



蘇州大學  
Soochow University

# CEN 286 Computational Methods in Civil

## Engineering

Winter 2024

**Course Credits:** 4

**Contact Hours:** 56 hours

**Instructor:** TBA

**Email:**TBA

### COURSE OBJECTIVES

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This course introduces students to the fundamental principles and applications of computational methods in civil engineering. It equips students with the necessary knowledge and skills to utilize modern computational tools and techniques for solving complex engineering problems in areas such as structural analysis, fluid dynamics, geotechnical engineering, and more.

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

1. Gain a deep understanding of various numerical methods and techniques commonly used in civil engineering, such as finite element analysis, finite difference methods, and numerical integration;
2. Develop problem-solving skills by applying computational methods to real-world civil engineering problems, such as structural analysis, fluid flow simulations, and geotechnical analysis;
3. Apply computational techniques to model and analyze fluid flow, hydraulic systems, and open channel flows;
4. Use computational methods to model and simulate environmental processes related to civil engineering projects.

### PREREQUISITES

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CS 220 Introduction to Computing System; MAT 260 Calculus III; MAT 332 Ordinary Differential Equations and Numerical Methods



## GRADING

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

ITEM	POINTS
2 Quizzes	20 Points
3 Assignments	30 Points
Group Project	10 Points
Midterm Exam	20 Points
Final Exam	20 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:**

1. Blazek, Jiri, *Computational Fluid Dynamics: Principles and Applications*, 3rd Edition, Elsevier Science, 2015.
2. Steven C. Chapra, *Numerical Methods for Engineers*, 8th Edition, McGraw-Hill Higher Education, 2021.

### **Recommended (Optional) Texts or Other Materials:**

None

## COURSE TOPICS

MODULE	TASKS
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Module 1	<p><b>Topics:</b>  Topic 1: Governing Equations  Topic 2: The Flow and Its Mathematical Description  Topic 3: Complete System of the Navier-Stokes Equations  Topic 4: Principles of Solution of the Governing Equations</p> <p><b>Assessments:</b>  Quiz#1</p>
Module 2	<p><b>Topics:</b>  Topic 5: Geotechnical Engineering - A Historical Perspective  Topic 6: Modeling, Computers, and Error Analysis  Topic 7: Mathematical Modeling and Engineering Problem Solving  Topic 8: Programming and Software</p> <p><b>Assessments:</b>  Quiz#2  Group Project</p>
Module 3	<p><b>Topics:</b>  Topic 9: Ordinary Differential Equations  Topic 10: Predator-Prey Models and Chaos (Civil/Environmental Engineering)  Topic 11: Partial Differential Equations  Topic 12: Deflections of a Plate (Civil/Environmental Engineering)</p> <p><b>Assessments:</b>  Assignment#1  Midterm Exam</p>
Module 4	<p><b>Topics:</b>  Topic 13: Roots of Equations  Topic 14: Greenhouse Gases and Rainwater (Civil/Environmental Engineering)  Topic 15: Numerical Integration and Differentiation  Topic 16: Effective Force on the Mast of a Racing Sailboat (Civil/Environmental Engineering)</p> <p><b>Assessments:</b>  Assignment#2</p>
Module 5	<p><b>Topics:</b>  Topic 17: Programs for Stability Analysis  Topic 18: Structured to Unstructured Grid Converter  Topic 19: Quasi 1-D Euler Solver  Topic 20: Unstructured 2-D Euler/Navier-Stokes Solver</p> <p><b>Assessments:</b>  Assignment#3  Final Exam</p>

**ATTENDANCE**

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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**

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- 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**

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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**

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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.

### **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.