



# MATH232

## Mathematical Techniques

S2 Day 2018

*Dept of Mathematics*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	3
<a href="#"><u>General Assessment Information</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	5
<a href="#"><u>Learning and Teaching Activities</u></a>	6
<a href="#"><u>Policies and Procedures</u></a>	6
<a href="#"><u>Graduate Capabilities</u></a>	8

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#### **Disclaimer**

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## General Information

### Unit convenor and teaching staff

#### Convenor

Vladimir Gaitsgory

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Contact via [vladimir.gaitsgory@mq.edu.au](mailto:vladimir.gaitsgory@mq.edu.au)

738, Level 7, 12 Wally's Walk

3-4pm Tuesday or by appointment

#### Lecturer

Elena Vynogradova

[elena.vynogradova@mq.edu.au](mailto:elena.vynogradova@mq.edu.au)

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709, Level 7, 12 Wally's Walk

12-1pm Wednesday or by appointment

### 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 10% of the earned mark for each day that the assignment is late, up to a maximum of 50%, unless an extension has been granted by the unit convenor or disruption to studies provisions apply. After 5 days, including weekends and public holidays, a mark of 0% will be awarded for the assignment.

**HURDLES:** This unit has no hurdle requirements. This means that there are no second chance examinations and assessments if you happen to fail at your first attempt. Students should aim to get at least 60% for the course work in order to be reasonably confident of passing the unit.

**IMPORTANT:** If you receive [special consideration](#) for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the [policy](#) prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn ([bit.ly/FSESup](http://bit.ly/FSESup)) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Three assignments</a>	30%	No	see iLearn
<a href="#">One Test</a>	20%	No	see iLearn

Name	Weighting	Hurdle	Due
<u>Final examination</u>	50%	No	University Examination Period

## Three assignments

Due: **see iLearn**

Weighting: **30%**

Assignments on Modelling and Fourier Analysis

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%**

Supervised in class test

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%**

## Final Examination

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.

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

## Learning and Teaching Activities

### Lectures

There will be two two-hour lectures per week, where the concepts are introduced, explained and illustrated. During these the content of the unit will be explained and example problems will be solved and applications in other disciplines discussed.

### Tutorials

There will be one one-hour tutorial class per week. The tutorial questions will be available on iLearn by the end of the previous week. A set of model answers for the tutorial questions will be posted on iLearn at the end of each week.

### Assignments

There will be three assignments in this unit. Assignment questions will be made available on iLearn after the material required to answer them has been covered in lectures and at least two weeks before the due date. While we encourage collaborative learning, these are individual assignments, and the work you submit must be your own work. For your own protection, we advise all students participating in group study sessions related to assignment questions to ensure that all participants in such groups destroy any notes they have made at the end of such a session. Participants can then independently construct their own solutions based on the understanding and insight provided by the study session without running the risk of breaching the rules relating to academic misconduct

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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](#)

- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway](#) (<https://students.mq.edu.au/support/study/student-policy-gateway>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](#) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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](http://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](http://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/](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.
- Apply mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

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

## 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