



蘇州大學
Soochow University

MAT 220 Introduction to Numerical Analysis

Winter 2024

Course Credits: 4

Contact Hours: 56 hours

Instructor: TBA

Email:TBA

COURSE OBJECTIVES

This course aims to equip students with foundational understanding of numerical algorithms and computer implementation skills. Emphasis will be placed on practical applications with strong theoretical basis. Main topics covers nonlinear algebraic equations, interpolation, extrapolation, numerical differentiation/integration, and ordinary differential equations.

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

1. Develop a basic understanding of numerical algorithms;
2. Gain proficiency in implementing numerical algorithms to solve mathematical problems using computers;
3. Explore various numerical methods for solving nonlinear algebraic equations;
4. Understand techniques for interpolation and extrapolation of data;
5. Learn methods for numerical differentiation and integration;
6. Acquire skills in the numerical solution of ordinary differential equations;
7. Appreciate the theoretical underpinnings of numerical analysis methods.

PREREQUISITES

None

GRADING

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



ITEM	POINTS
Participation	10 Points
Midterm 1	15 Points
Midterm 2	15 Points
2 Homework	20 Points
Term Paper	10 Points
Final Exam	30 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:

J. Stoer , R. Bulirsch, *Introduction to Numerical Analysis*, 3rd Edition, Springer, 2002.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	<p>Topics: Topic 1: Introduction to Numerical Analysis Topic 2: Nonlinear Algebraic Equations: Bisection, Newton-Raphson Topic 3: Interpolation: Lagrange, Newton Topic 4: Extrapolation Techniques</p> <p>Assessments: Homework#1</p>
Module 2	<p>Topics: Topic 5: Numerical Differentiation: Forward, Backward, Central Difference Topic 6: Numerical Integration: Trapezoidal, Simpson's Rule Topic 7: Ordinary Differential Equations: Euler, Runge-Kutta Topic 8: Error Analysis</p>



	Assessments: Homework#2
Module 3	Topics: Topic 9: Root-Finding Methods: Secant, False Position Topic 10: Polynomial Approximation: Least Squares Topic 11: Cubic Spline Interpolation Topic 12: Richardson Extrapolation Assessments: Midterm#1
Module 4	Topics: Topic 13: Higher-Order Differentiation Methods Topic 14: Adaptive Quadrature Methods Topic 15: Systems of Nonlinear Equations: Newton's Method Topic 16: Higher-Order ODEs: Predictor-Corrector Methods Assessments: Midterm#2
Module 5	Topics: Topic 17: Stability Analysis Topic 18: Finite Difference Methods for PDEs Topic 19: Monte Carlo Methods Topic 20: Applications in Engineering and Science Assessments: Term Paper Final Exam

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.

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:



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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.