



蘇州大學
Soochow University

ENR 212 Computational Science and Engineering

Summer 2023

Course Credits: 4

Contact Hours: 55 hours

Instructor: TBA

Email: TBA

COURSE OBJECTIVES

This course provides an overview of how MATLAB can be applied to solve different engineering problems. These applications encompass solving systems of linear algebraic equations, conducting interpolation and curve fitting tasks, determining equation roots, performing numerical differentiation and integration, solving initial value problems, addressing two-point boundary value problems, tackling symmetric matrix eigenvalue problems, and exploring engineering design optimization through MATLAB.

Upon Completion of this Course, students will be able to:

1. Use computational techniques and tools to solve a wide range of engineering problems
2. Gain proficiency in using programming languages, such as Python or MATLAB, and relevant engineering software packages to analyze and model engineering systems
3. Develop the skills to analyze and interpret the results obtained from computational simulations and critically evaluate the accuracy, validity, and limitations of the computational models and results, and make informed engineering decisions based on the findings
4. Apply appropriate numerical techniques, such as finite element analysis, finite difference methods, or numerical optimization, to solve engineering problems related to structural analysis, fluid dynamics, heat transfer, and other relevant domains
5. Develop computational models to represent and simulate engineering systems.

PREREQUISITES



MAT 271 Mathematics for Engineering

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
Practical Projects	20 Points
Midterm 1	20 Points
Midterm 2	20 Points
Final Exam	40 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F.$$

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

Computational Engineering: Design, Development, and Applications by Alexander K McMann and Jaclyn E Browning, Nova Science Publishers Inc. UK ed. 2012.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	<p>Topics:</p> <p>Topic 1: MATLAB Environment and basics of Programming</p> <p>Topic 2: Solving Systems of Linear Algebraic Equations</p> <p>Topic 3: Gaussian Elimination and LU Decomposition Methods</p> <p>Topic 4: Matrix Inversion and solving Linear Systems using MATLAB</p> <p>Assessments:</p>



	Practical Project#1
Module 2	<p>Topics: Topic 5: Interpolation and Curve Fitting Topic 6: Polynomial Interpolation and Curve Fitting Techniques Topic 7: MATLAB Functions for Interpolation and Curve Fitting Topic 8: Finding Equation Roots, Root-finding Methods (e.g., Newton-Raphson, Bisection)</p> <p>Assessments: Practical Project#2</p>
Module 3	<p>Topics: Topic 9: Numerical Differentiation and Integration Topic 10: MATLAB tools for differentiation and integration Topic 11: Solving Initial Value Problems Topic 12: Euler's method and higher-order numerical methods</p> <p>Assessments: Midterm#1</p>
Module 4	<p>Topics: Topic 13: Solving Two-Point Boundary Value Problems Topic 14: Finite Difference Methods for Boundary Value Problems Topic 15: MATLAB Approaches to solve Two-point Boundary Value Problems Topic 16: Solving Symmetric Matrix Eigenvalue Problems</p> <p>Assessments: Midterm#2</p>
Module 5	<p>Topics: Topic 17: Power Iteration and Jacobi Methods Topic 18: MATLAB Techniques for solving Symmetric Matrix Eigenvalue Problems Topic 19: Introduction to Engineering Design Optimization Topic 20: Optimization Concepts and Principles</p> <p>Assessments: Final Exam</p>

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning



and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

- 1) Late assignments are not acceptable and are subjected to grade deductions.
- 2) Assignments submitted in the wrong format will be counted as not submitted.
- 3) Failure to submit or fulfill any required course component results in failure of the class.
- 4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
- 5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACADEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.



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DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.