

Department of Civil Engineering
Punjabi University, Patiala
(Established under Punjab Act No. 35 of 1961)

Syllabus of Ph.D. Entrance Test – 2026-27

SECTION A:
(RESEARCH METHODOLOGY)

Research: Meaning, definition and scope,

Steps in Research: defining the research problem, review of literature, hypothesis formulation, panel study, data collection, presentation, analysis and interpretation of data and presentation of results.

Research Design: Meaning, Types – Descriptive, Diagnostic, Exploratory, and Experimental.

Data Interpretation: Sources, acquisition and interpretation of data; quantitative and qualitative data; graphical representation and mapping of data, classification, tabulation, depiction of data.

Statistics in research: Percentages, Frequency distribution, Averages, Measures of Central tendency, Arithmetic mean, Median, Mode, Geometric Mean, Harmonic Mean, Dispersion, Range, Mean Deviation, Standard deviation, Root mean square deviation, Variance, Moments

SECTION B
(SUBJECT)

1. Structural Engineering

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM.

Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.

Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Plastic analysis of beams and frames

2. Geotechnical Engineering

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and

quicksand condition; Compaction in laboratory and field conditions; One-dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin Friction

3. Transportation Engineering

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; Airport runway length, taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

4. Water Resources Engineering

Hydrology, Hydrologic cycle, precipitation, evaporation, watershed, infiltration, unit hydrographs and aquifers.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, Gravity Dams and Spillways; Lined and unlined canals, Design of weirs; cross drainage structures.

Environmental Engineering: Water and Waste Water Quality and Treatment, Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment, primary and secondary treatment.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Fluid Mechanics: Properties of fluids, Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; and Flow in pipes.