept; Establishment of control by traingulation and traversing—measurements and adjustment of observations computation of coordinates; Field astoronomy. Concept of global positioning system; Map preparation by plane tabling and by photogrammetry. Remote sensing concepts, map substitutes.

(b)   Transportation Engineering

Planning of highway systems, alignment and geometric design horizontal and vertical curves, grade separation; Materials and construction methods for different surfaces and maintenance; Principles of pavement design; Drainage, Traffic Surveys; Intersection, Signalling; Mass transit system, accessibility, networking.

Tunnelling, alignment, methods of construction, disposal of muck, drainage lighting and ventilation, traffic control, emergency management.

Planning of railway systems, terminology and designs relating to gauge, track, controls transits, rolling stock, tractive power

and track modernisation; Maintenance, Appurtenant works, Containnerisation.

Harbours—layouts, shipping lanes, anchoring, location identification; Literal transport with erosion and deposition; Sounding methods; Dry and wet docks, components and operations; Tidal data and analysis.

Airports—layout and orientation; Runway and Taxiway; design and drainage management; Zoning laws; Visual aids and air traffic control; helipads, hangers, service equipment.