

## **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 defect on permissible stress, preservation, dry and wet rots, codal provisions for design, plywood.

**Bricks** : Types, Indian Standard 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, lasticity, 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, combine 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-Breslau 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 pre stressed concrete design, materials, methods of prestressing, losses. Design of simple members and determinate structures. Introductions to 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, Pressure, Thrust, Buoyancy; Flow Kinematics; Integration of flow equations; Flow measurement; Relative motion; Moment of momentum; Viscosity, Boundary layer and Control, Drag, Lift; dimensional Analysis, Modelling; Cavitation; Flow oscillations; Momentum and Energy principles in Open channel flow, Flow controls, Hydraulic jump, Flow sections and properties; Normal flow, Gradually varied flow; Surges; Flow development and losses in pipe flows, Measurements; 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 house, classification and layout, storage, pondage, control of supply.

#### **2. (a) HYDROLOGY**

Hydrological cycle, precipitation and related data analyses, 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 relationships, irrigation systems, water demand assessment; Storages and their yields, ground water yield and well hydraulics; Waterlogging, 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 training.

### **3. ENVIRONMENTAL ENGINEERING**

**(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 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, streamflow 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 an standards; Ecological chain and balance, Environmental assessment.

**4.**

**(a) SOIL MECHANICS**

Properties of soil, classification and terrelationship; Compactionbehaviour, methods of compaction andtheir choice; rmeability and seepage,flow nets, Inverted filters; Compressibilityand consolidation; Shearingesistance, stresses and ailure; soiltesting in laboratory and in-situ; Stresspath and applications; Earth pressuretheories, stress distribution in oil; soilexploration, samplers, load tests, penetrationtests.

**(b) FOUNDATION ENGINEERING**Types of foundations, election criteria,bearing capacity, settlement, laboratoryand field tests; Types of pilesnd their design and layout, oundationson expansive soils, swelling andits prevention, foundation on swellingsoils.

**5. (a) SURVEYING**Classification of surveys, scales, accuracy;Measurement of distances - directand indirect methods; ptical andelectronic devices; Measurement ofdirections, prismatic compass, localattraction; Theodolites - types; easurementof elevations - Spirit andtrigonometric levelling; Relief representation;Contours; Digital elevationmodellng oncept; Establishment ofcontrol by triangulations and traversing- measurements and adjustmentof observations, oputation of coordinates;Field astronomy, Concept ofglobal positioning system; Map preparationby plane tabling nd y photogrammetry;Remote sensing concepts,map substitutes.

**(b) TRANSPORTATION ENGINEERING**Planning of ighway systems, alignmentand geometric design, horizontaland vertical curves, grade separation;Materials and onstruction methodsfor different surfaces and maintenance:Principles of pavement design;Drainage.Traffic surveys, ntersections, signalling:Mass transit systems, accessibility,networking.Tunnelling, alignment, methods of construction,disposal of muck, drainage,lighting and ventilation, traffic control,emergency management.Planning of ailway systems, terminologyand designs, relating to gauge,track, controls, transits, rolling stock,tractive power and rackmodernisation; Maintenance; Appurtenantworks; Containerisation.Harbours - layouts, shipping lanes,anchoring, ocation identification; Littoraltransport with erosion and deposition;sounding methods; Dry and Wetdocks, omponents nd operationalTidal data and analyses.Airports - layout and orientation; Runwayand taxiway design and drainagemanagement; Zoning laws; Visual aidsand air traffic control; Helipads, hangers,service equipment.