

Syllabus for Written Test for PhD Admission

1. Real Analysis: Sequence and series of real numbers and functions, continuity and differentiability of real valued functions of one variable and applications, uniform convergence, Riemann integration, continuity and differentiability of real valued functions of several variables, partial derivatives and mixed partial derivatives, inverse and implicit function theorems.

2. Complex Analysis: Holomorphic functions, Cauchy's theorem and Cauchy integral formula, Liouville theorem, Morera's theorem, open mapping theorem, maximum modulus theorem, Schwarz lemma, conformal maps and geometry of Mobius transformations, Laurent series, singularities, theory of residues, contour integration, several applications of Cauchy integral formula and Residue theorem in different contexts in complex analysis.

3. Algebra:

a) Group theory: Groups, subgroups, cyclic groups, homomorphisms, Lagrange's theorem & normal subgroups, finite groups, symmetric and alternating groups, direct product, structure of finite Abelian groups, group actions, Sylow theorems.

b) Rings and Fields: Rings and ideals, quotients, homomorphism and isomorphism theorems, maximal ideals, prime ideals, integral domains, field of fractions, Euclidean rings, principal ideal domains, unique factorization domains, polynomial rings. Fields, characteristic of a field, algebraic extensions, roots of polynomials.

c) Linear Algebra: Vector spaces, subspaces, linear independence, dimension; linear transformations & matrices, determinant, rank-nullity theorem, solution of linear system of equations, eigenvalues, eigenvectors, & diagonalizability, Jordan canonical form.

4. General Topology: Topological spaces, continuous functions, connectedness, compactness, separation axioms, product spaces, complete metric spaces, uniform continuity, quotient topology.