

MATH 5334/001 (Spring 2005)

Numerical Methods for Engineers

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About the course : It is well-known that the use of numerical methods for the analysis, simulation, and design of engineering processes and systems has been increasing at a rapid rate. Therefore, this course is intended to better prepare future engineers, as well as to assist practicing engineers, in understanding the fundamentals of numerical methods, especially their application, limitations, and potentials. The course is designed as an introductory course in numerical analysis with emphasis on applications. The course will cover the classical fundamental topics in numerical analysis such as, approximation, numerical integration, numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary and partial differential equations. The viewpoint will be modern, with connections made between each topic and a variety of engineering applications. This course is intended for all graduate students from all engineering departments at Texas Tech University. Every graduate student will have the opportunity to work on projects related to their specific field of engineering. By the end of the course, the student should not only be familiar, but more confident, in effectively using numerical tools to solve problems in your own field of interest.

Course Objectives and Learning Outcomes : The goal in this course is to achieve the following education objectives:

1. Introducing numerical methods to engineering students and practicing engineers
2. Emphasizing the practical aspects of the use of these methods
3. Establishing the limitations, advantages, and disadvantages of these methods

In this course, I would like to emphasize how we can APPLY numerical techniques to solve engineering problems and evaluate the results. Problem-based learning (both in and out of class) will be an integral part of the course.

Grading : Your grade for the course will be computed as follows:

Homework	30 %
Computer Project	30 %
Midterm Exam	15 %
1 Final Exam	25 %

Homework, Projects and Exams : There will be five homework assignments during the semester each worth 6 %. There will also be computer projects which is worth 30 %. These items

should be written up and handed in on time to receive full credit as they add towards 60 % of the total grade. There will be one midsemester exam and one comprehensive final exam in this course. Make-up exams may be possible only in the case of documented emergencies.

Course Outline : We plan to cover the following topics in this class.

1. Introduction to Mathematical Modeling and Engineering Problem Solving
2. Solutions of Nonlinear Equations
3. Numerical Linear Algebra
4. Interpolation and Polynomial Approximation
5. Numerical Differentiation and Integration
6. Initial Value Problems for Ordinary Differential Equations
7. Numerical Solutions to Partial Differential Equations

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Recommended Textbooks : The primary text book for the course will be, *Numerical Analysis (7th edition)* by Richard L. Burden and J. Douglas Faires. This text emphasizes the intelligent application of numerical techniques to the type of problems that commonly occur in engineering and the physical sciences. The objective will be to understand why the methods work, what type of errors to expect, and when an application might lead to difficulties. The following text books will also be useful for some parts of the course:

1. Applied Numerical Methods for Engineers and Scientists by Singiresu S. Rao
2. Numerical Methods for Engineers by Bilal M. Ayyub and Richard H. McCuen
3. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale

ADA Accomodation : Any student who, because of a disability, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible to make such accomodations as may be necessary.

Religious Holy Day Observance (OP 30.16) : “2. Texas House Bill 256 requires institutions of higher education to excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day. The student shall also be excused for time necessary to travel. An institution may not penalize the student for the absence and allows for the student to take an exam or complete an assignment from which the student is excused. No prior notification of the instructor is required.

Good Luck and please feel free to contact me if you have any questions.