Syllabus for Ph.D Entrance Examination - Mathematics

Matrix Algebra: Rank of a Matrix, Linear dependence. Solutions of Linear Systems: Existence and Uniqueness. Diagonalization of a Matrix, Power of a Matrix, Diagonalization by Orthogonal Transformation, Quadratic Forms.

Vector Analysis: Divergence and curl of a vector point function. Physical interpretation of divergence and curl of a vector point function. Integration of vector functions – Line, surface and volume integrals. Guass, Green and Stoke's theorems.

Differential Equations: General solution of homogeneous equations, non-homogeneous equations, Wronskian, method of variation of parameters.

Modern Algebra: Definition of Groups, Subgroups and Factor Groups, Lagrange's Theorem, Homomorphisms, Normal Subgroups and Permutation Groups.

Complex Analysis: Analytic functions, CR-equations. Cauchy's theorem, integral formula, poles and singularities.

Real Analysis: Limit of Functions. Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Derivative of a Real Function. Mean Value Theorem.

Numerical Methods: Bisection method, fixed-point iteration, Newton's method. Error analysis for Iterative Methods. Computing roots of polynomials. Interpolation: Lagrange Polynomial. Divided Differences.

Statistics and Probability Theory: Probability, conditional probability, independent events, total probability and Baye's theorem. Random Variable, Probability density function, distribution function, mathematical expectation, variance, Discrete Distributions −Binomial, Poisson, Continuous Distribution − Normal distribution.