MATH3905

Methods for Mathematical Computation

Session 1, In person-scheduled-weekday, North Ryde 2025

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Stuart Hawkins
stuart.hawkins@mq.edu.au
Contact via Email
722, 12WW

Unit Convenor
Christian Thomas
christian.thomas@mq.edu.au
Contact via Email
726, 12WW

Credit points
10

Prerequisites
MATH2020 or MATH2110

Corequisites

Co-badged status

Unit description
This unit develops the ideas and techniques of numerical analysis that allow computers to study complicated, realistic problems that are challenging or impossible to solve using analytic calculation. Topics in this unit include the basic theory of numerical analysis, computational solutions to differential equations, and numerical linear algebra. We will first introduce important ideas such as computational complexity and measures of numerical error. This will be followed by the study of computational methods for solving large linear systems and partial differential equations.

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: Understand and apply fundamental principles and concepts of numerical analysis

and mathematical computation.

ULO2: Utilise mathematical software to implement algorithmic processes for solving mathematical problems.

ULO3: Design computational approaches to solve partial differential equations arising from science and engineering on finite domains.

ULO4: Determine solutions to large linear systems of equations using computationally efficient algorithmic approaches.

ULO5: Evaluate the effectiveness of computational algorithms using mathematical concepts including computational complexity and error bounds.

General Assessment Information

Requirements to Pass this Unit

To pass this unit you need to:

- Achieve a total mark equal to or greater than 50% across all assessments.

Attendance and participation

We strongly encourage all students to actively participate in all learning activities. Regular engagement is crucial for your success in this unit, as these activities provide opportunities to deepen your understanding of the material, collaborate with peers, and receive valuable feedback from instructors, to assist in completing the unit assessments. Your active participation not only enhances your own learning experience but also contributes to a vibrant and dynamic learning environment for everyone.

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, assignments, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration: https://connect.mq.edu.au

Assessments where Late Submissions will be accepted:

- Assignment – YES, Standard Late Penalty applies
- Project – YES, Standard Late Penalty applies
- Final Examination – 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 https://connect.mq.edu.au.

Assignement/Project: If you experience circumstances or events that affect your ability to complete the written assessments in this unit on time, please inform the convenor and submit a Special Consideration request through https://connect.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment	25%	No	02/05/2025
Project	25%	No	06/06/2025
Final examination	50%	No	Examination Period

Assignment

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 15 hours
Due: **02/05/2025**
Weighting: **25%**

The assignment will test the ability of students to solve mathematical problems using concepts and techniques learnt in the unit.

On successful completion you will be able to:

- Understand and apply fundamental principles and concepts of numerical analysis and mathematical computation.
- Utilise mathematical software to implement algorithmic processes for solving mathematical problems.
- Design computational approaches to solve partial differential equations arising from science and engineering on finite domains.
- Determine solutions to large linear systems of equations using computationally efficient algorithmic approaches.

Project

Assessment Type [1]: Project
Indicative Time on Task [2]: 15 hours
Due: **06/06/2025**
Weighting: **25%**

This project gives students the opportunity to apply the knowledge gained in the unit to a larger scale mathematical problem than the short questions typical in assignments.

On successful completion you will be able to:

- Understand and apply fundamental principles and concepts of numerical analysis and mathematical computation.
- Utilise mathematical software to implement algorithmic processes for solving mathematical problems.
- Determine solutions to large linear systems of equations using computationally efficient algorithmic approaches.
- Evaluate the effectiveness of computational algorithms using mathematical concepts including computational complexity and error bounds.

Final examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **Examination Period**
Weighting: **50%**

The exam will test the ability of students to utilise concepts and techniques learnt in the unit.

On successful completion you will be able to:

- Understand and apply fundamental principles and concepts of numerical analysis and mathematical computation.
- Utilise mathematical software to implement algorithmic processes for solving mathematical problems.
- Design computational approaches to solve partial differential equations arising from science and engineering on finite domains.

- Determine solutions to large linear systems of equations using computationally efficient algorithmic approaches.

- Evaluate the effectiveness of computational algorithms using mathematical concepts including computational complexity and error bounds.

---

[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

Choose from the following:

- Lectures (beginning in Week 1): There is one two-hour lecture each week.
- SGTA classes (beginning in Week 1): There is one two-hour SGTA each week.

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

Technology Used and Required

This subject requires the use of several items of software. Each of these is available to you at no cost, either because the software is open source or otherwise freely available, or because Macquarie University has arranged access for students. You will need the following:

- Matlab: Macquarie University provides Matlab access on a wide range of computingplatforms. You will be required to sign up with Mathworks using your student email account.
  - Access and installation instructions may be found at: https://au.mathworks.com/academia/tah-portal/macquarie-university-916052.html
  - Students may also use the free online Matlab implementation using their university licence, found at: https://au.mathworks.com/products/matlab-online.html
- LaTeX: LaTeX is a free mathematical typesetting program.
  - Access and installation instructions may be found at: https://www.latex-project.or

g/get

- Students may also use the free online LaTeX compiler, Overleaf, which is found at: https://www.overleaf.com

Methods of Communication

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 your lecturers from your university email address.

Unit Schedule

Week	Topics
1	Computer arithmetic
2	Interpolation and quadrature
3	Composite quadrature rules
4	Nonlinear equations
5	Initial value problems for ODEs
6	Systems and boundary value problems for ODEs
7	LU factorisation
8	Error analysis and QR factorisation
9	Householder and least squares
10	PDEs including classification and finite difference
11	PDEs including finite difference
12	PDEs

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 connect.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 the Service Connect Portal, 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.

Changes from Previous Offering

To enable students more time to focus on learning, understanding and reflecting on the content of our unit we have revised the assessment structure as follows. There are now only three assessments: an assignment, a project and final exam. Although no marks are associated with attendance, all activities provide you with key content designed to help you understand content and complete the assessments.

Changes since First Published

Date	Description
11/02/2025	Updated 'Changes from Previous Offerings' section.

Unit information based on version 2025.06 of the Handbook