MATH3700: Partial Differential Equations

Callaghan Semester 2 - 2023



OVERVIEW

Course Description

Partial differential equations arise from the mathematical modelling of a wide range of problems in biology, engineering, physical sciences, economics and finance. Therefore, they form an essential part of the mathematical background required for engineering and physical sciences. This course introduces students to the modern theory and methods of partial differential equations. It provides the students with the skills to formulate partial differential equations for modelling real-world problems, the knowledge to solve them using fundamental analytical and numerical methods, and the ability to interpret the results in the relation to the modelling context.

Assumed Knowledge MATH2310

Contact Hours	Callaghan Lecture Face to Face On Campus 3 hour(s) per Week for Full Term Tutorial and computer lab work will be integrated with lecture material as required.		
Unit Weighting	10		
Workload	Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10		

unit course.



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CONTACTS

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SYLLABUS

Course Content

- Modelling with partial differential equations.
- Classical solution techniques: method of characteristics, separation of variables and Fourier series, transform methods.
- Numerical methods for partial differential equations: consistency, stability and convergence.

Course Learning Outcomes	On successful completion of this course, students will be able to: 1. Build mathematical models of relevant real-world problems based on partial differential equations in studying differential equations.			
	2. Classify second order partial differential equations, apply analytical methods to solve them, and physically interpret the solutions.			
	3. Apply numerical methods to solve practical partial differential equations and implement them in computers.			
	4. Interpret and communicate solutions in relation to the underlying modelling problem.			
	5. Analyse the consistency, stability and convergence properties of numerical methods.			
Course Materials	 Lecture Materials: Lecture notes will be posted on Canvas on a weekly basis. 			
	Recommended Reading:			

 [1] L.C. Evans. Partial differential equations, volume 19 of Graduate Studies in Mathematics. American Mathematical Society, Providence, RI, second edition, 2010.
 [2] M.P. Coleman. An Introduction to Partial Differential Equations with MATLAB, Chapman & Hall, second edition, 2016

[3] K.W. Morton and D.F. Mayer. Numerical solution of partial differential equation: An introduction, Cambridge University Press, second edition, 2005



SCHEDULE

Week	Week Week Begins Topic		Learning Activity Assessment		
1	1 17 Jul Review of ordinary		Lectures		
		introduction to portiol			
		differential equations			
	24 1	Method of observatoriation	Lasturas		
2	24 Jul	Method of characteristics			
3	31 JUI				
4	7 Aug	Wave, heat and Laplace equations, separation of variables and Fourier series	Lectures		
5	14 Aug	Separation of variables	Lectures	Quiz 1 on Wednesday	
6 21 Aug Transform methods Lectures Assignment 1 Wednesday				Assignment 1 Due on Wednesday	
7 28 Aug Partial differential equations in polar coordinates Lectures					
8 4 Sep Partial differential equations in polar coordinates Lectures					
9 11 Sep Mean value property and maximum principle			Lectures		
10 18 Sep Numerical methods for partial differential equations Lectures			Lectures	Quiz 2 on Wednesday	
Mid Term Break					
		Mid Ter	m Break		
11 9 Oct Numerical methods for partial differential equations: consistency, stability and convergence. Lectures Assignment 2 Wednesday		Assignment 2 Due on Wednesday			
12	12 16 Oct Numerical methods for heat, wave, Laplace and transport equations Lectures				
13	23 Oct	Review lectures			
Examination Period					
Examination Period					

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Quiz	₩eek 5 and Week 10 during the Wednesday lecture.	Individual	25%	2, 3, 4, 5
2	Assignments	Week 6 and Week 11, to be submitted at the beginning of the Wednesday lecture in class.	Individual	25%	1, 2, 3, 4, 5
3	End of Semester Exam	Examination period	Individual	50%	2, 3, 4, 5

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.



