COMPUTER SCIENCE 310/MATHEMATICS 310
NUMERICAL ANALYSIS

I. Introduction

   A. Catalog Description

      Students will learn about numerical solutions to linear systems; numerical linear
      algebra; polynomial approximations (interpolation and quadrature); numerical
      differentiation and integration. Students will also learn about error analysis and how to
      select appropriate algorithms for specific problems.

   B. Objectives

      This course is concerned with students learning how to solve mathematical problems
      using digital computers. The main objectives are for students to gain a clear
      understanding of how to select a suitable method for a given problem and to determine
      from computer output whether the desired accuracy was achieved.

   C. Prerequisites

      MATH 221, 232, and CSCI 161 or equivalent. A grade of C- or better is required in
      prerequisite courses.

II. Required Topics

   A. Algorithms, Errors, and Digital Devices
      1. Representation of numeric data
      2. Loss of Significance and Error Propagation
      3. Strategies for Minimizing Roundoff Error

   B. Numerical Methods for solving Equations in One Variable

      1. Rates of Convergence

      2. Iterative Algorithms

      3. Numerical Methods for Solving $f(x) = 0$

      4. Approximations of Polynomials

   C. Methods for Solving Linear Systems

      1. Basic Properties of Matrices

      2. Gaussian Elimination

      3. Triangular Systems

   D. Differentiation and Integration

      1. Lagrange Polynomials

      2. Richardson's Formula

      3. Composite Rules and Romberg Integration

II. Required Topics   (continued)

    E. Differential Equations and Boundary Value Problems
        1. Taylor Series
        2. Runge-Kutta Methods
        3. Predictor-Corrector Methods
        4. Finite Difference Methods

III. Optional Topics
    A. Eigenvalues
    B. Random Number Generation

IV. Bibliography

Burden & Faires	Numerical Analysis
W. Cheney & D. Kincaid	Numerical Mathematics & Computing
M. J. Maron	Numerical Analysis: A Practical Approach
S. D. Conte & C. de Boor	Elementary Numerical Analysis: An Algorithmic Approach
G. Forsythe, M. Malcolm, & C. B. Moler	Computer Methods for Mathematical Computation
CD ROM	Dr. Dobb's Numerics and Numerical Programming