SYLLABUS FOR LECTURER (CIVIL ENGINEERING) EXAMINATION, 2018
UNDER
ADVANCED TECHNICAL TRAINING CENTRE, BARDANG

FULL MARKS=85

1. Building Materials and Constructions

Engineering Materials: Physical properties of construction materials: stones, bricks, timber, sand, tiles, lime, surkhi, mortar, concrete, varnishes, plastics, rubber, damp-proofing materials, termite treatment materials, materials for low cost buildings, seasoning and preservation of timber.

Building Construction: Building components and their functions: walls, floors, roofs, ceilings, staircase, doors and windows, ventilation, air-conditioning, lighting & acoustics etc. Finishing of buildings: plastering, pointing, painting, use of building codes.

Functional Planning of building: Building orientation. circulation, grouping of areas, privacy concept and design of energy efficient building, provision of building codes and building regulations.

2. Design of Structures

Design of RC Structures: Concept of mix design; Limit State and Working Stress method of design; Recommendations of I.S Codes of one way and two-way slabs, staircase, simple and continuous beams of rectangular T and L sections, compression members under direct load with or without eccentricity, isolated and combined footings, elevated and underground water tanks; Methods and systems of prestressing, anchorages, losses in prestress; design of prestress girder; Design of Cantilever and Counterford type retaining walls.

Design of Steel Structures: Factors of safety and load factor; Riveted, bolted and welded connections. Design of tension and compression and flexural members, beams of built up section, riveted and welded plate girders, gantry girders, stanchions with battens and lacings, slab and gusseted column bases. Design of highway and railway bridges, warren girder, Pratt truss; Design of industrial roof and multi-storey buildings; water tanks; plastic design of continuous frames and portals.

3. Engineering Mechanics

Static: Coplaner and multiplaner system; Varignon's theorem, free body diagrams, conditions of equilibrium; second moment of plane figure; force and funicular polygon; principle of virtual work; suspension systems of catenary.

Dynamic: Units and dimensions; Gravitational and absolute systems; MKS & S.I. Units; Vectors, concept of force, concept of particle and rigid body.

Kinematics: Rectilinear and Curvilinear motion; relative motion; instantaneous centre.

Kinetics: Mass moment of inertia; simple harmonic motion, momentum and impulse; equation of motion of rigid body rotating about a fixed axis.

4. Strength of Materials

Simple Stress and strain; Elastic constants; tension and compression in one direction; riveted and welded joints.

Shear force and bending moment; Theory of simple bending; shear stress distribution in cross section of beams; beams of uniform strength; Strain energy in direct stress, bending and shear.

Deflection of beams; Maculay's method, Mohr's moment area method, conjugate beam method, unit load method. Torsion of shafts, transmission of power, close coiled helical springs.

Theories of column and struts; Euler's, Rankine's and Secant formulae. Principal stress and strain; simple theories of failure; Mohr's circle.

Thin and thick cylinders; stresses due to internal and external pressure.

5. Structural Analysis:

Analysis of determinate structures - different methods including graphical methods; reciprocal theorem, unsymmetrical bending; moment of inertia.

Analysis of indeterminate skeletal frames - moment distribution, slope-deflection, stiffness and force methods, energy methods, column analogy method and Kani's method.

Plastic analysis of indeterminate beams and simple frames - shape factor. Matrix methods of analysis.

Moving loads-shearing force and bending moment diagrams; influence lines for simple and continuous beams and frames.

6. Fluid Mechanics and Hydraulic Engineering

Dynamics of fluid flow: Equation of continuity; energy and momentum Bernoulli's theorem; cavitation, velocity potential and stream function; rotational and irrotational flow, free and forced vortices; flow net

Dimentional analysis and its application to practical problems

Viscous flow: Flow between static and moving parallel plates, flow through circular tubes; film lubrication; velocity distribution in laminar and turbulent flow; boundary layer.

Incompressible flow through pipes: Laminar and turbulent flow, critical velocity; losses, stamton diagram; hydraulic and energy gradelines; siphon pipe network; forces on pipe bends

Compressible flow: Adiabatic and isenthropic flow; subsonic and supersonic velocity; mach number, shock waves; water hammer.