Assessment 1 - Quiz

Assessment Type	Quiz
Purpose	To provide students with feedback on student learning.
Description	Two 50-minutes quizzes of written questions.
Weighting	25%
Length	50 min
Due Date	Week 5 and Week 10 during the Wednesday lecture.
Submission Method	Th Class
Assessment Criteria	Mathematical correctness and clarity of presentation
Return Method	In Class
Feedback Provided	In Class - Two academic weeks after the quiz date.

Assessment 2 - Assignments

Assessment Type	Written Assignment
Purpose	Written Assignments meet the course objectives of knowledge acquisition to demonstrate assimilation of data.
Description	An articulate and concise document which conveys evidence-based understanding of the concepts and topics. There are two written assignments. The first one will be available in Week 4 and the second one will be available in Week 9.
Weighting	25%
Due Date	Week 6 and Week 11, to be submitted at the beginning of the Wednesday lecture in class.
Submission Method	IN Class
Assessment Criteria	Mathematical correctness and quality of presentation.
Return Method	In Class
Feedback Provided	In Class - Two weeks after submission. Assignments 1 and 2 are returned in class.

Assessment 3 - End of Semester Exam

Assessment Type	Formal Examination
Purpose	To test the individual student's knowledge of the course and their ability to describe, analyse and hypothesise from this material.
Description	Formal Examination
Weighting	50%
Length	120 min
Due Date	Examination period
Submission Method	Formal Exam
Assessment Criteria	Mathematical correctness and clarity of presentation
Return Method	Not Returned
Feedback Provided	No Feedback

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass	Satisfactory standard indicating an adequate knowledge and



		(P)	understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
	0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.
	*Skills are th	ose identified f	for the purposes of assessment task(s).
Communication Methods	Communicat - Canva or anr - Email - Face	ion methods u as Course Site nouncements o : Students will to Face: Comn	sed in this course include: e: Students will receive communications via the posting of content on the Canvas course site. receive communications via their student email account. nunication will be provided via face to face meetings or supervision.
Course Evaluation	Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.		
Oral Interviews (Vivas)	As part of the (viva) may b the material conducted in In cases whe own work the	e evaluation pr e conducted. ⁻ submitted in accordance w ere the oral ex e case will be o	rocess of any assessment item in this course an oral examination The purpose of the oral examination is to verify the authorship of response to the assessment task. The oral examination will be vith the principles set out in the <u>Oral Examination (viva) Procedure</u> . amination reveals the assessment item may not be the student's dealt with under the <u>Student Conduct Rule</u> .
Academic Misconduct	All students standards re Academic In all locatio https://policie	are required to inforce the im tegrity policies ns. For es.newcastle.e	o meet the academic integrity standards of the University. These aportance of integrity and honesty in an academic environment. apply to all students of the University in all modes of study and in the Student Academic Integrity Policy, refer to du.au/document/view-current.php?id=35.
Adverse Circumstances	The Universitiallowable ad Applications online Adver 1. the as 2. the as specified in the system; 3. you at 4. the co Before apply Procedure an https://policie	ity acknowledg verse circumst for special cor se Circumstan ssessment iten ssessment iten the Course Ou re requesting a ourse has a cor ving you must vailable at: es.newcastle.e	ges the right of students to seek consideration for the impact of tances that may affect their performance in assessment item(s). Insideration due to adverse circumstances will be made using the trees system where: In is a major assessment item; or In is a minor assessment item and the Course Co-ordinator has utline that students may apply the online Adverse Circumstances a change of placement; or Impulsory attendance requirement. In refer to the Adverse Circumstance Affecting Assessment Items adu.au/document/view-current.php?id=236
Important Policy Information	The Help bu Learning Ma procedures procedures t	tton in the Ca nagement Sys at https://v hat support a s	nvas Navigation menu contains helpful information for using the stem. Students should familiarise themselves with the policies and www.newcastle.edu.au/current-students/no-room-for/policies-and- safe and respectful environment at the University.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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