



# **MAT 420 Partial Differential Equations**

**Winter 2024**

**Course Credits:** 4

**Contact Hours:** 56 hours

**Instructor:** TBA

**Email:** TBA

## **COURSE OBJECTIVES**

Our understanding of the fundamental process of the natural world is based to a large extent of partial differential equations. This course requires students to have previous knowledge of advanced mathematics foundation to learn more detailed about calculus and linear algebra. Topics of this course covered classification of equations and characteristics, heat equation, initial and boundary value problems in bounded regions, Laplace equation, Fourier series, etc. Besides, students will be equipped with analytical methods to solve partial differential equations.

Upon completion of this course, students will be able to:

1. Describe the most common partial differential equations that appear in problems concerning
2. Solve simple first order equations using the method of characteristics
3. Demonstrate an understanding of the meaning, the order and solution of a partial differential equation, and boundary conditions
4. Define the Fourier series and apply them to the partial differential equations
5. Formulate maximum principles for various equations and derive consequences

## **PREREQUISITES**

N/A

## **GRADING**

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



ITEM	POINTS
Assignment	10 Points
2 Quizzes	30 Points
Midterm Exam	25 Points
Final Exam	35 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:

Erich Zauderer, *Partial Differential Equations of Applied Mathematics*, 3rd Edition, John Wiley & Sons, Inc. Press, 2006.

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

None

## COURSE TOPICS

MODULE	TASKS
Module 1	<b>Topics:</b> Topic 1: Course Introduction Topic 2: Characteristic Curves Topic 3: Classification of Equations in General Topic 4: Formulation of Initial and Boundary Value Problems Topic 5: Stability Theory, Energy Conservation <b>Assessments:</b> Assignment



Module 2	<p><b>Topics:</b>  Topic 6: Adjoint Differential Operators  Topic 7: Maple Methods; Classification of Equations and Canonical Forms  Topic 8: Balance Law for Heat Conduction and Diffusion  Topic 9: Separation of Variables  Topic 10: The Sturm-Liouville Problem</p> <p><b>Assessments:</b>  Quiz#1</p>
Module 3	<p><b>Topics:</b>  Topic 11: Series Solutions of Boundary  Topic 12: Inhomogeneous Equations: Duhamel's Principle  Topic 13: Inhomogeneous Equations: Duhamel's Principle (Cont.)  Topic 14: How are Financial Statements Prepared and Analyzed?  Topic 15: Midterm Test Reviews</p> <p><b>Assessments:</b>  Midterm Exam</p>
Module 4	<p><b>Topics:</b>  Topic 16: Nonlinear Stability Theory: Eigenfunction Expansions  Topic 17: Maple Methods; Eigenvalue Problems for ODEs  Topic 18: One-Dimensional Fourier Transforms; General Properties  Topic 19: Fourier Sine and Cosine Transforms; General Properties  Topic 20: Higher-Dimensional Fourier Transforms; Huygens' Principle</p> <p><b>Assessments:</b>  Quiz#2</p>
Module 5	<p><b>Topics:</b>  Topic 21: Hankel Transforms; General Properties  Topic 22: Laplace Transforms; General Properties  Topic 23: Asymptotic Approximation Methods for Fourier Integrals  Topic 24: Asymptotic Approximation Methods for Fourier Integrals (Cont.)  Topic 25: Final Exam Reviews</p> <p><b>Assessments:</b>  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**

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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.