

SEMESTER-V

COURSE 14: ADVANCED NUMERICAL METHODS

Theory

Credits: 4

5 hrs/week

Course Outcomes

After successful completion of this course, the student will be able to

1. find derivatives using various difference formulae
2. understand the process of Numerical Integration
3. solve Simultaneous Linear systems of Equations
4. understand Iterative methods
5. find Numerical Solution of Ordinary Differential Equations

Course Content

UNIT – I

Numerical Differentiation

Derivatives using Newton's forward difference formula - Newton's backward difference formula - Derivatives using central difference formula - Stirling's interpolation formula - Newton's divided difference formula.

UNIT – II

Numerical Integration

General quadrature formula on errors - Trapezoidal rule – Simpson's $1/3$ rule - Simpson's $3/8$ rule - Weddle's rule - Euler-Maclaurin formula of summation and quadrature - The Euler transformation.

UNIT – III

Solution of Simultaneous Linear systems of Equations – I

Solution of linear systems - Direct Methods - Matrix inversion method – Gaussian elimination method - Gauss Jordan Method.

UNIT – IV

Solution of Simultaneous Linear systems of Equations – II

Method of factorization - solution of Tridiagonal systems - Iterative methods - Jacobi's method - Gauss - Seidel method.

UNIT – V

Numerical Solution of Ordinary Differential Equations

Introduction – solution of Taylor's series – Picard's method of successive approximations – Euler's method – Modified Euler's method – Runge-Kutta methods.

Activities

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson Publications.
2. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain, New Age International Publishers.
