

NUMERICAL METHODS THEORY AND NUMERICAL PRACTICALS IN C.

Unit I: Error Analysis and Curve Fitting

Error Analysis : Systematic and random errors – Absolute versus relative errors – Floating point arithmetic – Curve fitting Method of least squares – Normal equations – Straight line fit.

Unit II : Solutions of Linear equations and Random Numbers

Simultaneous linear equations: Gauss elimination method – Jordan's modification, Newton - Raphson method – Iterative rule – Termination criteria – Pitfalls – Order of convergence Uniform random numbers (Theory only) – General iterative process – Park and Miller generator.

Unit III: Interpolation

Newton interpolation polynomial: Linear interpolation – Higher-order polynomials – First-order divided differences – Gregory – Newton interpolation polynomials.

Unit IV: Numerical Integration, Differentiation and Numerical solution to ordinary Differential Equation

Newton-Cotes quadrature formula – Trapezoidal, Simpson's 1/3 and 3/8 rules- Differentiation: First and Second order derivatives. First order equations: Euler and improved Euler methods – Second order Euler and Runge-Kutta methods.

Unit V: Numerical Methods: Practice in C - List of Experiments

1. Curve Fitting – Straight line fit
2. Newton-Raphson method- Complex roots of one-dimensional equations
3. Solution of simultaneous equations – Gauss- Jordan method
4. Numerical differentiation – First derivative
5. Euler method for second-order ordinary differential equation
6. Runge-Kutta method for second-order ordinary differential equation
7. Uniform random number generator – Park – Miller method

Books for Study and Reference:

Relevant Chapters in

1. M.K.Jain, S.R.A.K. Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computation
2. J.H. Mathews, Numerical Methods for Mathematics, Science and Engineering (Prentice-Hall of India, New Delhi, 1998)
3. S.D. Conte, C.Boor, Elementary Numerical Analysis (McGraw –Hill, Singapore, 1981) 3rd edition
4. W.H. Press, S.A. Teukolsky, W.T. Vetterling, B.P. Flannery, Numerical recipes (Foundation Books, new Delhi, 1993)