

## **Syllabus for Paper 2 of Phase I & Phase II in Engineering Stream – Civil (Common Syllabus for both phases)**

**1. Building Materials:** Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminium, Fly Ash, Basic Admixtures, Timber, Bricks and Aggregates: Classification, properties and selection criteria; Cement: Types, Composition, Properties, Uses, Specifications and various Tests; Lime & Cement Mortars and Concrete: Properties and various Tests; Design of Concrete Mixes: Proportioning of aggregates and methods of mix design.

**2. Solid Mechanics:** Elastic constants, Stress, plane stress, Strains, plane strain, Mohr's circle of stress and strain, Elastic theories of failure, Principal Stresses, Bending, Shear and Torsion.

**3. Structural Analysis:** Basics of strength of materials, Types of stresses and strains, Bending moments and shear force, concept of bending and shear stresses; Analysis of determinate and indeterminate structures; Trusses, beams, plane frames; Rolling loads, Influence Lines, Unit load method & other methods; Free and Forced vibrations of single degree and multi degree freedom system; Suspended Cables; Concepts and use of Computer Aided Design.

**4. Design of Steel Structures:** Principles of Working Stress methods, Design of tension and compression members, Design of beams and beam column connections, built-up sections, Girders, Industrial roofs, Principles of Ultimate load design.

**5. Design of Concrete and Masonry structures:** Limit state design for bending, shear, axial compression and combined forces; Design of beams, Slabs, Lintels, Foundations, Retaining walls, Tanks, Staircases; Principles of pre-stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

**6. Construction Practice, Planning and Management: Construction** - Planning, Equipment, Site investigation and Management including Estimation with latest project management tools and network analysis for different Types of works; Analysis of Rates of various types of works; Tendering Process and Contract Management, Quality Control, Productivity, Operation Cost; Land acquisition; Labour safety and welfare.

### **7. Flow of Fluids, Hydraulic Machines and Hydro Power:**

**(a) Fluid Mechanics, Open Channel Flow, Pipe Flow:** Fluid properties; Dimensional Analysis and Modelling; Fluid dynamics including flow kinematics and measurements; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Principles in open channel flow, Flow controls. Hydraulic jump; Surges; Pipe networks.

**(b) Hydraulic Machines and Hydro power: Various pumps, Air vessels, Hydraulic turbines** – types, classifications & performance parameters; Power house – classification and layout, storage, pondage, control of supply.

**8. Hydrology and Water Resources Engineering:** Hydrological cycle, Ground water hydrology, Well hydrology and related data analysis; Streams and their gauging; River morphology; Flood, drought and their management; Capacity of Reservoirs.

**Water Resources Engineering :** Multipurpose uses of Water, River basins and their potential; Irrigation systems, water demand assessment; Resources - storages and their yields; Water logging, canal and drainage design, Gravity dams, falls, weirs, Energy dissipaters, barrage Distribution works, Cross drainage works and headworks and their design; Concepts in canal design, construction & maintenance; River training, measurement and analysis of rainfall.

### **9. Environmental Engineering:**

**(a) Water Supply Engineering:** Sources, Estimation, quality standards and testing of water and their treatment; Rural, Institutional and industrial water supply; Physical, chemical and biological characteristics and sources of water, Pollutants in water and its effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.

**(b) Waste Water Engineering:** Planning & design of domestic waste water, sewage collection and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

**(c) Solid Waste Management:** Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes and Utilization by Civil Engineers.

**(d) Air, Noise pollution and Ecology:** Concepts & general methodology.

### **10. Geo-technical Engineering and Foundation Engineering:**

**(a) Geo-technical Engineering:** Soil exploration - planning & methods, Properties of soil, classification, various tests and inter-relationships; Permeability & Seepage, Compressibility, consolidation and Shearing resistance, Earth pressure theories and stress distribution in soil; Properties and uses of geo-synthetics.

**(b) Foundation Engineering:** Types of foundations & selection criteria, bearing capacity, settlement analysis, design and testing of shallow & deep foundations; Slope stability analysis, Earthen embankments, Dams and Earth retaining structures: types, analysis and design, Principles of ground modifications.

### **11. Surveying and Geology:**

**(a) Surveying:** Classification of surveys, various methodologies, instruments & analysis of measurement of distances, elevation and directions; Field astronomy, Global Positioning System; Map preparation;

Photogrammetry; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road/railway alignment and buildings, Setting out of Curves.

**(b) Geology:** Basic knowledge of Engineering geology & its application in projects.

## **12. Transportation Engineering:**

**Highways** - Planning & construction methodology, Alignment and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.

**Tunneling** - Alignment, methods of construction, disposal of muck, drainage, lighting and ventilation.

**Railways Systems** – Terminology, Planning, designs and maintenance practices; track modernization..

**Harbours** – Terminology, layouts and planning. Airports – Layout, planning & design.

