MA5601: APPLIED PARTIAL DIFFERENTIAL EQUATIONS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Applied Partial Differential Equations

Subject Code
MA - Mathematics
Course Number
5601

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to introduce more advanced topics of partial differential equations with an emphasis on their mathematical theory and applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain clearly mathematical formulation of stationary and time-dependent boundary value problems arising in physical problems.	20	x		
2	describe analytic and structural properties of Green’ s functions.	20	x	x	
3	find Green’ s functions for boundary value problems by various methods including the use of Dirac-delta functions.	20	x	x	
4	apply Fourier series and integral transform techniques to obtain solutions of appropriate initial/boundary value problems.	20	x	x	
5	state and derive the one-dimensional Euler-Lagrange equation.	10	x	x	x
6	obtain minimizers of functionals on analytic function spaces as solutions of classical partial differential equations.	10	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6	39 hours in total
2	Take-home Assignments	Learning through take-home assignments helps students implement more advanced theory and functional analytic techniques of partial differential equations, with applications in mathematical physics.	1, 2, 3, 4, 5, 6	after-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test	1, 2, 3, 4	20	Questions are designed for the first part of the course to see how well students have learned classical results in the theory of stationary and time-dependent boundary value problems as well as integral transform techniques in solving these problems.
2	and-in assignments	1, 2, 3, 4, 5, 6	20	These are skills based assessment to help students manipulate advanced theory and functional analytic techniques of partial differential equations, and their applications in mathematical physics.

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Additional Information for ATs

Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student' s versatility in advanced theory and techniques underlying solutions of partial differential equations.

Assessment Rubrics (AR)

Assessment Task

1. Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Independent problem solving skills on progressive learning based on lecture

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B, B-) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Fair

(C+, C, C-) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Marginal

(D) Demonstrates limited understanding of classical partial differential equations and has limited ability to apply them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Assessment Task

2. Hand-in assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Understanding based on both lecture and outsource reference

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B, B-) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Fair

(C+, C, C-) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Marginal

(D) Demonstrates limited understanding of classical partial differential equations and has limited ability to apply them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Assessment Task

3. Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Comprehensive problem solving skills on learning materials throughout the semester

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B, B-) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Fair

(C+, C, C-) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Marginal

(D) Demonstrates limited understanding of classical partial differential equations and has limited ability to apply them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Assessment Task

1. Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Independent problem solving skills on progressive learning based on lecture

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Marginal

(B-, C+, C) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Assessment Task

2. Hand-in assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Understanding based on both lecture and outsource reference

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Marginal

(B-, C+, C) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Assessment Task

3. Examination

Criterion

Comprehensive problem solving skills on learning materials throughout the semester

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of classical partial differential equations and applies them to complex problems

Good

(B+, B) Adequately demonstrates an understanding of classical partial differential equations and applies them to moderately complex problems

Marginal

(B-, C+, C) Demonstrates some understanding of classical partial differential equations and applies them to simple problems

Failure

(F) Demonstrates little understanding of classical partial differential equations and is unable to apply them to problems

---

Part III Other Information

Keyword Syllabus

The fundamental stationary and time-dependent boundary value problems of solid and fluid mechanics. Classical and weak solutions. Green's functions. Solutions by Fourier series and Fourier transforms. Euler-Lagrange equation and minimization of functionals.

Reading List

Compulsory Readings

	Title
1	W. Strauss, 1992, Partial Differential Equations: An Introduction. John Wiley & Sons.
2	P.Wilmott & S. Howison & J. Dewynne, 1997, The Mathematics of Financial Derivatives. A Student Introduction. Cambridge University Press.

Additional Readings

	Title
1	Nil