



蘇州大學
Soochow University

MAT 420 Partial Differential Equations

Fall 2023

Course Credits: 4

Contact Hours: 56 hours

Instructor: TBA

Email:TBA

COURSE OBJECTIVES

This course is designed for students who have certain advanced mathematics foundation to learn more detailed about calculus and linear algebra from the perspective of partial differential equations. Main topics include classification of equations and characteristics, initial and boundary value problems in bounded regions, and integral transforms. In addition, this course will familiarize students with analytical methods to solve partial differential

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

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

PREREQUISITES

MAT 110 Calculus I

MAT 130 Linear Algebra

GRADING

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



ITEM	POINTS
2 Quizzes	20 Points
2 Assignments	20 Points
Midterm Test	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, JohnWiley& Sons, Inc. Press, 2006.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	<p>Topics:</p> <p>Topic 1: Course Introduction Linear Second Order Partial Differential Equations; Canonical Forms for Equations of Hyperbolic Type</p> <p>Topic 2: Characteristic Curves; First Order PDEs; Second Order PDEs</p> <p>Topic 3: Classification of Equations in General; Classification of Second Order PDEs</p> <p>Topic 4: Formulation of Initial and Boundary Value Problems; Well-Posed Problems</p> <p>Assessments:</p> <p>Quiz#1</p>



Module 2	<p>Topics: Topic 5: Stability Theory, Energy Conservation, and Dispersion Topic 6: Adjoint Differential Operators; Scalar PDEs; Systems of PDEs; Quasilinear PDEs Topic 7: Maple Methods; Classification of Equations and Canonical Forms Topic 8: Balance Law for Heat Conduction and Diffusion; Basic Equations of Parabolic, Elliptic, and Hyperbolic Types; Boundary Conditions</p> <p>Assessments: Assignment#1</p>
Module 3	<p>Topics: Topic 9: Separation of Variables; Self-Adjoint and Positive Operators Topic 10: The Sturm-Liouville Problem and Fourier Series; Sturm-Liouville Problem Topic 11: Series Solutions of Boundary and Initial and Boundary Value Problems Topic 12: Inhomogeneous Equations: Duhamel's Principle</p> <p>Assessments: Midterm Test</p>
Module 4	<p>Topics: Topic 13: Eigenfunction Expansions: Finite Fourier Transforms; PDEs with General Inhomogeneous Terms and Data Topic 14: Nonlinear Stability Theory: Eigenfunction Expansions; Nonlinear Heat Equation: Stability Theory; Nonlinear Heat Equation: Cauchy Problem Topic 15: Maple Methods; Eigenvalue Problems for ODEs Topic 16: One-Dimensional Fourier Transforms; General Properties Fourier Sine and Cosine Transforms; General Properties</p> <p>Assessments: Quiz#2</p>
Module 5	<p>Topics: Topic 17: Higher-Dimensional Fourier Transforms; Huygens' Principle; Helmholtz and Modified Helmholtz Equations Topic 18: Hankel Transforms; General Properties Topic 19: Laplace Transforms; General Properties Topic 20: Asymptotic Approximation Methods for Fourier Integrals</p> <p>Assessments: Assignment#2 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



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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.