Syllabus for Written Test for PhD Admission 2025

Probability and Statistics: Counting (permutation and combinations), probability axioms, Sample space, events, independent events, mutually exclusive events, marginal, conditional and joint probability, Bayes Theorem, conditional expectation and variance, mean, median, mode and standard deviation, correlation, and covariance, random variables, discrete random variables and probability mass functions, uniform, Bernoulli, binomial distribution, Continuous random variables and probability distribution function, uniform, exponential, Poisson, normal, standard normal, t-distribution, chi-squared distributions, cumulative distribution function, Conditional PDF, Central limit theorem, confidence interval, z-test, t-test, chi-squared test.

Linear and Abstract Algebra: Vector space, subspaces, linear dependence and independence of vectors, matrices, projection matrix, orthogonal matrix, idempotent matrix, partition matrix and their properties, quadratic forms, systems of linear equations and solutions; Gaussian elimination, eigenvalues and eigenvectors, determinant, rank, nullity, projections, LU decomposition, singular value decomposition; set theory

Calculus and Optimization: Functions of a single variable, limit, continuity and differentiability, Taylor series, maxima and minima, optimization involving a single variable.

Data Structures and Algorithms: Programming logic; Basic data structures: stacks, queues, linked lists, trees, hash tables; Search algorithms: linear search and binary search, basic sorting algorithms: selection sort, bubble sort and insertion sort; divide and conquer: mergesort, quicksort; introduction to graph theory; basic graph algorithms: traversals and shortest path.