MAT 388 Fourier Series and Boundary Value Problems

Winter 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email:TBA

COURSE OBJECTIVES

This course offers students a strong foundation in the theory and practical application of Fourier methods for solving boundary value problems within ordinary and partial differential equations. It encompasses various mathematical tools, including separation of variables, orthogonal functions, and Fourier series and transforms, all essential for addressing complex mathematical challenges.

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

1. Apply separation of variables and orthogonal functions to solve a variety of boundary value problems.
2. Understand and analyze wave, diffusion, and Laplace's equations, as well as their solutions.
3. Work with Sturm-Liouville boundary value problems and eigenfunction expansions.
4. Utilize the Fourier transform for solving partial differential equations and signal processing applications.
5. Learn to apply the mathematical techniques covered in the course to solve interdisciplinary problems in various scientific and engineering fields.

PREREQUISITES

MAT 233 Vector Calculus

GRADING

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

ITEM	POINTS
Quizzes	20 Points
Assignments	20 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:

Nakhle H. Asmar, ***Partial Differential Equations with Fourier Series and Boundary Value Problems***, 3rd Edition, Dover Publications.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Fourier Series Topic 2: Partial Differential Equations in Rectangular Coordinates Topic 3: Solution of the One Dimensional Wave Equation: The Method of Separation of Variables Topic 4: The Two Dimensional Wave and Heat Equations **Assessments:** Quiz#1

Module 2	**Topics:** Topic 5: Laplace's Equation in Rectangular Coordinates Topic 6: Partial Differential Equations in Polar and Cylindrical Coordinates Topic 7: The Laplacian in Various Coordinate Systems Topic 8: Laplace's Equation in Circular Regions **Assessments:** Quiz#2 Assignment#1
Module 3	**Topics:** Topic 9: Laplace's Equation in a Cylinder Topic 10: Bessel's Equation and Bessel Functions Topic 11: Integral Formulas and Asymptotics for Bessel Functions Topic 12: Partial Differential Equations in Spherical Coordinates **Assessments:** Midterm Exam
Module 4	**Topics:** Topic 13: Preview of Problems and Methods Topic 14: Sturm–Liouville Theory with Engineering Applications Topic 15: Orthogonal Functions Topic 16: The Fourier Transform and Its Applications **Assessments:** Assignment#2
Module 5	**Topics:** Topic 17: The Laplace and Hankel Transforms with Applications Topic 18: Sampling and Discrete Fourier Analysis with Applications to Partial Differential Equations Topic 19: Partial Differential Equations and the Sampling Theorem Topic 20: The Fourier and Discrete Fourier Transforms **Assessments:** 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).

ACEDEMIC 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:

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.