Civil Engineering (Module II)

Part II **10 Marks**

Codes and Specifications

- Ø Bureau of Indian Standards Codes; Indian Road Congress Codes Related to the discipline
  - For materials
  - For design
  - For earthquake resistance
  - For workmanship
  - For testing and quality
  - For acceptance
  - For limits of tolerance
  - For fire resistance

- Ø British, Euro or American Codes for special areas where Indian Codes are not available or specific description / standards desired or for imported materials or work;

Part III **50 Marks**

Civil Engineering

Specializations offered are : (a) Structure and Foundation, (b) Infrastructure and (c) Water Resources and Management.

A candidate has to select any one out of the above three specializations.

Syllabus common for both Structure and Foundation AND Infrastructure

Work Elements

- Ø Design and Drawings
- Ø Contracts
- Ø Construction Management
- Ø Survey and Geotechnical Investigation
- Ø Repairs and Rehabilitation
- Ø Water and Waste Management

Areas of Work -- Infrastructure

- Ø Roads
- Ø Railways
- Ø Irrigation
- Ø Water Sourcing, Treatment and Distribution
- Ø Drainage / Sanitation / Waste Treatment / Solid Waste Disposal / Treatment and Disposal of Hazardous Wastes
- Ø Port and Harbours
- Ø Airports and Runways
- Ø Power Sub-station and Transmission Line Towers

Civil Engineering (Module II) -- continued

Areas of Work -- Structures

- Ø Buildings
- Ø Bridges
- Ø Canals and Hydraulic Structures
- Ø Dams
- Ø Retaining Walls and Earth-retaining Structures
- Ø Tunnels
- Ø Berths, Jetties, etc
- Ø Industrial Structures
- Ø Sport Structures
- Ø Tall Structures : Chimneys, Silos and Towers
- Ø Underground and overground storage

Quality Assurance and Quality Control

- Ø Requirements of the Contract and Specifications
- Ø Quality Assurance Plan, Responsibilities of the Employer, Engineer (Quality Manager), Contractor, Unified policy for quality of work
- Ø Quality Planning for Civil Works
- Ø Quality Control of Documentation
- Ø Quality Control of Designs, Drawings and Data
- Ø Quality Control of Materials
- Ø Quality Control of Work and Workmanship
- Ø Sampling and Analysis
- Ø Testing Methods and testing as per specifications
- Ø Acceptance criteria
- Ø Tolerance limits
- Ø Treatment of non-conforming materials and work

Quality Audit

Syllabus for Water Resources and Management

A. Fluid Mechanics
Flow Measurement , Dimensional Analysis

PIPE FLOW : Energy and momentum equations and their applications to pipe flow, characteristics of turbulent flow, losses in pipe flows, hydraulic grade line and total energy line, siphons, expansions and contraction in pipes, pipe networks, water hammer.

OPEN CHANNEL FLOW : Uniform and non-uniform flows, Flow sections and properties, specific energy and specific force, critical depth, resistance

equations and variation of roughness co-efficient, hydraulic jump and its applications, surges and waves.

B. Hydraulic Machines and Hydropower

CENTRIFUGAL AND RECIPROCAL PUMPS : Types and characteristics

HYDROPOWER GENERATION : Hydraulic turbines -- types, performance parameters, controls, choice power houses -- layout and component works.

C. Water Resources and Irrigation Engineering

HYDROLOGY : Hydrologic cycle, precipitation, evaporation, transpiration, infiltration, hydrograph, unit hydrograph, frequency analysis, flood estimation.

GROUND WATER FLOW : Specific yield, storage co-efficient, co-efficient of permeability, confined and unconfined aquifers, tubewells, ground water potential.

WATER RESOURCES PLANNING : Ground and surface water resources, storage capacity of reservoirs, reservoir losses, reservoir sedimentation, flood routing through reservoirs.

WATER REQUIREMENTS FOR CROPS : Consumptive use of water, quality of irrigation water, duty and delta, irrigation methods and their efficiencies.

CANALS : Distribution system for canal irrigation, canal capacity, canal losses, alignment of main and distributary canals, most efficient section, lined channels, their design, regime theory, critical shear stress, cost analysis of lined and unlined canals, drainage behind lining.

WATER LOGGING : Causes and control, drainage system design, salinity.

CANAL STRUCTURES : Design of regulation, cross-drainage works, cross regulators, head regulators, canal falls, aqueducts, metering flumes and canal outlets.

DIVERSION HEAD WORKS : Principles of design of weirs on permeable and impermeable foundations, Khosla's theory, energy dissipation, stilling basins, sediment exclusion.

STORAGE WORKS : Types of dams, design principle of rigid gravity and earth dams, stability analysis.

SPILLWAYS : Types, crest gates, energy dissipation.

RIVER TRAINING : Objectives of river training, methods of river training.