ENGG250

Materials

S1 Day 2016

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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Credit points
3

Prerequisites
(ENGG170 or ELEC170 or ENGG150) and (MATH132 or MATH135)

Corequisites

Co-badged status

Unit description
This unit provides an introduction to engineering materials and the relationship of mechanical, electrical and chemical properties to the structure of materials in an engineering context. Mechanical and electrical properties will be of particular focus and be the subject of lectures and practical giving an underpinning to an appreciation of engineering materials, at present and in their future development.

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:

Students will understand the basis upon which materials are categorised as metals,

ceramics, polymers or composites; electrical insulators, semiconductors or conductors; brittle or ductile materials.

Students will be able to account for the observed difference in conductivity between insulators, conductors and semiconductors. Students will understand the concept of majority charge carriers in semiconductors, and will thus be able to explain the difference between p-type and n-type semiconductors.

Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.

Students will be able to account for the observed features of a stress-strain curve, for ductile materials. Students will have knowledge of methods of increasing yield strength, including work hardening, solute strengthening, grain refinement and precipitation hardening. Steels will be used as a case study for each of these, leading to a familiarity with a dominant group of engineering materials.

Students will understand the role of different types of material in a composite. Students will be able to explain the function of a material dispersion in a matrix of a second material; and will be able to explain how this increases strength and also increases resistance to cracking.

General Assessment Information

Students must attend a minimum of 75% of workshops (/tutorials/pracs) to be eligible for the final exam.

Any student who misses 15 mins of a workshop will be deemed absent for that workshop.

Late assignments will incur at least a 50% mark penalty.

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

coversheets will not be marked. (http://web.science.mq.edu.au/intranet/lt/barcode/coversheet.php)

All submitted assignments should be submitted on iLearn via Turnitin.

- In order to pass this unit, students must achieve **an overall mark of 50%, including satisfactory performance in all aspects of the unit** including the final examination.
- Attendance at workshop sessions is compulsory. **A minimum of 75% of workshops must be attended to be eligible for the sitting of the final exam**.
- Student's attendance is based on workshop participation. **All class activities are to be dated and documented in a bound A4 book**.
- Any student who **misses 20 mins of a workshop will be deemed** absent for that workshop.

Assessment Tasks

Name	Weighting	Due
Materials Assignment 1	10%	End week 4
Test 1	15%	Week 5
Materials Assignment 2	10%	End week 8
Test 2	15%	Week 10
Materials Assignment 3	10%	End week 12
Examination	40%	See examination timetable

Materials Assignment 1

Due: **End week 4**
Weighting: **10%**

Introduction to materials; free electron theory.

On successful completion you will be able to:

- Students will understand the basis upon which materials are categorised as metals, ceramics, polymers or composites; electrical insulators, semiconductors or conductors; brittle or ductile materials.

Test 1

Due: **Week 5**
Weighting: **15%**

Test (on weeks 1 - 4).

On successful completion you will be able to:

- Students will understand the basis upon which materials are categorised as metals, ceramics, polymers or composites; electrical insulators, semiconductors or conductors; brittle or ductile materials.
- Students will be able to account for the observed difference in conductivity between insulators, conductors and semiconductors. Students will understand the concept of majority charge carriers in semiconductors, and will thus be able to explain the difference between p-type and n-type semiconductors.

Materials Assignment 2

Due: **End week 8**
Weighting: **10%**

Electrical and Mechanical properties of materials.

On successful completion you will be able to:

- Students will be able to account for the observed difference in conductivity between insulators, conductors and semiconductors. Students will understand the concept of majority charge carriers in semiconductors, and will thus be able to explain the difference between p-type and n-type semiconductors.
- Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.

Test 2

Due: **Week 10**
Weighting: **15%**

Test (on weeks 5 - 9)

On successful completion you will be able to:

- Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.
- Students will be able to account for the observed features of a stress-strain curve, for

ductile materials. Students will have knowledge of methods of increasing yield strength, including work hardening, solute strengthening, grain refinement and precipitation hardening. Steels will be used as a case study for each of these, leading to a familiarity with a dominant group of engineering materials.

