MATH6904

Mathematical Modelling

Session 2, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

Contents

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General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites

Corequisites

Co-badged status
MATH1010/S2/F2F-DAY MATH1010/S2/ONL-S-DAY MATH6904/S2/ONL-S-DAY

Unit description
This unit introduces students to a range of mathematical techniques from algebra and calculus. Its focus is on the modern application of these ideas, with a particular emphasis on applications to problems in economics, business and finance, and provides a sound mathematical basis for further study in these areas. A key focus of the unit is the development of a sound grasp of how mathematics is used to provide sophisticated modelling of complex real problems. The algebra content of the unit includes topics such as linear systems, matrices, determinants, vector spaces, eigenvalues and eigenvectors. The study of these topics is applied to model various economic problems such as Leontief input-output models and dynamical systems used to predict long-term behaviours. The calculus content includes the development of the techniques of differentiation and integration with applications to constrained and unconstrained optimisation, including multivariable cases, and the development and application of a variety of useful approximation techniques. The techniques studied in the calculus are used to study and solve a wide variety of economic and financial problems.

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: Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.

ULO2: Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.

ULO3: Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.

ULO4: Investigate a range of optimisation problems using the techniques of calculus.

ULO5: Formulate models of a variety of real world situations using techniques from differential equations.

General Assessment Information

ATTENDANCE and PARTICIPATION: There are no explicit hurdle tasks in MATH6904; however attendance at, and reasonable engagement in, Small Group Teaching Activities (SGTA) 2-hour classes in mathematics and statistics units is highly encouraged. Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you will miss a class, you can apply for Special Consideration via ask.mq.edu.au.

ASSIGNMENT SUBMISSION: Assignment submission will be online through the iLearn page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

- Assignment submission is via iLearn. You should upload this as a single scanned PDF file.
- Please note the quick guide on how to upload your assignments provided on the iLearn page.
- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
- It is your responsibility to make sure your assignment submission is legible.
- If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

LATE ASSESSMENT SUBMISSION PENALTY — General Policy

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see https://students.mq.edu.au/study/assessment-exams/assessments for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written 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. Submission time for all written assessments is set at **11:55 pm**. A 1-hour grace period is 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, students need to submit an application for Special Consideration.

Assessments where Late Submissions will be accepted:

In this unit, late submissions will be accepted as follows:

- **MatLab assessment**: **Yes**, Standard Late Penalty applies.

If special consideration has NOT been granted, 5% of the total value will be deducted for each 24-hour period (or part thereof) that the submission is late for the first 7 days (including weekends and/or public holidays). For example, if an assignment is submitted 3 days late, its mark will attract a penalty equal to 15% of the total value. After 7 days (including weekends and public holidays) a mark of 0% will be awarded.

- **Timed assessment** tasks (e.g. online tests, quizzes, examinations): **No**, unless Special Consideration is granted.

A generous window of times is assigned for tests and quizzes, usually covering up to 2 days. All attempts must be done within this window.

FINAL EXAM POLICY: It is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester; that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via: Special Consideration.

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 this 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/FSESupp) 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
Matlab Assignment	10%	No	Week 12
Weekly Quiz	16%	No	Weekly
Major Test 2	12%	No	Week 11
Final Examination	50%	No	Examination period
Major Test 1	12%	No	Week 5

Matlab Assignment

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 7 hours
Due: **Week 12**
Weighting: **10%**

The problem set will be aimed at introducing Matlab as a mathematical tool. It will ask students to perform various tasks using Matlab, such as plotting functions, computing derivatives and integrals, performing Gaussian elimination, and solving linear optimisation problems.

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- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential equations.

Weekly Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 9 hours

Due: **Weekly**
Weighting: **16%**

The subject will have nine weekly online (iLearn) quizzes containing one to three short questions. The quizzes will last for one hour, and be available for a duration of one week. The quizzes will not run in Week 1, or weeks containing a midterm test. Each quiz is worth 2%, with the best eight quizzes counted to the overall grade.

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Major Test 2

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 7 hours
Due: **Week 11**
Weighting: **12%**

This will test the ability of students to analyse and solve mathematical problems using concepts and techniques in linear algebra and calculus.

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- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
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Final Examination

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

This will be an invigilated exam, 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 mathematical problems with various applications.

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- Investigate a range of optimisation problems using the techniques of calculus.
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Major Test 1

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 7 hours
Due: **Week 5**
Weighting: **12%**

This will test the ability of students to analyse and solve mathematical problems using concepts and techniques in linear algebra and calculus.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.
- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential equations.

[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

Classes:

- Lectures: there are two one-hour lectures each week.
- SGTA classes: students should attend one, two-hour class per week.

Course Notes: Student notes will be posted on iLearn.

Suggested textbooks:

- Algebra — *Lay*, Linear Algebra and its Applications, 5th edition.
- Calculus — *Stewart*, Calculus (Metric Version), 8th edition.

Other useful texts:

- Anton — Linear Algebra and its Applications
- Hughes-Hallett — Calculus: single and multivariable

Unit Schedule

Wk	Wednesday Lecture	Friday Lecture	Assessment Due
	Sets and Vectors	Dot Product and Orthogonality	

Wk	Wednesday Lecture	Friday Lecture	Assessment Due
	Matrix Operations	Linear Equations and Gauss–Jordan Elimination	
	Gauss–Jordan Elimination and Consistency	Homogeneous Equations	
	Determinants and Vector/Scalar Product	Equations of Lines	
	Equations of Planes	Functions and Trigonometry	Test 1
	Composite and Inverse Functions	Monotonicity and Exponential	
	Limits	One Sided and Infinite Limits	
	Continuity	Differentiation	
	Differentiation Rules	Extreme Values	
	Integration	Integral Properties	
	Fundamental Theorem of Calculus	Integration Techniques	Test 2
	Integration Techniques	Differential Equations	MatLab Assignment
	Review	Review	

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 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.