



MATH232

Mathematical Techniques

S2 Day 2016

Dept of Mathematics

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	3
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	5
<u>Unit Schedule</u>	6
<u>Policies and Procedures</u>	7
<u>Graduate Capabilities</u>	8
<u>Changes since First Published</u>	13

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General Information

Unit convenor and teaching staff

Convenor

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AHH 2.611

By appointment

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Credit points

3

Prerequisites

MATH133 or MATH136

Corequisites

Co-badged status

Unit description

This unit develops techniques and skills that are fundamental in the study and application of mathematics at an advanced level. In any successful application, two contrasting but complementary skills must be developed: the ability to formulate a given real-world problem in appropriate mathematical terms; and sufficient knowledge to obtain useful information and testable predictions from that model, by analytical and numerical means. The unit shows how differential equations arise as mathematical models of such real phenomena in science, engineering and the social sciences, and introduces some tools including Fourier series for the study and eventual solution of these equations. Maps arising from discrete time models are also introduced. Fourier series and transforms are particularly useful in those situations where the system response (and indeed many functions) can be seen as a complex sum of simpler vibrations or oscillations. Numerical techniques are briefly discussed; they are essential when analytical methods fail, or provide only limited information about the model.

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:

Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.

Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.

Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.

Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

General Assessment Information

Late assignments will incur a penalty of 20% of the assignment total unless an extension has been granted by the unit convenor or disruption to studies provisions apply. No marks will be awarded after the assignment solutions are made available (usually, 48 hours after the due date/time).

Please note the University's [Final Examination policy](#) states:

Each student will be responsible for:

- checking the final examination timetable
- adhering to the final examination timetable
- ensuring they are available for the full duration of the final examination period.

The mathematics department cannot reschedule the final examination date to suit the travel and holiday arrangements of students.

Assessment Tasks

Name	Weighting	Due
Three assignments	30%	see iLearn
One Test	20%	see iLearn
Final examination	50%	University Examination Period

Three assignments

Due: **see iLearn**

Weighting: **30%**

-

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

One Test

Due: **see iLearn**

Weighting: **20%**

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On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Final examination

Due: **University Examination Period**

Weighting: **50%**

-

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Delivery and Resources

Classes

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

Tutorials: you should attend one tutorial each week.

Required and Recommended Texts and/or Materials

A set of online notes is available on iLearn.

The online notes are intended primarily as a source of reference. These are not intended to be treated as the only source for learning.

The following texts provide useful references for various sections of the course

- A. Pinkus & S. Zafrany, *Fourier Series and Integral Transforms*, Cambridge University Press, 1997. (QA404.P56 1997)
- E. Kreyszig, *Advanced Engineering Mathematics*, Wiley (several editions) (QA401.K7)
- F. B. Hildebrand, *Advanced Calculus for Applications*, Prentice-Hall, 1962 (QA303.H55)
- R. Knobel, R. *An introduction to the mathematical theory of waves*, American Mathematical Society, 1999 (QA927.K963/1999).
- G. Fulford, P. Forrester & A. Jones, *Modelling with Differential and Difference Equations/ i* , Cambridge University Press, 1997 (QA401.F85)
- G. D. Smith, *Numerical Solution of Partial Differential Equations*, Oxford University Press, 2nd /3rd Edition (QA374.S56/1978, 1985)
- K.K. Tung, *Topics in Mathematical Modelling*, Princeton University Press, 2007.

Other similar texts are available in the Library.

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	
1	Series of functions, inner products	Introduction to modelling
2	Fourier series	Modelling with ordinary differential equations (ODEs)
3	Fourier series: Bessel's inequality	Models drawn from biology, physics and other fields
4	Fourier series: convergence	
5	Sine and cosine series	
6	Fourier series: differentiation, integration	ODEs and phase plane
7		Modelling with PDEs
	MID-SEMESTER BREAK	
8	Fourier series on general intervals. Application to PDEs and ODEs	Heat and diffusion: PDE models
9		Waves and potentials: PDE models
10	Fourier transform	Modelling with maps
11		The logistic map: period doubling and chaos
12	Fourier transform: application to PDEs	Brief introduction to numerical methods for ODEs
13	Revision	Revision

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

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.html>

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.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/

Results

Results shown in *iLearn*, 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.

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://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.

Graduate Capabilities

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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Three assignments
- One Test
- Final examination

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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
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Assessment tasks

- Three 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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Three assignments
- Final examination

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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Three assignments
- One Test
- 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:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of mathematical modelling and

Fourier series.

- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Three assignments
- 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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
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Assessment tasks

- Three assignments
- 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

- Demonstrate knowledge of the principles and concepts of mathematical modelling and Fourier series.
- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Three 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

- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment task

- Three assignments

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

- Demonstrate understanding of the role of mathematics in other disciplines and the way other disciplines contribute to the development of the mathematical sciences.

Assessment task

- Three assignments

Changes since First Published

Date	Description
18/07/2016	Ditto.