MAT 440 Numerical Analysis

COURSE DESCRIPTION:

MAT 440      Spring 2004
Numerical Analysis     Semester Hours: 3

Instructor:  Dr. J. Bauer
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Description: An introduction to numerical solutions to problems. Topics to include: solution of equations, interpolation and approximation of polynomials, numerical differentiation and integration, summation of series, and use of orthogonal polynomials.

The course is a requirement for the mathematics endorsement and major, and is recommended for computer science and several science-based majors.

Prerequisite: MAT 240, Calculus II

Class Meeting Time/Place: 10:00-10:50 A.M. MWF, CS 006

COURSE GOALS: It is the course's intent;

- To provide a sound working base in numerical methods,
- To provide the student with the basic skills to solve single variable equations and systems of equations numerically,
- To provide the student with the basic skills to interpolate and derive polynomial approximations from data points,
- To provide the student with the basic skills to perform integration and differentiation numerically,
- To increase the student’s ability to apply proper mathematical tools to specific situations,
- To increase the student’s ability to think abstractly,
- To increase the student’s ability to work independently and collaboratively on mathematics,
- To introduce computing technology and apply it to numerical methods,
- To create a positive outlook toward mathematics, and
- To provide a realistic view of mathematics involvement in the applied sciences.
INSTRUCTIONAL MATERIALS:


References:


Recommended Equipment: Graphing calculator, downloaded version of Octave.

Resources/Equipment: Octave and other computing programs (accessible from the MAT Linux-server)

COURSE OUTLINE:

I. Solving Equations and Systems
   Equations of One Variable
   - Bisection Method
   - Secant Method
   - Newton's Method
   - Muller's Method
   - Bairstow's Method
   Direct Methods for Systems
   - Elimination
   - Pivoting
   - Matrix Inversion
   - Factorization
   - Special Matrices
   Iterative Methods for Systems
   - Vector Convergence
   - Eigenvalues and Eigenvectors
   - Jacobi and Gauss-Seidel Methods
   - SOR Method

II. Interpolation and Polynomial Approximation
   Interpolation
   - Lagrange Polynomials
   - Newton Polynomials
   - Hermite Polynomials
   - Spline Interpolation
   - Parametric Curves
   - Bezier Curves
   Function Approximation
   - Least Square Regression
   - Power Regression
   - Exponential Regression
   - Chebyshev Polynomials
   - Rational Function Approximation
III. Integration and Differentiation

Integration
- Quadrature
- Composite Quadrature
- Gaussian Quadrature
- Multiple Integrals

Differentiation

EVALUATION: Students will be evaluated based on their performance on four projects. The projects will consist of problems from the text. Grades will be determined on 10% intervals, i.e. the 90s are an A, the 80s are a B, ... The last project will be in lieu of the final and will be due on Thursday May 6th at 12:30 P.M.

WSC STATEMENT OF STUDENT RESPONSIBILITIES:

Wayne State College strives to develop students of a wide range of academic abilities through quality teaching and support. It is our desire to prepare students to accept the privileges, duties, and responsibilities of global citizens; to develop moral and ethical values, to encourage creative ability and develop aesthetic judgments, to encourage the ability to think critically about their world and work; and promote competence in and understanding of fields of knowledge which are required of educated people.

To this end we, the faculty and staff of WSC, have established a standard of student responsibilities in the following statement:

All students will:

Take responsibility for their education. This will include:

- Being knowledgeable of academic requirements and college policies concerning registration, academic standing, payment of tuition and fees, withdrawal and graduation.
- Initiating communication with faculty, advisors and administration regarding questions, concerns and intellectual dialogue.

Cultivate an attitude of integrity both in and out of the class. Integrity is demonstrated by:

- Showing courtesy, dependability, honesty, and respect for instructor expectations concerning attendance, assignments, deadlines and appointments.
- Showing courtesy and respect toward others with diverse points of view in and out of class.
- Displaying a positive work ethic and a genuine interest in welfare of others.
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