



# MECH2005

## Engineering Materials

Session 2, In person-scheduled-weekday, North Ryde 2024

*School of Engineering*

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#### Disclaimer

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## General Information

Unit convenor and teaching staff

Unit Convenor

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Unit Co-Convenor

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Credit points

10

Prerequisites

MECH1001

Corequisites

Co-badged status

Unit description

The purpose of this unit is to develop an understanding and insight into the design and utilisation of engineering materials. Students will develop knowledge of the mechanical properties of different materials in relations to the physical and chemical phenomenon. Topics covered in this unit will include physical and chemical nature of materials, the effects of nano-, micro- and macro- structures in material properties, considerations in modifying mechanical properties in metallic systems, composite design and materials selection.

## 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:** Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.

**ULO2:** Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.

**ULO3:** Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.

**ULO4:** Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as well as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.

**ULO5:** Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.

**ULO6:** Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

## General Assessment Information

### Grading and Passing Requirement

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD). For further details about grading, please refer to the policies and procedures section below.

### *Late Submissions*

The late submission policies adopted in this unit are in line with the general faculty's policy on assessment submission deadlines, including late submissions. 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, for a written report or presentation assessment that 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 11:59 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, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration. Assessments where Late Submissions will be accepted.

**Special consideration for the quiz and 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 declare yourself available for a resit during the supplementary examination period, and you 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 their supplementary examination's exact date and time. For the quiz, the convenor will discuss with the students and arrange for a suitable time to take the quiz.

### ***Final Examinations***

- Final examinations will take place at the end of the semester. For further information, please refer to the Examination Timetable website on [www.mq.edu.au](http://www.mq.edu.au)

### ***Other Relevant Information***

- Only in-class assessments should be handwritten, in blue or black ink; all other assessments should be typed.
- Diagrams should be drawn neatly and be presented in a legible manner. Any work that is deemed untidy may not be marked or marks may be deducted.
- All numerical answers must have correct units and an appropriate number of trailing digits. A mark deduction will be made for answers without appropriate units and trailing digits.
- All citations should be referenced appropriately.
- Do not exceed the maximum length requirement. Any work that exceeds the specified word or page limit may not be marked or marks may be deducted.
- Your name, your student number, your tutor's name and your workshop class time should be clearly indicated on your assignment. Assignments without this information may not be marked or marks may be deducted.
- All submitted assignments should have the Faculty coversheet attached. Assignments without coversheet will not be marked.
- All submitted assignments should be submitted on iLearn via Turnitin.

## **Assessment Tasks**

Name	Weighting	Hurdle	Due
<a href="#">Assignments</a>	20%	No	Weeks 6 and 9
<a href="#">Quiz</a>	40%	No	Weeks 4, 7, 10 and 12
<a href="#">Final Exam</a>	40%	No	See Exam Timetable

## **Assignments**

Assessment Type <sup>1</sup>: Essay

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Weeks 6 and 9**

Weighting: **20%**

This assessment consists of two individual assignments, which will build students' progressive understanding of the unit content.

On successful completion you will be able to:

- Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.
- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as well as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

## Quiz

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Weeks 4, 7, 10 and 12**

Weighting: **40%**

This Assessment Task is a fortnightly in-class quiz that will cover the information of the preceding 2 Lectures. It aims to build an environment of progressive learning and enhance students' understanding of relevant course materials being delivered in the lecture.

On successful completion you will be able to:

- Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.
- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as well as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

## Final Exam

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 24 hours

Due: **See Exam Timetable**

Weighting: **40%**

The final examination will cover the entire unit

On successful completion you will be able to:

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- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their

limitations, and will be able to account for the observed features of a stress-strain curve.

- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as well as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

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<sup>1</sup> 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.

<sup>2</sup> 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

All slides and materials, recommended book list and pdfs will be provided on iLearn.

Unit details can be found on iLearn, <https://ilearn.mq.edu.au/login/MQ/>

Useful reading and websites will be posted to iLearn.

Useful urls [www.materialsaustralia.com.au](http://www.materialsaustralia.com.au) [www.engineersaustralia.org.au](http://www.engineersaustralia.org.au)

Databases Macquarie Library has a collection of various databases available to MQ students.

<http://www.mq.edu.au/about/campus-services-and-facilities/library>

How to find a government report

This short video provides you with tips and tricks for finding government reports easily using Google

<https://www.youtube.com/watch?v=0grCZuGLkpg>

Acknowledging the words and ideas of others

This video introduces Referencing the ideas and works of others, copyright and creative commons licencing.

[https://www.youtube.com/watch?v=QXlo98z\\_yFs](https://www.youtube.com/watch?v=QXlo98z_yFs)

## 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](https://connect.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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/](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.

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Unit information based on version 2024.02 of the [Handbook](#)