Syllabus for PhD Admission Written Test
January 2022

Written Test: Duration of the written test is 2 hours.

Interview: The interview will be conducted for the candidates who cleared their written test. The interview will be mainly based on three areas chosen by the candidate, typically their area(s) of interest.

Syllabus

Candidates are required to answer questions from at least three of the following 6 general areas related to their area of interest.

1.1 Linear Algebra


1.2 Abstract Algebra

Basic Group Theory, Normal Subgroups, Quotient Groups and Homomorphism Theorems, Group Actions with examples, Cayley’s Theorem, The Class Equation and their application, Sylow’s Theorems, Direct Products, Structure Theorem for Finite Abelian Groups, Existence and universal Properties of free Groups. Basic Ring Theory, Commutative Ring With Identity, Properties of Ideals, Prime and Maximal Ideals, Zorn’s lemma and existence of maximal ideals, Quotient Rings and Localization, Chinese Reminder Theorem, Field of Fractions and
Integral Domains, Euclidean Domain, Principal Ideal Domain (PID), Unique Factorization Domain (UFD), Irreducibility Criterion, Primes in $\mathbb{Z}[i]$ and Fermat’s Two-Square Theorem, Definition and simple examples of modules over commutative and non-commutative rings. Field Theory: Finite, Algebraic and Transcendental Extensions, Existence and Cardinality of Algebraic Closure, Splitting fields and Normal extensions, Galois Theory of Polynomial in characteristic zero and simple examples, Separable, Inseparable and Purely inseparable extensions, Finite Fields.

1.3 Real Analysis and Complex Analysis


1.4 Functional Analysis


1.5 Differential Equations


Partial Differential Equations: Linear PDEs, First Linear and Quasi-linear PDEs, Classification of Second Order PDEs, Cauchy Problem, Variable Separable, Wave Equation, Heat Equation, Laplace Equation, Transport Equation, D’Alembert’s Principle, Boundary Value Problems, Green’s Function

1.6 Numerical Analysis