



MECH6004

Numerical Modelling and Simulation Techniques

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Engineering

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General Information

Unit convenor and teaching staff

Unit convener

Ann Lee

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Contact via email

9WW-2.119

Wednesday 1pm-2pm

Credit points

10

Prerequisites

Corequisites

Co-badged status

MECH6004

Unit description

This unit focuses on exploring the practical applications of mathematical equations frequently employed in engineering practices, including computational fluid dynamics (CFD) and finite element analysis (FEA). The curriculum encompasses various topics, ranging from numerical differentiation and integration of differential equations to partial differential equations. Upon completion of this unit, students should have attained proficiency in the methodologies and comprehensive understanding necessary to address challenges using CFD techniques.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals ([UNSDGs](#)) Good Health and Well Being; Quality Education; Industry, Innovation and Infrastructure; Climate Action

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:** Apply advanced mathematical and numerical theories within the domain of numerical simulations to effectively resolve complex real-world engineering challenges.
- ULO2:** Evaluate and generate inventive design solutions, showcasing adept critical

thinking skills through the application of computational techniques.

ULO3: Exhibit proficiency in utilizing CFD tools, essential within the realm of computational modeling in engineering.

ULO4: Demonstrate domain-specific knowledge to address problems that emulate real-world situations.

ULO5: Apply effective communication skills through the creation of well-structured written reports.

ULO6: Proficiently apply problem-solving techniques aligned with industry requirements.

General Assessment Information

Notifications

Formal notification of assessment tasks, grading rubrics and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, the University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Logbook

Logbook tasks will be posted on iLearn at least two weeks prior to their due date. Submissions will not be accepted after the solutions have been demonstrated by the teaching staff.

Logbooks may be handwritten or typed but must be neat, legible, and logically structured. Poorly organised or illegible submissions will not be marked. Logbooks will be marked in person by the class's assigned casual academic during Week 8. Students must bring their completed logbooks to class for assessment.

Project Presentation

Each student is required to deliver an individual presentation in Week 13, based on a case study assigned according to their student ID. The case will be made available on iLearn well in advance to allow sufficient preparation time.

The presentation should clearly demonstrate the student's understanding of the assigned case, incorporating relevant analysis, reflections, and engineering reasoning where appropriate. Students are expected to present their findings in a clear, structured, and professional manner.

Presentations will be conducted in person during scheduled class time and assessed by the teaching staff based on clarity, depth of analysis, and engagement with the topic. Attendance during all presentation sessions is expected, as students are encouraged to learn from their peers' work.

Late Assessment Submission Penalty

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.

Special Consideration

If you experience events or conditions that adversely affect your academic performance and you require an extension to complete the assessment tasks, you should apply for "Special Consideration". More information can be found [here](#)

Grading and passing requirement for unit

In order to pass this unit, a student must obtain a mark of 50 or more for the unit. For further details about grading, please refer below in the policies and procedures section.

Supplementary Final Exam

If you receive [special consideration](#) for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. 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. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Final Exam

More information if there will be open- or closed-book exams will be provided on iLearn.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Project Presentation	35%	No	Week 13	Individual	No	Observed
Professional Engagement and Logbook	35%	No	17/09/2026	Individual	Yes	Open
Final Exam	30%	No	Exam period	Individual	No	Observed

Project Presentation

Assessment Type ¹: Presentation task

Indicative Time on Task ²: 35 hours

Due: **Week 13**

Weighting: **35%**

Groupwork/Individual: Individual

Short extension ³: No

AI Approach: Observed

The final presentation will be held in Week 13 and will focus on students' Computational Fluid Dynamics (CFD) investigations. Each student is required to present their findings based on a case assigned according to their student ID.

On successful completion you will be able to:

- Apply advanced mathematical and numerical theories within the domain of numerical simulations to effectively resolve complex real-world engineering challenges.
- Evaluate and generate inventive design solutions, showcasing adept critical thinking skills through the application of computational techniques.
- Exhibit proficiency in utilizing CFD tools, essential within the realm of computational modeling in engineering.
- Apply effective communication skills through the creation of well-structured written reports.
- Proficiently apply problem-solving techniques aligned with industry requirements.

Professional Engagement and Logbook

Assessment Type ¹: Portfolio

Indicative Time on Task ²: 32 hours

Due: **17/09/2026**

Weighting: **35%**

Groupwork/Individual: Individual

Short extension ³: Yes

AI Approach: Open

Students will use the logbook to document the results of their numerical simulations performed using MATLAB. The logbook should effectively integrate both theoretical and computational elements in a structured and coherent manner. The logbook will be assessed during the first half of the session.

On successful completion you will be able to:

- Apply advanced mathematical and numerical theories within the domain of numerical simulations to effectively resolve complex real-world engineering challenges.

- Evaluate and generate inventive design solutions, showcasing adept critical thinking skills through the application of computational techniques.
- Apply effective communication skills through the creation of well-structured written reports.
- Proficiently apply problem-solving techniques aligned with industry requirements.

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 3 hours

Due: **Exam period**

Weighting: **30%**

Groupwork/Individual: Individual

Short extension ³: No

AI Approach: Observed

You will undertake a final examination during the formal examination period.

On successful completion you will be able to:

- Apply advanced mathematical and numerical theories within the domain of numerical simulations to effectively resolve complex real-world engineering challenges.
- Evaluate and generate inventive design solutions, showcasing adept critical thinking skills through the application of computational techniques.
- Exhibit proficiency in utilizing CFD tools, essential within the realm of computational modeling in engineering.
- Demonstrate domain-specific knowledge to address problems that emulate real-world situations.
- Proficiently apply problem-solving techniques aligned with industry requirements.

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
- [Academic Success](#) 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.

³ An automatic short extension is available for some assessments. Apply through the [Service Connect Portal](#).

Delivery and Resources

There is no single core text for this course. However, the following texts are recommended:

- 1- "Applied Numerical Methods for Engineers and Scientists" by Singiresu S. Rao
- 2- "Computational Fluid Dynamics- A Practical Approach by Jiyuan Tu, Guan Heng Yeoh and Chaoqun Liu
- 3- "Computational Methods for Fluid Dynamics" by Joel H. Ferziger, Milovan Perić, Robert L. Street

Unit Schedule

Lectures : Week 1-13

Practicals : Week 2-13

For full unit schedule please refer to iLearn.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://policies.mq.edu.au) (<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) (<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) (<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/>

Academic Success

[Academic Success](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Ask a Study Coach](#)
- [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 <https://students.mq.edu.au/support/technology/service-desk>.

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.

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1:50%
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1:50%
	1.3 In-depth understanding of specialist bodies of knowledge	
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	ULO2:50%
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO2:50% ULO3:50%
	2.2 Fluent application of engineering techniques, tools and resources.	ULO3:50%
	2.3 Application of systematic engineering synthesis and design processes.	
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	
	3.2 Effective oral and written communication in professional and lay domains.	ULO4:100%
	3.3 Creative, innovative and pro-active demeanour.	
	3.4 Professional use and management of information.	

	3.5 Orderly management of self, and professional conduct.	
	3.6 Effective team membership and team leadership	

Unit information based on version 2026.02 of the [Handbook](#)