

CEE/ME 5/7362 Engineering Analysis with Numerical Methods (Elective Course)

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Catalog Course Description

Applications of numerical and approximate methods in solving a variety of engineering problems. Examples include equilibrium, buckling, vibration, fluid mechanics, thermal science, and other engineering applications.

Prerequisite

Permission of Instructor

Textbook and Other Related Material

Chapra, S., Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2012.

Course Objectives

The goal of this course is to introduce students to applied computational methodologies to solve engineering problems when no closed-form, analytical solution exists. Emphasis will be placed on understanding the fundamental concepts behind various numerical methods, implementing basic numerical methods using technical computing, and utilizing sophisticated numerical methods available. With respect to engineering issues, the student will:

1. Select and use appropriate methods for finding roots of equations as well as interpolation and approximation methods.
2. Use numerical methods to solve systems of equations.
3. Design computer programs and use packaged software to solve engineering problems.
4. Use numerical methods for differentiation and integration with engineering applications.
5. Understand the processes of numerical simulation, modeling, optimization, identification, and visualization of engineering systems.
6. Solve boundary value problems using the finite difference method.
7. Solve time-dependent problems

Course Requirements

Homework	25% of grade
Term Project	25% of grade
Midterm Exam	25% of grade
Final Exam	25% of grade

Students taking the course at the 7000 level will have to solve all assignments and exam problems

Students taking the course at the 5000 level will be asked to solve a subset of questions in assignments and exam problems

Curriculum Professional Component Allocation

Engineering Science and Design: 3 Term Credit Hours or 100 percent of the course content

Student Learning Outcomes

1. Students will be able to solve problems using algebraic, geometric, calculus, statistical and/or computational methods.
2. Students will be able to interpret and/or draw inferences from mathematical models, data, graphs or formulas.

Relevant Program Outcomes

This course includes, but is not limited to, content that supports the educational objectives and outcomes of the environmental and civil engineering programs. Specific emphasis is placed on students attaining and demonstrating:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (Outcome 1).

Topics Covered

Reading assignment prior to start of classes: View videos posted on Canvas. Read Chapters 1 through 4 of the textbook and redo all solved examples.

You can download MATLAB on your computer. Contact Lyle help desk to obtain license information.

Date	Topic	Reference
01/07 Morning	Roots: Open and Closed Methods	Chapters 5 and 6
01/07 Afternoon	Roots: Open and Closed Methods	Chapters 5 and 6
01/08 Morning	Optimization /Linear Algebra	Chapters 7 and 8
01/08 Afternoon	Optimization /Linear Algebra	Chapters 7 and 8
01/09 Morning	Gauss Elimination/LU Factorization	Chapters 9 and 10
01/09 Afternoon	Iterative Methods	Chapter 12
01/10 Morning	Eigenvalues	Chapter 13
01/10 Afternoon	Numerical Integration	Chapters 19 and 20
01/11 Morning	Numerical Differentiation/Boundary-Value Problems	Chapters 21, 24
01/11 Afternoon	Boundary-Value and Initial Value Problems/ MIDTERM Exam (Take Home)/Term Project	Chapters 22 and 24
01/14 Morning	Initial-Value Problems	Chapter 22
01/14 Afternoon	Linear Regression	Chapter 14
01/15 Morning	General Least Square	Chapter 15
01/15 Afternoon	Polynomial Interpolation/Splines	Chapters 17/18
01/16 Morning	Exam preparation	
01/16 Afternoon	FINAL EXAM (Take Home)	

Prepared by: Usama El Shamy

Date: 9/11/18

Disability Accommodations: Students needing academic accommodations for a disability must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (214-768-4557) to verify the disability and establish eligibility for accommodations. They should then schedule an appointment with the professor to make appropriate arrangements. (See University Policy No. 2.4.)

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)