Syllabus for the Entrance Examination for Admission to Ph. D in Civil Engineering for the Autumn Session -2015.

Mechanics: Bending moment and shear force in statically determinate beams,. Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, flexural and shear stress, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.

Structural Analysis: Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force/energy methods, analysis by displacement methods (slope deflection and moment distribution methods) influence lines for determinate and indeterminate structures. Basic concepts of matrix methods for structural analysis.

Concrete Structures: Concrete Technology- properties of concrete, basics of mix design. Concrete design-basic working stress and limit state deign concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of prestressed concrete, analysis of beam sections at transfer and service loads.

Steel Structures: Analysis and 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

Soil Mechanics: Origin of soils, soil classification, three-phase system, fundamental definitions, permeability and seepage effective stress principle, consolidation , compaction, shear strength.

Foundation Engineering: Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load test. Earth pressure theories, effect of water table, layered soils, Stability of slopes- infinite slopes, finite slopes. Foundations types- foundations design requirements. Shallow foundations- bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands and clays. Deep foundations- pile types –dynamic and static formulae, load capacity of piles in sands and clays, negative skin friction.

Fluid Mechanics and Hydraulics: Properties of fluids, principal of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, vertical flow and gradually varied flow in

channels, specific energy concept, hydraulic jump. Forces on immersed bodies flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

Hydrology:- Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

Irrigation : Duty , delta, estimation of evapo- transpration. Crop water requirements. Design of: lined and unlined canals, water ways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

Highway Engineering: Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements. Highway drainage, Hill road Engienering.

Traffic Engineering:- Traffic Characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity & Los.

Transport Planning: Travel demand modeling, Land se Transport planning, PT &NMT planning

Engineering Geosscience: Crystallography, crystal optics, general geology & geomorphology, structural geology, igneous petrology, metamorphic petrology, sedimentary petrology, stratigraphy, economic geology, palaeontology, geology, mineralogy and petrology, structural geology and geotectonics, palaeontology and its applications, sedimentology and stratigraphy, marine geology and pale oceanography, economic geology, applied geology, geophysics

Water Requirements: Quality standards, basic unit processes an operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards, Domestic wastewater treatment, quantity of characteristics of domestic waste water , primary and secondary treatment. Unit operations and unit processes of domestic waste water sludge disposal.

Air pollution; Types of pollutants, their sources and impact, air pollution meteorology, air pollution control, air quality standards and limits.

Municipal solid wastage: Characteristics, generation , collection and transportation of solid wastes, engineered systems of solid waste management (reuse/recycle, energy recovery, treatment and disposal.

Surveying : Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying , errors and adjustments, curves

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

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 & Green's theorems.

Differential equations; First order equations(linear and non linear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equations.

Complex Variables: Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

Probability and Statistics: Definitions of 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 Simpsons rule, single and multi- step methods for differential equations.