OFFICIAL SYLLABUS

465 – Numerical Analysis

Adopted – Fall 2011 (Committee: Drs. Lu, Leem, Pelekanos, 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, 9th Edition by Burden and Faires

Course Outline and Topics

Chapter 1. Mathematical Preliminaries and Error Analysis

1.2 Round-off 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 and Its Extensions
2.4 Error Analysis for Iterative Methods
2.5 Accelerating Convergence

Chapter 3. Interpolation and Polynomial Approximation

3.1 Interpolation and the Lagrange Polynomial
3.3 Divided Differences
3.4 Hermite Interpolation
3.5 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
4.6 Adaptive Quadrature Methods
4.7 Gaussian Quadrature

Chapter 5. Initial-Value Problems for Ordinary Differential Equations

5.1 The Elementary Theory of Initial-Value Problems **(Brief Review)**
5.2 Euler's Method
5.3 Higher-Order Taylor Methods
5.4 Runge-Kutta Methods
5.6 Multistep Methods
5.7 Variable Step-Size Multistep Methods

Chapter 6. Direct Methods for Solving Linear Systems

6.1 Linear Systems of Equations **(Optional)**
6.2 Pivoting Strategies **(Optional)**