PhD Admission Test-2022
Mathematics
Syllabus

Algebra:

Groups, homomorphism, Sylow theorems. Rings and fields. Vector spaces, subspaces, linear dependence, basis and dimension. Linear transformation, range space, null space, rank and nullity. Matrix representation of a linear transformation. Change of basis. Eigenvalues and eigenvectors. Inner product, orthogonality, Gram-Schmidt process, orthogonal expansion. Quadratic forms, reduction to normal form.

Analysis:

The real number system. Sequences, series and uniform convergence. Continuity and differentiability of functions of real variable. Riemann and Lebesgue integrals. Analytic function, Cauchy Riemann equations, Cauchy's theorem and integral formula, singularities, Taylor's and Laurant's series. Cauchy's residue theorem and applications. Metric spaces.Cauchy sequences and convergence. Completeness. Normed space. Banach space. Inner product space. Hilbert space.

Differential Equations:

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations. Second order linear differential equations. Variation of parameters. Systems of linear differential equations. Solution by matrix method. Laplace transform methods. Applications. Sturm-Liouville problem. Green's function. First and second order partial differential equations. Method of separation of variables for Laplace, heat and wave equations.

Operations Research:

Linear programming problems, convex set, convex functions, Simplex method and its variants, duality, sensitivity analysis. Transportation problems, initial basic feasible solution and optimal solution, degeneracy. Assignment problems, applications of Transportation and Assignment problems. Game Theory. Queuing Models. Nonlinear programming problems, Kuhn-Tucker conditions.

Numerical Analysis:

Approximation of functions, their derivatives and integrals by interpolation. Finite and divided differences. Iterative methods for solving nonlinear and linear equations, convergence. Power method for largest eigenvalue. Numerical Solution of ordinary differential equations. Solution ofInitial value problems by Runge-Kutta and predictor-corrector methods. Boundary value problems by finite difference methods. Numerical Solution of Laplace and Poisson equations.

Probability and Statistics:

Sample space, events and probability axioms. Random variable and probability distributions. Mean and Variance. Binomial, normal and Poisson distributions. Random sampling, confidence intervals, testing hypotheses, goodness of fit. Regression Analysis.