ENGG250

Materials

S1 Day 2015

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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Head tutor
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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 bases 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 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.

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%**

On successful completion you will be able to:

- Students will understand the bases 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%**

On successful completion you will be able to:

- Students will understand the bases 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%**

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%**

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 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%**

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 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%**

On successful completion you will be able to:

- Students will understand the bases 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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- 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.

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 full text material Macquarie University Library already subscribe 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

Date		Topic	
Monday, 23 February 2015	Lecture 1	Introduction - classes of materials, crystal structures	
Monday, 2 March 2015	Lecture 2	Free electron theory	
Week of 2 March	Workshop 1	Material types	
Monday, 9 March 2015	Lecture 3	Band theory: conductors, semiconductors, insulators	
Week of 9 March	Workshop 2	Electrical properties	
Monday, 16 March 2015	Lecture 4	P,N type semiconductors: majority charge carriers	
Week of 16 March	Workshop 3	Semiconductors	
ASSIGNMENT DUE			
Monday 23 March 2015	Lecture 5	P-N junctions, diodes, transistors.	(+ IN-CLASS TEST)
Week of 23 March	Workshop 4	Diodes	
Monday,30 March 2015	Lecture 6	Metals: mechanical properties, metals under stress	
Week of 30 March	Workshop 5	Hardness testing	
MID-SEMESTER BREAK			

Monday, 20 April 2015	Lecture 7	Strengthening of metals
Week of 20 April	Workshop 6	Strengthening of metals
Monday, 27 April 2015	Lecture 8	Testing of metals
Week of 27 April	Workshop 7	Tensile testing of aluminium and steel
ASSIGNMENT DUE		
Monday, 4 May 2015	Lecture 9	Polymer and ceramic materials
Week of 4 May	Workshop 8	Tensile testing of polymers and ceramics
Monday, 11 May 2015	Lecture 10	Composite materials (+ IN-CLASS TEST)
Week of 11 May	Workshop 9	Concrete testing
Monday, 18 May 2015	Lecture 11	Composite materials
Week of 18 May	Workshop 10	Fibre composite materials
Monday, 25 May 2015	Lecture 12	Composite materials
Week of 25 May	Workshop 11	Structural composite materials
ASSIGNMENT DUE		
Monday 1 June 2015	Lecture 13	Composite materials
Week of 1 June	Workshop 12	Hot seat
EXAMINATION		

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use 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 bases 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 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 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 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 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