暨南大學 JINAN UNIVERSITY

Summer 2023

0701M344

Introduction to Partial Differential Equations

Instructor: TBA

Time: May 8, 2023 - June 9, 2023

Office Hours: 2 hours (according to the teaching schedule)

Contact Hours: 60 (50 minutes each)

Credits: 4

Email: TBA

Course Description

Topics including fourier series and the method of separation of variables; the wave equation, heat equation and Laplace's equation; d'Alember's formula. Maximum principles, energy integrals and uniqueness. Sturn-Liouville problems and eigenfunction expansions.

Textbook(s)

A First Course in Partial Differential Equations, J. Robert Buchanan and Zhoude Shao, World Scientific Publishing Company, Hackensack, ISBN-13: 978-9813226432.

Prerequisites

0701M242 Elementary Differential Equations

Course Schedule

Please note that the schedule is meant to give an overview of the major concepts in this course. Changes may occur in this calendar as needed to aid in the student's development.

Week 1:

- Course Introduction

First-Order Partial Differential Equations

- 2.1 First-Order Linear Equations
- 2.2 First-Order Quasilinear Equations

Fourier Series

- 3.1 Periodic Functions
- 3.2 The Trigonometric System and Orthogonality
- 3.3 Euler-Fourier Formulas and Fourier Series
- 3.4 Even and Odd Functions
- 3.5 Even or Odd Extension of Functions

Week 2:

- 3.6 Convergence Theorem
- 3.7 The Gibbs Phenomenon and Uniform Convergence
- 3.8 Differentiation and Integration of Fourier Series
- 3.9 Mean Square Approximation and Parseval's Identity.
- 3.10 Complex Form of the Fourier Series
- 3.11 Proofs of Two Theoretical Results

The Heat Equation

- 4.1 Homogeneous Boundary Value Problems on Bounded Intervals

- 4.2 Nonhomogeneous Boundary Value Problems

Week 3:

- 4.3 A Maximum Principle and Uniqueness of Solutions
- 4.4 The Heat Equation on Unbounded Intervals
- 4.5 The Heat Equation on a Rectangular Domain

The Wave Equation

- 5.1 Wave Equation with Homogeneous Boundary Conditions
- 5.2 d'Alembert's Approach
- 5.3 Solving the Wave Equation - Revisited
- 5.4 Nonhomogeneous Cases
- 5.5 The Energy Integral and Uniqueness of Solutions
- Midterm Exam

Week 4:

Laplace's Equation

- 6.1 Boundary Value Problems of Laplace's Equation
- 6.2 Dirichlet Problems on Rectangles
- 6.3 Dirichlet Problems on Disks
- 6.4 Dirichlet Problems on Domains Related to Disks
- 6.5 Neumann Problems on Rectangles
- 6.6 Neumann Problems on Disks
- 6.7 Mixed Boundary Conditions on Rectangles
- 6.8 Poison's Formula and Mean Value Property.
- 6.9 Maximum Principle and Uniqueness

Week 5:

Sturm-Liouville Theory

- 7.1 Two-Point Boundary Value Problems of Second-Order Differential Equations

- 7.2 Properties of Eigenvalues and Eigenfunctions
- 7.3 Zeros of Eigenfunctions
- 7.4 Generalized Fourier Series
- 7.5 Estimating Eigenvalues and the Rayleigh Quotient
- 7.6 Existence of Eigenfunctions and Eigenvalues
- Final Exam

Grading Policy

Midterm exam 30%

Homework 10%

Quizzes 30%

Final exam 30%

Grading Scale

The instructor will use the grading system as applied by JNU:

Definition	Letter Grade	Score
Excellent	A	90~100
Good	B	80~89
Satisfactory	C	70~79
Poor	D	60~69
Failed	E	Below 60

Academic Integrity

As members of the Jinan University academic community, students are expected to be honest in all of their academic coursework and activities. Academic dishonesty, includes (but is not limited to) cheating on assignments or examinations; plagiarizing, i.e., misrepresenting as one's own work any work done by another; submitting the same paper, or a substantially similar paper, to meet the requirements of more than

one course without the approval and consent of the instructors concerned; or sabotaging other students` work within these general definitions. Instructors, however, determine what constitutes academic misconduct in the courses they teach. Students found guilty of academic misconduct in any portion of the academic work face penalties that range from the lowering of their course grade to awarding a grade of E for the entire course.