COURSE DESCRIPTION:

MAT 440  
Numerical Analysis  
Spring 2005
Semester Hours: 3

Instructor: Dr. J. Bauer
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Office Hours:
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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 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, student version of MATLAB.

**Resources/Equipment:** MATLAB and other computing programs (accessible from the Mathematics server, gauss)

**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 quizzes and four projects. The quizzes will be demonstrations of student's ability to apply numerical methods to simple situations. The quizzes will be valued at 40% of student's grade. The projects will consist of problems from the text. The projects will be worth 60% of the student's grade. 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 ____________________________.
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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