

Part B - Syllabus

CIVIL ENGINEERING (CEE)

Engineering Mathematics: Linear algebra: matrices, determinants, eigenvalues; calculus: differentiation and integration; ordinary and partial differential equations; numerical methods: Newton-Raphson, Runge-Kutta, trapezoidal rule; probability and statistics: mean, variance, distributions, regression, hypothesis testing; complex analysis basics; Laplace and Fourier transforms.

Structural Analysis: Determinate and indeterminate structures; method of sections and joints for trusses; bending moment and shear force diagrams; influence lines for beams and trusses; deflection by conjugate beam, moment-area, and unit load methods; matrix stiffness and flexibility methods; arches and cables; three-moment theorem; Muller-Breslau principle.

Solid Mechanics: Stress and strain concepts; generalized Hooke's law; principal stresses and Mohr's circle; bending stress and shear stress in beams; deflection of beams; torsion of circular shafts; thin and thick cylinders; theories of failure: maximum normal stress, maximum shear stress, distortion energy (von Mises); columns and buckling (Euler's formula); strain energy methods.

Reinforced Concrete Design: Working stress method and limit state method (IS 456); design of singly and doubly reinforced beams; flanged beams; one-way and two-way slabs; design of columns under axial and eccentric loading; footings (isolated and combined); retaining walls; staircase design; development length and bond; serviceability limit states (deflection and cracking).

Steel Structures: Properties of structural steel; IS 800 design philosophy; tension and compression members; design of beams and plate girders; beam-column design; riveted, bolted, and welded connections; plastic analysis: plastic moment, collapse mechanisms, load factor; design of industrial buildings and trusses.

Geotechnical Engineering: Soil composition: particle size distribution, Atterberg limits, and plasticity; soil classification (IS and USCS); permeability and seepage flow nets; effective stress principle; consolidation theory (Terzaghi): primary and secondary; shear strength: Mohr-Coulomb criterion, direct shear, triaxial, and unconfined compression tests; bearing capacity of shallow foundations (Terzaghi, Meyerhof, Hansen); pile foundations: load capacity and settlement; slope stability: Taylor's, Bishop's, and Swedish methods; compaction characteristics.

Fluid Mechanics and Hydraulics: Fluid properties; hydrostatics; Bernoulli's equation and applications; laminar and turbulent pipe flow; Moody chart and pipe networks; boundary layer theory; open channel flow: gradually and rapidly varied flow, hydraulic jump; weirs and notches; flow in channels (Manning's and Chezy's equations); dimensional analysis: Buckingham Pi theorem; hydraulic similarity; pumps and turbines.

Hydrology and Water Resources Engineering: Precipitation, evaporation, and infiltration; hydrograph analysis; unit hydrograph theory; flood estimation and routing; surface water resources; groundwater: Darcy's law, aquifer properties, pumping tests; irrigation: canal design, water requirements, consumptive use; reservoirs: yield, storage, and operation; dam types and design principles; drought management.

Environmental Engineering: Water quality parameters: BOD, COD, DO, hardness; water treatment processes: coagulation, flocculation, sedimentation, filtration, disinfection; wastewater treatment: primary, secondary (activated sludge, trickling filter), tertiary; sludge management; air pollution: sources, pollutants, and control devices; noise pollution; solid waste management; environmental impact assessment; water supply and sewerage systems.

NRIU Ph.D. ENTRANCE EXAMINATION : 2026-26

Transportation Engineering: Highway geometric design: horizontal and vertical alignment, sight distance, and cross-section elements; flexible and rigid pavement design (IRC methods); pavement materials: aggregates, bitumen, and cement concrete; traffic engineering: traffic flow, speed-volume relationships, capacity and LOS; traffic signals; rail geometry: gauges, gradients, and curves; railway track components and maintenance; airport planning: runway design, terminal planning, and landing systems.

Construction Technology and Management: Building materials: bricks, cement, steel, glass, plastics, and composites; masonry construction; concrete technology: mix design, workability, durability, and quality control; construction equipment and methods; project management: CPM, PERT, and resource allocation; cost estimation and quantity surveying; building codes and regulations; building information modelling (BIM) basics; sustainable construction practices.