

Course Title: Advance Mathematics- VIII (Numerical Analysis)

Course Rating: 4 Cr. Hours

Error Analysis

- Errors, Absolute errors, Rounding errors, Truncation errors
- Inherent Errors, Major and Minor approximations in numbers

The Solution of Linear Systems

- Gaussian elimination method with pivoting, LU Decomposition methods,
- Algorithm and convergence of Jacobi iterative Method, Algorithm and convergence of Gauss Seidel Method
- Eigenvalue and eigenvector, Power method

The Solution of Non-Linear Equation

- Bisection Method, Fixed point iterative method, Newton Raphson method, Secant method, Method of false position, Algorithms and convergence of these methods

Difference Operators

- Shift operators
- Forward difference operators
- Backward difference operators
- Average and central difference operators

Ordinary Differential Equations

- Euler's, Improved Euler's, Modified Euler's methods with error analysis
- Runge-Kutta methods with error analysis
- Predictor-corrector methods for solving initial value problems
- Finite Difference, Collocation and variational methods for boundary value problems

Interpolation

- Lagrange's interpolation
- Newton's divided difference interpolation
- Newton's forward and backward difference interpolation, Central difference interpolation
- Hermit interpolation
- Spline interpolation
- Errors and algorithms of these interpolations

Numerical Differentiation

- Newton's Forward, Backward and central formulae for numerical differentiation

Numerical Integration

- Rectangular rule
- Trapezoidal rule
- Simpson rule
- Boole's rule
- Weddle's rule
- Gaussian quadrature formulae
- Errors in quadrature formulae

- Newton-Cotes formulae

Difference Equations

- Linear homogeneous and non-homogeneous difference equations with constant coefficients

Evaluation Criteria

| Examination | Type | Marks |
|----------------------|----------------|-------|
| Internal Examination | Sessional Work | 15% |
| | Mid-Semester | 25% |
| External Examination | Final Semester | 60% |

Recommended Books

1. Curtis F. Gerald and Patrick O. Wheatley, *Applied Numerical Analysis*, (Addison- Wesley Publishing Co. Pearson Education, 2003)
2. Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, (Brooks/Cole Publishing Company, 1997)
3. John H. Mathews, *Numerical Methods for Mathematics, Science and Engineering*, (Prentice Hall International, 2003)
4. Steven C. Chapra and Raymond P. Canale, *Numerical Methods for Engineers*, (McGraw Hill International Edition, 1998)