

Department of Physics

Indian Institute of Technology Kanpur

PHY605 : Review of Mathematical Methods in Physics

Instructor: Dr Amit Kumar Agarwal

Course Content:

- I. Complex analysis: Cauchy-Riemann conditions, Cauchy-Goursat theorem, Cauchy integral formula, Contour integrals, Taylor and Laurent Series, The residue theorem. Applications of complex analysis to physics problems
- II. Group Theory: Discrete and Continuous Group, Abelian and Non-Abelian Groups, Lie Algebra, Representation Theory.
- III. Differential equations: General introduction to ordinary differential equations, linear first and second order ordinary differential equations, singular points, series solutions- Frobenius method, second solution, inhomogeneous equations-Green's function, SturmLiouville theory, partial differential equations, characteristics, Boundary conditions. Special functions and applications in Physics.
- IV. Problem oriented review of Mathematical Methods in Physics. Vector spaces - Discrete and continuous: orthogonality, operator algebra. Hermitian and unitary operators, projection operators, matrices and applications in Physics. Calculus of variations, function spaces and Hilbert spaces, Orthogonal polynomials, expansions in orthogonal polynomials, generating functions. Integral transforms (e.g Fourier, Laplace, etc.) and applications to physics.

References:

1. Mathews, Walker - Mathematical Methods of Physics
2. Byron and Fuller - Mathematics of Classical and Quantum Physics