NUMERICAL ANALYSIS
FALL 2007
Math 355 / 555 (Section 001)

TIME:	Tuesdays, Thursdays	9:40 – 11:10
ROOM:	Swart 2	
INSTRUCTOR:	Saadat Moussavi	
OFFICE:	Swart 242	
PHONE:	424-1074	
EMAIL:	moussavi@uwosh.edu	
OFFICE HOURS:	Tuesdays, Thursdays	11:15 – 1:15
	Tuesdays, Thursdays	4:35 – 5:35
	Mondays, Wednesdays, Fridays	By appointment

TEXT: "Numerical Analysis", 8th Edition*, by Burden and Faires.

SOFTWARE: "Maple", (this software is available on all computers on campus).
Maple is a very powerful software package for doing Mathematics by computer. Maple is a general system for numerical, symbolic, and graphical computation which can be used as both an interactive calculation tool and as a programming language. It can manipulate formulas directly in algebraic form, performing such operations as symbolic equation solving, differentiation, power series expansions, integration, ... Extensive graphics capabilities allow Maple to generate 2D plots, 3D pictures, ...

COURSE DESCRIPTION: Mathematics is used in one form or another within most of the areas of science and industry. During the present century, Advanced Mathematical Models and Methods have been used more and more even within other areas such as Medicine, Economics, and Social Science. Very often applications lead to mathematical problems which, in their complete form, cannot be conveniently solved with exact formulas.
In the process of problem solving, it is possible to distinguish among several distinct phases. The first phase is formulation. Once a problem has been formulated, the second phase is numerical methods together with a preliminary error analysis to be devised for solving the problem. The numerical analyst should consider all the sources of error that may affect the results. The third phase of problem solving is programming. The programmer must transform the suggested algorithm into a set of step by step instructions to the computer.

Hence we could define Numerical Analysis as "The Study of Methods and Procedures Used to Obtain Approximate Solutions to Mathematical Problems." To the question "Why Approximate?" we can only answer "Because We Must!"

In this course we study various numerical methods. We will study the actual arithmetic operations that are used in calculations, most of which are done using computers. Most of numerical analysis is concerned with how to solve a problem numerically. Part of this process is the consideration of the errors that arise using these calculations. We will look at some simple numerical methods for calculating the roots of an equation with one variable.

We will learn how to find and evaluate a function whose graph goes through a set of given points. The points may arise as measurements in a physical problem, or they may be obtained from a known function (interpolation).

We will show a major use of interpolation using numerical methods to find numerical integration and differentiation. The need to solve differential equations was one of the original and primary motivations for the development of both analog and digital computers. We will discuss the numerical methods for both initial value problems and boundary-value problems for Ordinary Differential Equations.

To be able to pursue this description the students need to learn

1. How to take a non-mathematical problem and interpret it mathematically (modeling).
2. How to use algorithms and strategies to understand and solve the appropriate model and provide a convincing argument that the solution is consistent (problem solving and validation).
3. How to communicate effectively both individually and/or collaboratively in written and spoken discourse (communication and work environment).
4. How to use the proper software packages for computer and creating programs to solve the large problems (technology).
5. None of the above goals are accessible if the student has lack of knowledge and versatility in basics and fundamentals (connections and general skills).

COURSE COVERAGE: The following topics will be covered:

1. Mathematical Preliminaries.
2. Solution of Equations in one variable.
3. Interpolation and Polynomial Approximation.
4. Numerical Differentiation and Integration.
5. Initial-Value Problems for Ordinary Differential Equations.
6. Boundary-Value Problems for Ordinary Equations.

EXAMS: 2 exams + final exam. Dates will be announced at least one week in advance.

HOMEWORK & PROGRAMS: Some problems will be suggested (answers will be available). Some problems will be collected to be graded. There will also be some programs to write, coding in Maple.

Remark 1: Students are encouraged to work in teams on the homework assignments. Homework teams will be the students' responsibility. All assignments turned in will be clearly marked on the top of the first page with the team member's names.

Remark 2: Homework teams are encouraged in order to generate productive discussions regarding the solutions of the assigned exercises. Discussions involving three or four people might not provide for a uniform involvement of all participants. This might lead to a student not developing the skills necessary to independently solve these problems. Therefore, homework teams should be limited to no more than four people.

Remark 3: If you will have difficulty in meeting the homework or schedule, you should tell me as soon as possible.

TEST MAKE-UPS: Make-ups for missed tests will be available. If you are not able to make a scheduled test and expect to get any consideration with respect to a make-up, I should be notified in advance.

GRADING:

Exam I	19%
Exam II	19%
Final	25%
Homework, Programming, Project, Presentation & Journal	37%

Note: There will be some homework, programming, and presentation opportunities just for extra credit.

SCALE:

Letter	% Range
A	[92,100]
AB	[89,92)
B	[80,89)
BC	[77,80)
C	[69,77)
CD	[66,69)
D	[56,66)