

PH 532: NUMERICAL METHODS AND COMPUTATIONAL PHYSICS (3-0-0: 3)

Errors

The importance of estimating errors, systematic and random errors, absolute and relative errors, general formula for errors, error propagation, method of least squares, floating point errors, floating point complications, overflow and underflow

Matrices and Linear Algebraic Equations

Addition, subtraction and multiplication of matrices, transpose of a matrix, Gauss-Jordan elimination, Gauss-Seidel elimination, LU Decomposition, applications, eigen value problem

Root Finding and Nonlinear Sets of Equations

Bisection method, Newton–Raphson method, Secant method, applications

Interpolation

Lagrange polynomials

Modelling of Data

Least square fitting of functions and its applications

Numerical Differentiation

Forward, backward and centred difference formulae

Solution of Ordinary Differential Equations

Euler's method, second and fourth order Runge-Kutta methods, finite difference method, boundary value problems

Numerical Integration

Trapezoidal and Simpson and Gaussian Quadrature rules, applications.

Monte-Carlo Methods

Random number generation, checking the randomness of a sequence, Monte-Carlo integration

Text Books and References:

1. H. M. Antia, "Numerical Methods for Scientists and Engineers", Hindustan Book Agency.
2. V. Rajaraman, "Computer Oriented Numerical Methods", PHI Learning Publishers.
3. R. L. Burden and J. D. Faires, "Numerical Analysis", Brooks Cole Publishing.
4. K. P. N. Murthy, "Monte-Carlo Methods in Statistical Physics", University Press.
5. W. H. Press, S. S. Teukolsky, W. T. Vetterling and B. P. Flannery, "Numerical Recipes in C", Cambridge University Press.
6. R. H. Landau, M. J. Paez and C. C. Bordeianu, "Computational Physics", John Wiley.