

Course on Mathematical Methods

Syllabus:

- Vector analysis: Gauss' theorem, Stokes' theorem, Helmholtz's theorem
- Matrix algebra: Determinants; Orthogonal, Hermitian, Unitary, Cyclic matrices; eigenvalue problems
- Complex analysis: Cauchy-Reimann conditions, Laurent expansion, residue theorem, contour integration, method of steepest descent
- Definite integrals: exact evaluation methods, approximate methods (asymptotic expansion, saddle point method)
- Integral transforms: Fourier series, Fourier transform, Laplace transform, inverse Laplace transform
- Differential equations: ODE (closed form solutions, series solutions, WKB method, Green's function); PDE (separation of variables, integral transform methods); difference equations
- Probability theory: general properties of probability distributions; moments and cumulants; Binomial, Poisson and Gaussian distributions; Central limit theorem

References:

- Arfken. Mathematical methods for physicists and engineers
- Bender and Orszag. Adv Math methods for scientists and engineers
- Mathews and Walker. Mathematical methods of physics
- Copson. Theory of functions of a complex variable
- Dennery and Krzywicki. Mathematics for physicists