

Course Outline

Math 2081

Course title: Numerical Analysis

Course code: Math 2081

Credit hours: 2 Contact hrs

Aims

The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to help students to develop programming skills.

Chapter 1: Basic concepts in error estimation

1.1 Sources of errors

1.2 Approximations of errors

1.3 Rounding off errors

1.4 Absolute and relative errors

1.5 Propagation of errors

1.6 Instability

Chapter 2: Nonlinear equations

2.1 Locating roots

2.2 Bisection method, Interpolation and Secant methods, Newton-Raphson Method

2.3 Conditions for convergence

Chapter 3: System of equations (Reading Assignment)

3.1 Direct methods for system of linear equations (SLE): Gaussian method, Gaussian method with partial pivoting, Jordan's method, Jordan's method for matrix inversion, Matrix decomposition, Tri-diagonal matrix method

3.2 Indirect methods for SLE: Gauss Jacobi method, and Gauss Seidel method

3.3 Systems of non-linear equations using Newton's method

Chapter 4: Finite differences

Forward difference operators, backward difference operators, Central difference operators, and Shift operators

Chapter 5: Interpolations

5.1 Linear interpolation and Quadratic interpolation

5.2 Newton interpolation formula (forward and backward formulas)

5.2 Lagrange's interpolation formula and Newton's Divided difference formula

Chapter 6: Application of interpolations

6.1 Finding roots, numerical Differentiation, and numerical Integration (Trapezoidal and Simpson's rule)

Assessment Methods - Assignment 15%, Quiz 10%

-Mid semester examination 25%

-Final examination 50%

Teaching materials

Textbook: - Gerald C. F. and Wheatly P. O., Applied numerical analysis 5th ed, Edsion Wesley,Co

References: - Richard L. Burden, Numerical Analysis, 1981, 2nd Ed.

- P.A. Strock, Introduction to numerical analysis

- Volkov, Numerical methods 1986

- Frank Ayres, Theory and Differential Equations (Schuam's outline series, 1981)

- Robert Ellis and Denny Glick, Calculus with Analytical Geometry-3rd Ed.