Open channel flow: Uniform and non-uniform flow; best hydraulic cross-section; specific energy and critical depth gradually varied flow, classification of surface profiles; control sections; standing wave flume; surges and waves; hydraulic jump.

7. Water Resources Engineering

Hydrology: Hydrological cycle, precipitation evaporation; transpiration; depression storage; infiltration; overland flow; hydrograph; flood frequency analysis; flood estimation; flood routing through a reservoir; channel flow routing- Muskingam method.

Ground water flow: Specific yield; storage coefficient; coefficient of permeability; confined and unconfined aquifers; radial flow into well under confined and unconfined conditions; tube wells; pumping land recuperation tests; ground water potential.

Planning of water resources: Ground and surface water resources; surface flows; single and multipurpose projects; storage capacity; reservoir losses; reservoir silting; flood routing; benefit-cost ratio; general principles of optimization.

8. Sanitation and Water Supply (Environmental Engineering):

Sanitation: Site and orientation of buildings; ventilation and damp proof course; house drainage; conservancy and water-borne systems of waste disposal; sanitary appliances; latrines and urinals.

Disposal of sanitary sewage: Industrial waste; domestic waste; storm sewage-separate and combined systems; flow through sewers; design of sewers; sewer appurtenances-manholes, inlet junctions, siphon, ejections etc.

Sewer treatment: Working principles; units, chambers; sedimentation tanks; trickling filters; oxidation ponds; activated sludge; recycling of waste water; septic tanks; soak pit; disposal of sludge.

Environmental pollution and ecology: Sustainable development; radio-active waste and disposal; environmental impact assessment for thermal power plants; mines, river valley projects; air pollution and pollution control acts.

Water Supply: Estimation of water resources; ground water hydraulics; predicting demand of water; Impurities of water-physical, chemical and bacteriological analysis, water borne diseases.

Intake of water: Pumping and gravity schemes; water treatment-principles of setting, coagulation, flocculation and sedimentation, slow, rapid and pressure filters, softening; removal of taste, odour and salinity.

Water storage and distribution: Storage and balancing reservoirs, types, locations and capacity. Distribution system-layouts hydraulics of pipelines; pipe fittings; meters; analysis of distribution system; leak detection; maintenance of distribution system; pumping stations and their operations.

9. Hydraulic Machines and Hydropower

Hydraulic pumps: Type, characteristics, net positive suction height (NPSH), specific speed; pumps in parallel

Reciprocating pumps: Air vessels, hydraulic ram, efficiency parameters, rotary and positive displacement pumps, diaphragm and jet pumps.

Hydraulic turbines: Type, classification, choice of turbines; Performance parameters, control, characteristics, specific speed.

Principles of hydropower development: Types of dams, layouts and component works; Gates and valves; Intake structures, Tunnels, Penstocks; Surge tanks- types and choice. Flow duration curves and dependable flow. storage and pondage. Pumped storage plants. Layout of power stations. Specific features of mini, micro-hydel plants.

10. Irrigation Engineering

Water requirement for crops: Quality of irrigation water; consumptive use of water; water depth and frequency in irrigation; duty of water; irrigation methods and their efficiencies.

Distribution system for canal irrigation: Determination of require canal capacity; canal losses; alignment of main and distributory canals

Design of canals: Unlined canals in alluvium; the critical tractive stress; principles of sediment transport; regime theories, lined canals; hydraulic design and cost analysis; drainage behind lining.

Canal structures: Design of regulation works; cross drainage and communication works-cross regulators, head regulators, canal aqueducts, metering flumes etc; canal outlets.

Water logging; Its causes and control; design of drainage system; soil salinity

Diversion headworks: Principle and design of weirs of permeable and impermeable foundations; Khola's theory; energy dissipation; stilling basin; sediment excluders

Storage works: Types of dams including earth dam and their characteristics; principles of design; criteria for stability; foundation treatment; joint and galleries; control of seepage.

Spillways: Different types and their suitability; energy dissipation; spillway crest gates.

