

Syllabus: Mathematics

1) Algebra

Modern Algebra - Groups, Sylow Package Theorems, Rings, PID, UFD, Fields, Field Extension, Finite Fields. Linear Algebra – Algebra of Linear Transformation, Finite Dimensional Vector Spaces, Diagonalizability, Hermitian & Unitary Transformations, Spectral Theorem.

2) Real Analysis

Limit of Functions, Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic Functions, Infinite Limits & Limit at Infinity. Derivative of Real Function, Mean Value Theorem, Continuity of Derivatives, L'Hospital's rule, Derivatives of Higher Order, Taylor's Theorem.

3) Complex Analysis

Analytic Functions, Conformal Mappings, Bilinear Transformation, Complex Integration, Cauchy's Integral Theorem, Zeros & Singularities, Taylor's & Laurent's series, Residue theorem.

4) Differential Equations

ODE - Linear Differential Equations with Constant Coefficients, Existence and Uniqueness of Solution, Picard's Theorem, Applications of Linear Differential Equations, Boundary Value Problems. PDE – Linear & quasilinear first order PDE, Method of Characteristics, Second order linear equations in two variables and their classification.

5) Numerical Methods

Interpolation, Numerical Differentiation & Integration, Numerical solution of systems of linear equations, Solution of IVP's.

6) Combinatorics

Counting Principles, Generating Functions, Recursion, Boolean Algebra, Distributive Lattices, Graphs, Trees, Connectivity & Coloring of Graphs.

7) Calculus of Several Variables

Limit, Continuity, Differentiability, Implicit Function theorem, Integration of vector functions (Line, Surface, Volume integrals).