MATH3906

Partial Differential Equations

Session 2, In person-scheduled-weekday, North Ryde 2024

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites
(MATH2010 or MATH235) and (MATH2020 or MATH2110 or MATH232 or MATH236)

Corequisites
MATH3901 or MATH3902 or MATH3905 or MATH3909 or MATH331 or MATH332 or MATH335 or MATH339

Co-badged status

Unit description
Partial differential equations form one of the most fundamental links between pure and applied mathematics. Many problems that arise naturally from physics and other sciences can be described by partial differential equations. Their study gives rise to the development of many mathematical techniques, and their solutions enrich both mathematics and their areas of origin. This unit explores how partial differential equations arise as models of real physical phenomena, and develops various techniques for solving them and characterising their solutions. Special attention is paid to three partial differential equations that have been central in the development of mathematics and the sciences - Laplace's equation, the wave equation and the diffusion equation.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Have knowledge of the principles and concepts of a basic theory of partial differential equations.

ULO2: Use the ideas and techniques of the theory of partial differential equations to model a broad range of phenomena in science and engineering (in particular using the heat and wave equations).
ULO3: Understand the breadth of the theory of partial differential equations and its role in other fields.
ULO4: Construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning especially in the context of the theory of partial differential equations.
ULO5: Demonstrate efficient use of Fourier analysis techniques in the theory of partial differential equations.
ULO6: Further studies in the areas of partial differential equations and advanced analysis.

General Assessment Information

To pass this unit, you must:

- achieve a total mark equal to or greater than 50%.

Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is 11:55 pm. A 1-hour grace period will be provided to students who experience a technical concern. For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration.

Assessments where Late Submissions will be accepted:

Assignment 1 – YES, Standard Late Penalty applies Assignment 2 – YES, Standard Late Penalty applies Mid-semester test - NO, unless Special Consideration is Granted

Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through ask.mq.edu.au.

Descriptions of Assessment Activities

Both assignments will be written assessments - scan your written solutions and submit on iLearn. The midsemester test will online and time-limited.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 2	20%	No	Week 11
Final exam	50%	No	Exam period
Assignment 1	20%	No	Week 6
Mid-semester test	10%	No	Week 8

Assignment 2

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 15 hours
Due: **Week 11**
Weighting: **20%**

Assignment based on material from lectures in previous weeks.

On successful completion you will be able to:

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- Understand the breadth of the theory of partial differential equations and its role in other fields.
- Construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning especially in the context of the theory of partial differential equations.
- Demonstrate efficient use of Fourier analysis techniques in the theory of partial differential equations.

- Further studies in the areas of partial differential equations and advanced analysis.

Final exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 15 hours
Due: **Exam period**
Weighting: **50%**

This will be held during the final exam period. It will test the ability of students to synthesise the concepts taught in the course in order to analyse and solve partial differential equations.

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- Understand the breadth of the theory of partial differential equations and its role in other fields.
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Assignment 1

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 15 hours
Due: **Week 6**
Weighting: **20%**

Assignment based on material from lectures in previous weeks.

On successful completion you will be able to:

- Have knowledge of the principles and concepts of a basic theory of partial differential equations.
- Use the ideas and techniques of the theory of partial differential equations to model a broad range of phenomena in science and engineering (in particular using the heat and wave equations).
- Understand the breadth of the theory of partial differential equations and its role in other fields.
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Mid-semester test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 10 hours
Due: **Week 8**
Weighting: **10%**

Test based on material from lectures in previous weeks.

On successful completion you will be able to:

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

The **required** textbook for this unit is: *Introduction to Partial Differential Equations* (Peter J. Olver).

This text is available **free and online** through the MQ library service. Please ensure that you have this text available to you. We will assign readings, and draw questions and examples from this text. Most of the lectures will be directly based on the contents of this text.

There will be one lecture per week (starting Week 1). There will be one SGTA per week (starting Week 2).

We will communicate with you via your university email or through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or sent to the convenor via email.

The timetable for classes can be found on the University website at: https://publish.mq.edu.au/

Enrolment can be managed using eStudent at: https://students.mq.edu.au/support/technology/ systems/estudent

Unit Schedule

TOPIC	OLVER READING	
Week 1	Introduction to PDEs	Chapter 1, Section 2.1
Week 2	Method of Characteristics	Section 2.2
Week 3	Method of Characteristics	Sections 2.3 - 2.4
Week 4	Linear Second-Order PDEs	Section 4.4

TOPIC	OLVER READING	
Week 5	Fourier Series	Sections 3.1 - 3.4
Week 6	Similarity Solutions	Sections 8.1 - 8.2
Week 7	Separation of Variables	Sections 4.1 - 4.2
Week 8	Separation of Variables	Sections 4.1 (cont.), 4.3
Week 9	Fourier Transforms	Sections 7.1 - 7.2
Week 10	Fourier Transforms	Section 7.3
Week 11	Green's Functions	Sections 6.1 - 6.2
Week 12	Green's Functions	Section 6.3
Week 13	Revision	

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the

University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Unit information based on version 2024.02 of the Handbook