MAE 185 NUMERICAL ANALYSIS IN MECHANICAL ENGINEERING
(Elective for CE and ME)

Catalog Data: **MAE 185: Numerical Analysis in Mechanical Engineering (Credit Units: 4) S.** Solution of mechanical-engineering equations by means of numerical methods. Errors in numerical analysis. Nonlinear equations and sets of equations. Numerical differentiation and integration. Ordinary differential equations. Boundary-value problems. Partial differential equations. Prerequisites: MAE10, Mathematics 3D; Mathematics 2E or equivalent. MAE185 and Mathematics 105A may not both be taken for credit. (Design units: 2)

Textbook: Gerald, C.F. and Wheatley, P.O. *Applied Numerical Analysis,* 5th Edition, Addison Wesley, 1994.

References:

Coordinator: Donald Dabdub

Course Outcomes: Students will:
Solve numerically a variety of problems that arise from mechanical-engineering systems.
Develop and apply standard numerical schemes to solve fundamental and practical engineering problems.

Prerequisites By Topic: Understanding of Computer Algorithms
Mathematics

Lecture Topics: Solving nonlinear equations
Direct methods for solving linear systems
Theory of linear systems
Iterative methods for linear systems
Curve-fitting and interpolation
Numerical differentiation
Numerical integration
Single step methods for ordinary differential equations
Multistep methods for ordinary differential equations
Systems of ordinary differential equations; convergence
Parabolic partial differential equations
Hyperbolic partial differential equations

Class Schedule: Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.

Computer Usage: Heavy computer usage. Students are required to develop computer programs for the solution of a design project using FORTRAN under the MS-Windows or (preferably) the Unix platform.

Laboratory Projects: Students are required to work on a comprehensive open-ended project. The term laboratory in this course refers to computer laboratory. The problems are from the field of engineering. Usually, no analytical

solutions can be computed. Furthermore, often there is no unique solution. Students are required present a written report with their findings.

Professional Component: Contributes toward the Engineering Topics and/or Design experience for both Mechanical and Aerospace Engineering majors.

Relationship to Program Outcomes: This course relates to Program Outcomes a, e, and k; with additional Mechanical Engineering outcomes 2 and 3 as stated at: http://undergraduate.eng.uci.edu/degreeprograms/mechanical/mission

Design Content Description

Approach: There are two projects, each requiring design of an algorithm and extensive programming on the part of the student. Students may work in whatever computer language they choose, and on whatever system to which they have access. As part of the project write-ups, students are required to submit a listing of their program, as well as a sample execution. A major portion of the projects includes use by the student of the software they develop to solve a design problem. Design of software is covered in class for about 20% of the lecture time.

Lectures: 75%

Laboratory Portion: 25%

Grading Criteria:

Midterm Exam:	35%
Final Exam	40%
Design Project:	25%
TOTAL	100%

Estimated ABET Category Content:

Mathematics and Basic Science: ____credit units or ____%
Engineering Science: __2__credit units or _50__%
Engineering Design: __2__credit units or __50_%

Prepared by: Donald Dabdub **Date:** July 2007

CEP Approved: Fall 2000