

OFFICIAL SYLLABUS
465 - NUMERICAL ANALYSIS

Adopted - Spring 2004 (Committee: Drs. C. Lu, G. Pelekanos, E.Sewell)

Catalog Description. Error analysis, solution of nonlinear equations, interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations, solution of linear systems of equations. Prerequisite: MATH 250, 305 CS 140 or 141.

Textbook. Numerical Analysis, 7th edition by R. Burden and J. Faires

Course Outline and Topics

Chapter 1: Math Preliminaries

- 1.1 Review of Calculus
- 1.2 Roundoff Errors and Computer Arithmetic
- 1.3 Algorithms and Convergence

Chapter 2: Solutions of Equations in One Variable

- 2.1 The Bisection Method
- 2.2 Fixed-Point Iteration
- 2.3 Newton's Method
- 2.4 Error Analysis for Iterative Methods
- 2.5 Accelerating Convergence
- 2.6 Zeros of Polynomials and Miller's Method (Optional)

Chapter 3: Interpolation and Polynomial Approximation

- 3.1 Interpolation and the Lagrange Polynomial
- 3.2 Divided Differences
- 3.3 Hermite Interpolation
and/or
- 3.4 Cubic Spline Interpolation

Chapter 4: Numerical Differentiation and Integration

- 4.1 Numerical Differentiation
- 4.2 Richardson's Extrapolation
- 4.3 Elements of Numerical Integration
- 4.4 Composite Numerical Integration
- 4.5 Romberg Integration (Optional)
- 4.6 Adaptive Quadrature Methods (Optional)
- 4.7 Gaussian Quadrature

Chapter 5

- 5.1 The Elementary Theory of Initial-Value Problems
- 5.2 Euler's Method
- 5.3 Higher-Order Taylor Methods
- 5.4 Runge-Kutta Methods
- 5.5 Error Control and the Runge-Kutta-Fehlberg Method
- 5.6 Multistep Methods
- 5.9 Higher-Order Equations and Systems of Differential Equations (Optional)

Chapter 6: Direct Methods for Solving Linear Systems

- 6.1 Linear Systems of Equations (Optional)

Chapter 11: Boundary-Value Problems for Ordinary Differential Equations

- 11.1 The Linear Shooting Method
- 11.2 The Shooting Method for Nonlinear Problems

Any instructor should cover all of the material specified, additional sections are optional.