Materials Assignment 3

Due: **End week 12**
Weighting: **10%**

Composite materials

On successful completion you will be able to:

- Students will be able to account for the observed features of a stress-strain curve, for ductile materials. Students will have knowledge of methods of increasing yield strength, including work hardening, solute strengthening, grain refinement and precipitation hardening. Steels will be used as a case study for each of these, leading to a familiarity with a dominant group of engineering materials.
- Students will understand the role of different types of material in a composite. Students will be able to explain the function of a material dispersion in a matrix of a second material; and will be able to explain how this increases strength and also increases resistance to cracking.

Examination

Due: **See examination timetable**
Weighting: **40%**

ENGG250 final examination (on the entire unit)

On successful completion you will be able to:

- Students will understand the basis upon which materials are categorised as metals, ceramics, polymers or composites; electrical insulators, semiconductors or conductors; brittle or ductile materials.
- Students will be able to account for the observed difference in conductivity between insulators, conductors and semiconductors. Students will understand the concept of majority charge carriers in semiconductors, and will thus be able to explain the difference between p-type and n-type semiconductors.
- Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.

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Delivery and Resources

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.engineersaustralia.org.au

Google Scholar

This video provides a quick introduction to Google Scholar and how to search it effectively. It also shows how to access it, to ensure you link to the full text material Macquarie University Library already subscribes to.

https://www.youtube.com/watch?v=jI5ixQmCXDU&feature=youtu.be

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=2vqS4P_Q2z8

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

		Lectures
Week 1	3-Mar	Basic Course outline/introduction to materials/Bonding and e interaction

Week 2	10-Mar	Millar index's/ X'stal structures/semiconductor
Week 3	17-Mar	Free electron theory/Drude conduction model
Week 4	24-Mar	Band theory valance conduction etc.
Week 5	31-Mar	**Test1/** Band gap/Brillouin zone
Week 6	7-Apr	PN Junction/BPJ
Break		
Week 7	28-Apr	Metals/Phase diagram
Week 8	5-May	Phase diagram/ Hardening techniques
Week 9	12-May	Steels/ **Test 2**
Week 10	19-May	Ceramics and plastics by Kaveh/Nic
Week 11	26-May	Particulate/ Fibrous composites by Kaveh/Nic
Week 12	2-Jun	Structural composite by Kaveh/Nic
Week 13	9-Jun	Material selections/exam revision by Kaveh/Nic

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, 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.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

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.

Graduate Capabilities

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where

relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Students will understand the basis upon which materials are categorised as metals, ceramics, polymers or composites; electrical insulators, semiconductors or conductors; brittle or ductile materials.
- Students will be able to account for the observed difference in conductivity between insulators, conductors and semiconductors. Students will understand the concept of majority charge carriers in semiconductors, and will thus be able to explain the difference between p-type and n-type semiconductors.
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- Students will understand the role of different types of material in a composite. Students will be able to explain the function of a material dispersion in a matrix of a second material; and will be able to explain how this increases strength and also increases resistance to cracking.

Assessment tasks

- Materials Assignment 1
- Test 1
- Materials Assignment 2
- Test 2
- Materials Assignment 3
- Examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and

systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.
- Students will be able to account for the observed features of a stress-strain curve, for ductile materials. Students will have knowledge of methods of increasing yield strength, including work hardening, solute strengthening, grain refinement and precipitation hardening. Steels will be used as a case study for each of these, leading to a familiarity with a dominant group of engineering materials.
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- Test 2
- Materials Assignment 3
- Examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Students will have a good understanding of the behaviour of semiconductor diodes; and will hence be able to explain electron flow in a PNP or NPN transistor.
- Students will be able to account for the observed features of a stress-strain curve, for ductile materials. Students will have knowledge of methods of increasing yield strength,

including work hardening, solute strengthening, grain refinement and precipitation hardening. Steels will be used as a case study for each of these, leading to a familiarity with a dominant group of engineering materials.

- Students will understand the role of different types of material in a composite. Students will be able to explain the function of a material dispersion in a matrix of a second material; and will be able to explain how this increases strength and also increases resistance to cracking.

Assessment tasks

- Materials Assignment 2
- Test 2
- Materials Assignment 3
- Examination