

PHY 605A: Reviews of Mathematical Methods

Instructor: Debtosh Chowdhury

Broad topics that will be covered in this course are as follows:

- Eigenfunction methods for differential equations: Hermitian operators, Sturm-Liouville equations, eigenvalue problems, variation methods.
- Partial differential equations: general and particular solutions, Laplace and Poisson equations, Wave equation, Heat-flow or diffusion equation.
- Green's functions: definition and properties of Green's function, construction and uniqueness, generalized Green's function, problems in two- and three-dimensional systems, scattering problems.
- Complex analysis: Cauchy-Riemann conditions, conformal transformations, Cauchy integral theorem and formula, Taylor and Laurent series, Calculus of residues, applications to physics problems.
- Special functions: Gamma function, Bessel Function, Legendre function, Hermite functions, Hypergeometric functions, and applications.
- Elements of group theory: definition and examples of groups, group representations, finite groups, continuous groups, physical applications.

References: No textbook will be strictly followed. Below-listed books will be useful for the contents of the course:

1. Mathematical methods for physicists, G. B. Arfken, H. J. Weber and F. E. Harris, Academic Press.
2. Complex variables and Applications, J. W. Brown and R. V. Churchill, McGraw-Hill.
3. Group theory in a Nutshell for Physicists, A. Zee, Princeton University Press.