

UPSC Mains Civil Engineering Optional Paper-II Syllabus

1. Construction Technology, Equipment, Planning and Management

1.1 Construction Technology

Engineering Materials:

Physical properties of construction materials with respect to their use in construction-Stones, Bricks and Tiles; Lime, Cement, different types of Mortars and Concrete.

Specific use of ferro cement, fibre reinforced C. C., High strength concrete.

Timber; Properties defects-common preservation treatments.

Use and selection of materials for specific use like Low-Cost Housing, Mass Housing, High Rise Buildings.

1.2 Construction:

Masonry principles using Brick, stone, Blocks- construction detailing and strength characteristics.

Types of plastering, pointing, flooring, roofing and construction features.

Common repairs in buildings.

Principle of functional planning of building for residents and specific use-Building code provisions.

Basic principles of detailed and approximate estimating-specification writing and rate analysis-principles of valuation of real property.

Machinery for earthwork, concreting and their specific uses-Factors affecting selection of equipments operating cost of equipments.

1.3 CONSTRUCTION PLANNING AND MANAGEMENT:

Construction activity-schedules organization for construction industry- quality assurance principles.

Use Basic principle of network analysis in form of CPM and PERT-their use in construction monitoring, Cost optimization and resource allocation.

Basic principles of Economic analysis and methods.

Project profitability-Basic principles of Boot approach to financial planning-simple toll fixation criterions.

2. Surveying and Transportation Engineering

2.1 Surveying: Common methods and instruments for distance and angle measurement for CE work their use in plane table, traverse survey, levelling work, triangulation, contouring and topographical map.

Basic principles of photogrammetry and remote sensing.

2.2 Railways Engineering: Permanent way- components, types and their function-Functions and Design constituents of turn and crossing- Necessity of geometric design of track-Design of station and yards.

2.3 Highway Engineering:

Principles of Highway alignments-classification and geometrical design elements and standards for Roads.

Pavement structure for flexible and rigid pavements Design principles and methodology of pavements.

Typical construction methods and standards of materials for stabilized soil, WBM, Bituminous works and CC roads.

Surface and sub-surface drainage arrangements for roads culvert structures.

Pavement distresses and strengthening by overlays.

Traffic surveys and their application in traffic planning-Typical design features for channelized, intersection rotary etc.-signal designs-standard Traffic signs and markings.

3. Hydrology, Water Resources and Engineering:

3.1 Hydrology:

Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analyses, flood routing through a reservoir, channel flow routing-Muskingam method.

3.2 Ground Water flow:

Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions.

3.3 Water Resources Engineering:

Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.

3.4 Irrigation Engineering:

- (i) Water requirements of crops: consumptive use, duty and delta, irrigation methods and their efficiencies.
- (ii) Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributary canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load.
- (iii) Water logging: causes and control, salinity.
- (iv) Canal structures: Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets.
- (v) Diversion head work: Principles and design of weirs on permeable and impermeable foundation, Khosla's theory, energy dissipation.
- (vi) Storage works: Types of dams, design, principles of rigid gravity stability analysis.
- (vii) Spillways: Spillway types, energy dissipation. (viii) River training: Objectives of river training, methods of river training.

4. Environmental Engineering

4.1 Water Supply:

Predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

4.2 Intake of Water:

Water treatment: principles of coagulation, flocculation and sedimentation; slow-, rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.

4.3 Sewerage Systems:

Domestic and industrial wastes, store sewage- separate and combined systems, flow through sewers, design of sewers.

4.4 Sewage Characterisation:

BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water course and on land.

4.5 Sewage Treatment:

Working principles, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of wastewater.

4.6 Solid waste:

Collection and disposal in rural and urban contexts, management of long-term ill-effects.

5. Environmental pollution:

Sustainable development. Radioactive wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air pollution. Pollution control acts.

