

MA4538: NUMERICAL PARTIAL DIFFERENTIAL EQUATIONS

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Numerical Partial Differential Equations

Subject Code

MA - Mathematics

Course Number

4538

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

MA3525 Elementary Numerical Methods

Precursors

MA3511 Ordinary Differential Equations

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course gives students the opportunity for a further study in numerical methods for the solutions of partial differential equations. Students are also required to do mini-projects so that they will be able to apply what they have learned to problems in science and engineering.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 explain clearly concepts such as consistency, convergence and stability of numerical methods in solving partial differential equations.	15	x		
2 apply finite difference methods to various types of partial differential equations.	25		x	
3 create and formulate basic finite element approximations for boundary value problems in one or two variables.	25			x
4 apply sophisticated numerical methods to solve some complicated partial differential equations effectively on a computer.	15		x	x
5 the combination of CILOs 1-4	20	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	39 hours in total
2 Take-home assignments	Learning through take-home assignments helps students understand basic numerical techniques of partial differential equations and carry out stability and convergence analyzes for these methods.	1, 2, 3, 4	after-class

3	Project(s)	Learning through project(s) helps students apply mathematical knowledge and numerical methods to analyze/ solve boundary value problem(s) arising from practical applications. It also helps students to communicate and collaborate effectively in the team.	4	after-class
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Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	Test	1, 2, 3	15	Questions are designed for the first part of the course to see how well the students have learned basic numerical methods in solving partial differential equations, including finite difference and finite element methods.	No
2	Hand-in assignments	1, 2, 3, 4	5	These are skills based assessment to help students implement numerical techniques in solving various types of partial differential equations and analyzing their solutions.	Yes
3	Project	4	10	Students are assessed on their ability in applying numerical and computational methods to solve partial differential equations, as well as on the presentation of numerical results with analysis.	Yes

4	Formative take-home assignments	1, 2, 3, 4	0	The assignments provide students chances to demonstrate their achievements in solving and analyzing solutions of boundary value problems numerically.	Yes
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Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Minimum Examination Passing Requirement (%)

30

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. Test

Criterion

Ability in problem solving

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

Understanding of concepts and applications

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. Project

Criterion

Creativity and Team work ability

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

Study attitude

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

5. Examination

Criterion

Comprehensive ability in independent problem solving

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**

Description and numerical analysis of the main approximation methods for stationary and time-dependent boundary value problems: Finite differences, finite elements, spectral and collocation methods. Stability, consistency and convergence.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Nil