ENGR 2450

Division: Natural Science and Mathematics
Department: Engineering and Computer Science
Course: ENGR 2450
Title: Numerical Methods
Catalog Description:

ENGR 2450 is an introduction to numerical methods of problem solving, including root finding, solutions of linear and nonlinear equations, eigen value problems, curve fitting and regression analysis, numerical differentiation and integration, numerical solution of differential equations, optimization, and numerical solution of partial-differential equations. Computer implementation of these methods using spreadsheets, C++ programming, and MATLAB computational software will be a major emphasis of the course.

General Education Requirements: N/A
Semesters Offered: Spring
Credit/Time Requirement: Credit: 3; Lecture: 3; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: Calculus II (MATH 1220), C++ Programming

Corequisites: N/A

Justification:

This course is designed as a component of the standard preprofessional curriculum in engineering, which enables the student to transfer with junior level status into a four year engineering program. Similar courses are offered in university engineering schools. ENGR 2450 is to be taken during the sophomore year of the preengineering curriculum and will prepare the student for subsequent course work.

Student Learning Outcomes:

Upon successful completion of this course, students will:

- be able to solve a variety of engineering problems using numerical methods
- understand the power and the limitations of the various alternative numerical methods, and be able to select the most appropriate method for a given problem
- demonstrate the ability to formulate computer algorithms which implement the various numerical methods.

Content:

This course will include:

- principles from linear algebra, including Gaussian elimination, LU decomposition, and iterative methods
- finding roods of nonlinear equations using various methods
- using eigenvalues and eigenvectors to find solutions to systems of linear equations
- curve fitting, including numerical interpolation and extrapoliation
- numerical differentiation and integration, including Romberg integration and Gaussian quadrature
- numerical solutions of differential equations using Euler's method and Rung-Kutta methods with special attention to "stiff" differential equations
- optimization by finding minima and maxima of a function
- numerical solutions of partial-differential equations, both Laplace's equation and Poisson's equation.
- the C++ programming language and MATLAB computational software will be used to implement the above numerical methods.

General Education Outcomes:

6) Apply computational skills to a variety of contexts.

Mathematical and computational skills are essential to the success of an engineering student. The student must be able to perform calculations both manually and through the use of computational software.

7) Apply scientific reasoning to a variety of contexts.

Engineering consists of the application of scientific knowledge in order to design devices and systems with a practical purpose. Thus, students must be able to utilize the discoveries of science in the solution of engineering problems.

Key Performance Indicators:

- Daily homework assignments(25-30%), quizzes(5-10%), midterm tests(45-55%), and a final(10-15%) will be administred -- all related to the above outcomes.li>

Representative Text and/or Supplies:

- Schilling, Harris, *Applied Numerical Methods for Engineers,* current edition, Brooks-Cole.
- Gerald, Wheatley, *Applied Numerical Analysis,* current edition, Addison-Wesley.
- Chapra, Canale, *Numerical Methods for Engineers*, current edition, McGraw-Hill.

Optimum Class Size: 20
Maximum Class Size: 30

Signatures:

I hereby submit this course syllabus:

Garth O. Sorenson, MS, Associate Professor

I hereby find this course consistent with the goals and resources of the Engineering and Computer Science Department:

Garth O. Sorenson, MS, Associate Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

Michelle Olsen, MLS, Campus Librarian (Richfield Campus)