MATH336

Partial Differential Equations

S2 Day 2014

Mathematics

Contents

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General Information

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Credit points
3

Prerequisites
MATH235 and (MATH232 or MATH236)

Corequisites

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:

Knowledge of the principles and concepts of a basic theory of Partial Differential Equations

Ability to use the ideas and techniques of the theory of Partial Differential Equations to a model broad range of phenomena in science and and engineering (in particular using the heat and wave equations)

Understanding of the breadth of the theory of Partial Differential Equations and its role in other fields

Ability to 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

Preparing students to further studies in the areas of Partial Differential Equations and advance Analysis

Assessment Tasks

Name	Weighting	Due
Eight assignments	20%	TBA
One Test	20%	TBA
Final examination	60%	University Examination Period

Eight assignments

Due: **TBA**
Weighting: **20%**

Eight assignments

On successful completion you will be able to:

- Knowledge of the principles and concepts of a basic theory of Partial Differential Equations
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One Test

Due: **TBA**
Weighting: **20%**

One Test

On successful completion you will be able to:

- Knowledge of the principles and concepts of a basic theory of Partial Differential Equations
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Final examination

Due: **University Examination Period**
Weighting: **60%**

-

On successful completion you will be able to:

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Delivery and Resources

Classes

Lectures: you should attend two hours of each lecture stream each week, making a total of four hours.

Required and Recommended Texts and/or Materials

No single textbook is entirely satisfactory for MATH336. The following texts provide useful references for various sections of the course:

- W. A. Strauss Partial Differential Equations, an introduction. Wiley 2008

Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. Several areas of the university provide wireless access for portable computers. There are computers for student use in the Library and in the Numeracy Centre (C5A 255).

Difficulties with your home computer or internet connection do not constitute a reasonable excuse for lateness of, or failure to submit, assessment tasks.

Unit Schedule

Week	A	B	
1	First order PDEs	Introductory modeling	
2	First order PDEs	Initial and boundary conditions	
3	Second order PDEs	Waves	
4	Boundary value problems, separation of variables	Diffusion	

5	Wave equation, heat equation	Reflections and sources	
6	First general BVP in one dimension	Reflection and sources continued	
7	Laplace's equation	Waves in 2 and 3 space dimensions	
8		Waves in 2 and 3 space dimensions continued	
9	Harmonic functions	Linear initial and boundary value problems	
10	Boundary value problems in spatial domains	Linear initial and boundary value problems continued	
11	Eigenvalue problems	Nonlinear first order partial differential equations	
12	Green's function	Nonlinear first order partial differential equations continued	
13	Revision	Revision	

This table is a rough guide to the timing of the material in MATH336. Please note that the order and weeks of topics is likely to change.

Learning and Teaching Activities

Lectures

There will be two, two hours long lectures per week. During these the content of the unit will be explained and example problems will be solved and applications in other disciplines discussed.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task, except for cases in which an application for special consideration is made and approved or extension is granted by the lecturer before the due date.

Student Support

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

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

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

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Knowledge of the principles and concepts of a basic theory of Partial Differential Equations
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- Preparing students to further studies in the areas of Partial Differential Equations and advance Analysis

Assessment tasks

- Eight assignments
- One Test
- Final examination

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

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Assessment task

- Eight assignments

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

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- Final examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

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- One Test
- Final examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Knowledge of the principles and concepts of a basic theory of Partial Differential Equations
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Assessment tasks

- Eight assignments
- One Test
- Final examination

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Knowledge of the principles and concepts of a basic theory of Partial Differential Equations
- Ability to use the ideas and techniques of the theory of Partial Differential Equations to a model broad range of phenomena in science and and engineering (in particular using the heat and wave equations)
- Ability to construct logical, clearly presented and justified mathematical arguments

incorporating deductive reasoning especially in the context of the theory of Partial Differential Equations
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Assessment tasks

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- One Test
- Final examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Ability to use the ideas and techniques of the theory of Partial Differential Equations to a model broad range of phenomena in science and and engineering (in particular using the heat and wave equations)
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning especially in the context of the theory of Partial Differential Equations
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Assessment tasks

- Eight assignments
- One Test
- Final examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Understanding of the breadth of the theory of Partial Differential Equations and its role in other fields
- Preparing students to further studies in the areas of Partial Differential Equations and advance Analysis

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- Preparing students to further studies in the areas of Partial Differential Equations and advance Analysis

Assessment task

- Eight assignments

Extra requirements

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.