Syllabus for Ph.D. (Department of Mathematics and Statistics) Entrance Exam Paper -II

UNIT-1	Matrix Algebra

Rank of a Matrix, Linear dependence. Solutions of Linear Systems: Existence and Uniqueness. Eigen Values, Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem. Diagonalization of a Matrix, Power of a Matrix, Diagonalization by Orthogonal Transformation, Quadratic Forms.

UNIT-2	Linear algebra

Vector spaces over fields, subspaces, bases and dimension. Systems of linear equations, matrices, rank, Gaussian elimination. Linear transformations, representation of linear transformations by matrices, rank-nullity theorem, duality and transpose. Determinants, Laplace expansions, cofactors, adjoint, Cramer's rule.

UNIT-3	Differential Equations

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

PDE: Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification.

UNIT-4	Numerical Methods

Bisection method, fixed-point iteration, Newton's method. Error analysis for Iterative Methods. Computing roots of polynomials. Interpolation: Lagrange Polynomial. Divided Differences. Numerical differentiation; numerical integration: Trapezoidal and Simpson rules; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jacobi and Gauss-Seidel); numerical solution of ordinary differential equations: initial value problems: Euler's method, Runge-Kutta methods of order 2.

UNIT-5	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

References:
1. "Higher Engineering Mathematics" by Grewal B S
2. "Advanced Engineering Mathematics" by Erwin Kreyszig
3. "Advanced Engineering Mathematics" by Peter V O'Neil
4. "Numerical methods" by R.K.Jain and S.R.K. Iyengar