



MECH2005

Engineering Materials

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

School of Engineering

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	5
<u>Delivery and Resources</u>	8
<u>Unit Schedule</u>	9
<u>Policies and Procedures</u>	9

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General Information

Unit convenor and teaching staff

Unit Convenor

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Tuesdays 11:30am-12:30pm

Lecturer

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Level 1, 50 Waterloo Road, School of Engineering

Wed 11:30am-12:00pm

Credit points

10

Prerequisites

MECH1001 or ENGG150 or ENGG1050

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; these materials include metals, polymers, ceramics, and composites. 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: Explain the role of different types of materials in a composite, and the function of secondary reinforcing materials in a matrix, in particular their role in increasing strength and resistance to fracture.

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 Assessment Submission Penalty

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. This is to allow the timely release of assessments to the rest of the class.

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.
- 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.

Practical Component

Attendance of practical classes is **MANDATORY** before submitting the lab report. Lab reports submitted without attending the practical session will get a grade of '0' even if the assessment is submitted by the due date. A special consideration request must be submitted and approved if any student is unable to attend a practical session to organize alternative arrangements.

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.

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, ULO2

	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO4
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	ULO1, ULO5
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO1
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO3
	2.2 Fluent application of engineering techniques, tools and resources.	ULO6
	2.3 Application of systematic engineering synthesis and design processes.	ULO5
	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.	
	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	

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Quiz</u>	40%	No	Week 4, Week 7, Week 10, Week 12
<u>Assignments</u>	20%	No	Week 6, Week 11
<u>Final Exam</u>	40%	No	Please refer to exam timetable

Quiz

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 30 hours

Due: **Week 4, Week 7, Week 10, Week 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:

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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.
- Explain the role of different types of materials in a composite, and the function of secondary reinforcing materials in a matrix, in particular their role in increasing strength and resistance to fracture.

Assignments

Assessment Type ¹: Essay

Indicative Time on Task ²: 10 hours

Due: **Week 6, Week 11**

Weighting: **20%**

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

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- Explain the role of different types of materials in a composite, and the function of secondary reinforcing materials in a matrix, in particular their role in increasing strength and resistance to fracture.

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 20 hours

Due: **Please refer to exam timetable**

Weighting: **40%**

The final examination will cover the entire unit

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- 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.
- Explain the role of different types of materials in a composite, and the function of secondary reinforcing materials in a matrix, in particular their role in increasing strength and resistance to fracture.

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

Recommended and/or Required texts

The following textbook is recommended, but it is not compulsory: Materials Science and Engineering: An Introduction, 10th Australia and New Zealand Edition

<https://ebookcentral-proquest-com.simsrad.net.ocs.mq.edu.au/lib/MQU/detail.action?docID=5633322>

Useful urls

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

Useful reading and websites will be posted to iLearn.

www.materialsaustralia.com.au/

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

Unit Schedule

Refer to iLearn and lecture notes for the unit schedule

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 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.