COURSE SYLLABUS

MAE 340 COMPUTATIONAL METHODS IN MECHANICAL ENGINEERING

FALL SEMESTER 2014

Lectures:

4:20 – 5:35 p.m., Tues., Thur. KDH 125

Credits:

3 Semester Hours

Prerequisites:

CS 150 Introduction to Programming
MATH 307U Ordinary Differential Equations
MATH 312 Calculus III

Instructor:

Dr. A. O. Demuren
Office: KDH 238K
Tel: 683-6363
Office Hours: Tues, Thurs, 1:00 to 2:30pm

Teaching Assistant:

Russell Edwards
Office: KDH 104
Tel: 757-375-2724
Email: redwa021@odu.edu

OFFICE HOURS: Tues, Thurs, 1--6pm; & By Appointment

Text:

Applied Numerical Methods with MATLAB for Engineers and Scientists by S.C. Chapra (3rd Edition, McGrawHill 2011)

Practice Aid:

Any Good Programming Guide

References:

MATLAB User Guide

Numerical Methods in Engineering using MATLAB by Jaan Kiusalaas (Cambridge 2005)

Grading:

Homework & Assignments/Project 50%
Exams 50%

Grading Scale:

A- to A 90--100%
B- to B+ 80--89%
C- to C+ 70--79%
D- to D+ 60--69%
F 0--59%

Objectives:

The goal of the course is to introduce the student to the science and practice of mathematical modeling and analysis in Mechanical Engineering. The emphasis is on the development of the concepts involved in modeling, idealizations, approximations, error analysis and the interpretation of results. Relationships between continuous and discrete systems are discussed. Topics on consistency, convergence, uniqueness of

solution are discussed.

Program Outcomes:

(a) An ability to apply knowledge of mathematics, science and engineering.
(b) An ability to identify, formulate, and solve engineering problems.
(c) The broad education necessary to understand the impact of engineering solutions in a global and societal cor
(d) An ability to use techniques, skills, and modern engineering tools necessary
for engineering practices.
(e) To apply the knowledge of differential equations, and multivariate calculus to mechanical engineering design
(f) Ability to write computer programs, and to use already developed software in
analysis and design of engineering systems.

General Guidelines:

Regular class attendance is expected. Short quizzes may be given to the class at any time. Unless otherwise informed, all homework is due after 1 week. Special assignments and computer projects are due after 2 weeks. Late submissions will be penalized, and will not be accepted once solutions are posted or assignments returned. To obtain full marks, the solution to all problems must contain full workings. Statistics and common sense indicate that failure to submit all assignments usually results in poorer grades.

Responsibilities:

It is the responsibility of the Instructor to present the lectures and assignments as clearly as possible and to help the students to understand the subject to the best of his ability. He must be fair in his dealings with the students.

It is the responsibility of the students to attend lecturers regularly and make concerted effort to understand the subject. Students must ask questions when some material is not understood. Students are expected to participate fully in class discussions and to submit all homework and project assignments on time. The students must be fair in their dealings with their colleagues and the instructor.

Course Content:

A survey of modern computing techniques for mechanical engineers. Numerical algorithms are developed to solve realistic problems in solid mechanics, fluid mechanics, dynamics, and heat transfer. Emphasis is on providing computational experience in applied numerical methods using modern digital computing devices.

COURSE OUTLINE

WEEK NOS.	Description
1-4	Chapters 1-4 Introduction: Using MATLAB; Applied Problems; Numerical Techniques; Analysis of Numerical Methods.
5-6	Chapters 5-7 Solution of Equations of One Variable : Bisection Method; False Position Method; Secant Method; Newton's Method; Fixed Point Iteration.
7-10 .	Chapters 8-12 Solution of Systems of Linear Algebraic Equations by Direct Methods: Gaussian Elimination; Gaussian Elimination with Pivoting; Tri-Diagonal Systems; LU Factorization Methods for Linear Systems: LU Factorization for Gaussian Elimination; Tri-diagonal Matrices; Iterative Methods: Jacobi Methods; Gauss-Seidel method; Successive Over relaxation.
11-12	Chapters 14-15,17 Interpolation: Polynomial Interpolation; Function Approximation: Least Square Approximation;
13-14	Chapter 19 Numerical Integration: Basic Integration Methods; Composite Integration Methods; Matlab Methods.

Computer Programming Projects w ill be assigned from time to time