River training: Objectives of river training; methods of river training

11. Soil Mechanics and Foundation Engineering (Geo-Technical Engineering)

Soil Mechanics : Properties and Classification of soils; Atterburg limits; void ratio; moisture content; permeability-laboratory and field tests (Darcy's Law); seepage and flow nets; flow under hydraulic structures; uplift and quick sand condition; unconfined and direct shear test; triaxial test; earth pressure theories (Rankine's theory and Coulomb's wedge theory); stability of slopes; theories of soil consolidation (Terzaghi's theory); compaction of soil; rate of settlement; total and effective stress analysis; pressure distribution of soils; Boussinesque and Waterguard theories; soil stabilization.

Foundation Engineering: Sub-surface exploration; methods of boring; Bearing capacity of footings; Essential features of foundation; Types of foundation- shallow foundation and deep foundations; choice of foundations; design criteria; Foundation for bridges; ground improvement techniques.

12. Surveying, Estimation & Costing

Surveying: General principles; surveying instruments and their adjustments; recording of survey observations; plotting of maps and sections; errors and their adjustments. Measurement of distances, direction and heights; correction to measured lengths and bearings; correction for local attraction; measurement of horizontal and vertical angles; levelling operations; refraction and curvature correction. Chain and compass survey; theodolite and tachometric traversing; traverse computation; plan table survey; solution of two and three points problems; contour surveying. Setting out directions and

grades; types of curves; setting out of curves and excavation lines for building foundations. Field astronomy; concept of global positioning system; remote sensing concepts; map substitute.

Estimating and costing: Estimating quantities of various items of civil works like roads, bridges, building, water supply structures, dams, irrigation canals, hydro-power structures, airports, railways etc. estimating the costs of various items of works on the basis of prevalent market rates, analysis of
rates of civil works items.

13. Transportation Engineering

Airports: Layout and orientation; runway and taxiway; design and drainage management; zoning laws; visual aids and air traffic control; helipads, hangers and service equipment.

Harbours: Layout; shipping lanes; anchoring; location identification, littoral transport with erosion and deposition; sounding methods; dry and wet docks; components and operational tidal data and analysis.

Railways: Planning railway system; terminology; crossing and turnouts, setting out points; controls; transits; tractive power and track modernization; maintenance of tracks; super elevation; creep of rail; ruling gradient; station yards and machinery; station buildings; platform sidings; signals and interlocking.

Roads: Classification of roads; planning of highway systems; alignment and geometric design; horizontal and vertical curves; grade separation. Road construction materials; types of pavements, design of pavements and pavement structures; construction methods; evaluation of pavement failure and strengthening. Maintenance of roads. Drainage system-surface and sub-surface drainages. Traffic engineering: Forecasting techniques, traffic survey- origin and destination survey; highway capacity; channelised and unchannelised intersections; traffic signs and road safety measures. Principles of highway financing.

Tunnelling: Alignment; methods of construction; disposal of muck; drainage; lighting & ventilation; traffic control; emergency management.

14. Construction Planning & Management

Earthwork equipment: Excavators; bulldozers; power shovels; trailers; dumpers; tractors; air-compressors & drills; rollers

Concreting equipment: Weight batcher, mixer, vibrator, batching plant, concrete pump etc.

Planning & Management: Construction activity; schedules; job layout; bar charts; organization of contracting firms; project control and supervision; cost reduction measures; roles of employer; engineer and contractor in a project.

Network Analysis: Critical Path Method (CPM) and Programme Evaluation and Review Technique (PERT) analysis; float times; crashing of activities; contraction of network for cost optimization; time-cost study; cost analysis and resource allocation.

15. Design of Masonry Structures

Material: Stone masonry and Brick masonry; Physical characteristics; General specifications.

Types of structures: Load bearing wall; column; pier; pillar; buttress; foundations; arch; return walls; wing wall; retaining walls; breast walls; toe walls; revetment walls; walling for buildings etc.

Types of stone masonry; terms of masonry structures; design of masonry structures; functions of masonry walls; Construction procedure; drainage in masonry structures.