

CIVIL ENGINEERING

UNIT 1: ENGINEERING MATHEMATICS

Linear Algebra — matrix algebra, linear equations, - eigen values and eigen vectors.
Calculus- Functions of single variable, limit, continuity and differentiability - mean value theorems, evaluation of definite and improper integrals - partial derivatives, total derivative - maxima and minima - gradient, divergence and curl - vector identities - directional derivatives - line, surface and volume integrals - stokes, gauss and green's theorems.

Differential equations — first order equations (linear, nonlinear) — higher order linear differential equations with constant coefficients - Cauchy's and Euler's equations — initial and boundary value problems — Laplace transformations and equations — solutions to one dimensional heat and wave equations.

Complex variables — analytic functions — Cauchy's integral theorem — Taylor and Laurent series — Fourier series — general, odd and even functions.

Probability and Statistics - probability and sampling theorems- conditional probability — mean — median, mode and standard deviation — random variables — Poisson, Normal and Binomial distributions.

Numerical Methods — numerical solutions of linear and non-linear algebraic equations — integration by trapezoidal and simpson's rule, single and multistep methods for differential equations.

UNIT 2: MECHANICS

Simple stress and strain relationships in one, two and three dimensions — principal stresses, stress transformation — mohr's circle — properties of surfaces — friction — principle of conservation of energy — impulse and momentum — relative motions - bending moment and shear force in statically determinate beams— simple bending theory — flexural and shear stresses — unsymmetrical bending — shear center — pressure vessels (thin and thick walled) — uniform torsion— springs — buckling of columns —combined and direct bending stresses —theories of failure — shear stress, strain energy and distortion energy theories — residual stresses.

UNIT 3: STRUCTURAL ANALYSIS

Analysis of statically determinate and indeterminate trusses — arches — cables and frames — deflections of statically determinate structures (beams, frames and trusses) — analysis of statically indeterminate structures (slope deflection, moment distribution methods) — matrix methods of structural analysis — influence lines for determinate and indeterminate structures.

UNIT 4: CONCRETE STRUCTURES

Concrete technology — properties of concrete — mix design — working stress and limit state design concepts — design of all structural components (slab, beam, column, foundation and stair case) — retaining walls — water tanks — basic elements of prestressed concrete — methods - analysis of beams at transfer and service loads — seismic load analysis — theory of vibration — seismology — response of structures — design methodology - all related IS codes.

UNIT 5: STEEL STRUCTURES

Connections - analysis and design of tension, compression members, beams and beam columns — trusses - column bases — plate girders — plastic analysis — wind load analysis-all related IS codes.

UNIT 6: SOIL MECHANICS

Soil classification — engineering properties — three phase system — relationship and interrelationship — permeability — seepage — effective stress principle — consolidation — compaction — shear strength — CBR — Safe bearing capacity determination.

UNIT 7: FOUNDATION ENGINEERING

Sub surface investigation — sampling — standard penetration test — plate load test — earth pressure — effect of water table — layered soil — stability of slopes — foundation types and design requirements— stress distribution and settlement analysis — shallow and deep foundations.

UNIT 8: FLUID MECHANICS AND MACHINES AND HYDROLOGY

Properties of fluid — principle of conservation of mass — momentum — energy and corresponding equations — potential flow — Bernoulli's equation it and application — laminar and turbulent flow — flow in pipes — network — concept of boundary layer — uniform and non uniform flow — specific energy concept — hydraulic jump — forces on immersed bodies — flow measurements in open. channels and pipes dimensional analysis and hydraulic modeling — impact -kinematics of flow — velocity triangles — pumps and turbines.

Hydrologic cycle — rainfall — evaporation — infiltration — stage discharge relationships — unit hydrographs — flood estimation — reservoir capacity — reservoir and channel routing well hydraulics.

Duty — delta — estimation of evapo—transpiration — crop water requirements — design of lined and unlined canals — waterways — head works — gravity dams and spill ways — design of permeable foundation — types of irrigation system — irrigation methods — water logging and drainage.

UNIT 9: WATER SUPPLY AND WASTE WATER DISPOSAL

Quality standards — basic unit processes and operations - water treatment — drinking water standards — water requirements — surface water treatment — distribution — sewage and its treatment — quantity and characteristics of waste water — primary, secondary and tertiary treatment— effluent discharge standards — domestic waste water treatment — quantity and characteristics — treatment unit operations and unit processes — sludge disposal. — types of pollutants — their sources and impacts — standards and limits.

UNIT 10: HIGHWAY ENGINEERING

IRC standards — geometric design of highways — materials — construction and maintenance — testing and specifications of materials — design of flexible and rigid pavements — traffic characteristics — theory of traffic flow — intersection design — traffic signs and signal design — highway capacity — importance of surveying — principles and classification — mapping — coordinate system — map projections — measurements of distance and directions — leveling — theodolite traversing —errors and adjustments — curves.