MA3512: PARTIAL DIFFERENTIAL EQUATIONS

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Partial Differential Equations

Subject Code
MA - Mathematics
Course Number
3512

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA3511 Ordinary Differential Equations

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide an introduction to the theory and applications of partial differential equations. It trains students to formulate physical problems mathematically and develops a systematic approach of solving elementary partial differential equations.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain clearly concepts and theory of basic methods for solving partial differential equations.			x	x
2	recognize the types of second-order partial differential equations as typified by classical equations of mathematical physics, such as the wave equation, heat-diffusion equation and Laplace equation.			x	x
3	apply eigenfunction expansion methods to solve non-homogeneous versions of heat-diffusion and wave equations.			x	x
4	recognize the concept of a Green function and its applications in solving non-homogeneous problems and elementary boundary value problems (with the use of Dirac delta).			x	
5	create and formulate mathematical models for a range of scientific and engineering problems involving partial differential equations.			x	
6	the combination of CILOs 1--5				

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	Lecture	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 understand basic mathematical concepts and methods of solving elementary partial differential equations as well as their applications to scientific problems.	1, 2, 3, 4, 5	after-class
3	Online applications	Learning through online examples for applications helps students create and formulate mathematical models and apply to a range of problems in science and engineering.	5	after-class
4	Math Help Centre	Learning activities in Math Help Centre provides students extra help.	1, 2, 3, 4, 5	after-class

Assessment Tasks / Activities (ATs)

	ATs	**CILO No.**	**Weighting (%)**	**Remarks (e.g. Parameter for GenAI use)**
1	Quizzes/Test/Midterm	1, 2, 3	21	Questions are designed for the first part of the course to see how well the students have learned the basic methods and techniques of solving partial differential equations as typified by the wave equation, Laplace equation, etc.
2	Hand-in assignments	1, 2, 3, 4, 5	9	These are skills based assessment to enable students to demonstrate the basic concepts and theory of solving elementary partial differential equations and their applications to physical sciences.
3	Formative take-home assignments	1, 2, 3, 4, 5	0	The assignments provide students chances to demonstrate their achievements on solving partial differential equations learned in this course.

Continuous Assessment (%)

30

Examination (%)
70

Examination Duration (Hours)
3

Additional Information for ATs
30% Coursework
70% Examination (Duration: 3 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task
1. Quizzes/Test/Midterm

Criterion
Capacity to APPLY and EXPLAIN the basic concepts and methodology of partial differential equations

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2. Hand-in assignments

Criterion
Capacity to UNDERSTAND basic concepts and tools for solving partial differential equations

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)

Not even reaching marginal levels

Assessment Task
3. Examination

Criterion
Ability to APPLY different approaches in the theory of partial differential equations to concrete problems.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
4. Formative take-home assignments

Criterion
Ability for SELF-DIRECTED LEARNING to understand and apply different approaches in the theory of partial differential equations

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Basic Concepts of Partial Differential Equation. Heat-diffusion Equation. Eigenvalue Problems. Wave Equations. Elliptic Equations. Green's Function.

Reading List

Compulsory Readings

	Title
1	Parital Differential Equations. An Introduction. By Walter A. Strauss, 2nd Edition, 2008.

Additional Readings

	Title
1	Nil