Program	Ph.D.
Syllabus	Entrance Exam Syllabus for Civil Engineering
Examination Pattern	

Question Type	No. of Questions	Total Marks
1 Mark Domain Specific	35	35
1 Mark Research Aptitude	35	35
Total	**70**	**70**

Section – 1 - Weightage – 50%	
Sr. No.	**Topics**
1	**Engineering Mechanics** - System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system. **Solid Mechanics** - Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear center; Uniform torsion, Transformation of stress; 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.
2	**Construction Materials and Management** - Construction Materials: Structural Steel – Composition, material properties and behavior; Concrete – Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis – PERT and CPM; Cost estimation. **Concrete Structures** - Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams. **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; Concept of plastic analysis – beams and frames.
3	**Soil Mechanics** - Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability – one dimensional flow, Seepage through soils – two – dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One-dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths. **Foundation Engineering** - Sub-surface investigations – 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, Bishop's method; Stress distribution in soils – Boussinesq's theory; 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 – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.
4	**Geomatics Engineering** - Errors and their adjustment; Maps – scale, coordinate system; Distance and angle measurement – Levelling and trigonometric levelling; Traversing and triangulation survey; Total station;

	Horizontal and vertical curves. Photogrammetry & Remote Sensing – Scale, Flying Height, Basics of Remote Sensing and GIS.
5	**Fluid Mechanics** - Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag. **Hydraulics** - Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics – Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.
6	**Hydrology** - Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology – steady state well hydraulics and aquifers; Application of Darcy's Law. **Irrigation** - Types of irrigation systems and methods; Crop water requirements – Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.
7	**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. Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.
8	**Air Pollution** - Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits. **Municipal Solid Wastes** - Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).
9	**Transportation Infrastructure** - Geometric design of highways – cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.
10	**Highway Pavements** - Highway materials – desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes **Traffic Engineering** - Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.
Section – 2 - Weightage – 50%	
Sr. No.	**Topics**
1	**Research Aptitude -** Research: Meaning, characteristics and types; Steps of research, Methods of research; Research Ethics; Paper, article, workshop, seminar, conference and symposium.
2	**Reasoning (Including Mathematical) -** Number series; letter series; codes; Relationships; classification.
3	**Logical Reasoning -** Understanding the structure of arguments; Evaluating and distinguishing deductive and inductive reasoning; Verbal analogies: Word Analogy-Applied analogy; Reasoning Logical Diagrams: Simple diagrammatic relationship, multi-diagrammatic relationship; Venn diagram; Analytical Reasoning
4	**Data Interpretation -** Sources, acquisition and interpretation of data; Quantitative and qualitative data; Graphical representation and mapping of data.