ENGG250

Materials

S1 Day 2014

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 ((PHYS140 and PHYS143) or (PHYS106 and PHYS107)) and (MATH133 or MATH136)

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 hece 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 materil 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

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 hece 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 hece 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.

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 hece 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 materil 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.

No changes - this is a new unit.

Unit Schedule

Date		Topic	
Monday, 3 March 2014	Lecture 1	Introduction	
Monday, 10 March 2014	Lecture 2	Band theory	
Week of 10 March	Practical 1	Material types	
Monday, 17 March 2014	Lecture 3	Majority carriers	
Week of 17 March	Tutorial 1	Electrical properties	
Monday, 24 March 2014	Lecture 4	P-N junctions	
Week of 24 March	Tutorial 2	Semiconductors	
ASSIGNMENT DUE			
Monday 31 March 2014	Lecture 5	Diodes	(+ IN-CLASS TEST)
Week of 31 March	Tutorial 3	Diodes	
Monday, 7 April 2014	Lecture 6	Transistors	
Week of 7 April	Tutorial 4	Hot seat	
MID-SEMESTER BREAK			

Monday, 28 April 2014	Lecture 7	Stress & strain
Week of 28 April	Practical 2	Stress/strain curves
Monday, 5 May 2014	Lecture 8	Strength and design
Week of 5 May	Tutorial 5	Strength and selection
ASSIGNMENT DUE		
Monday, 12 May 2014	Lecture 9	Strengthening materials
Week of 12 May	Practical 3	Strengthening materials
Monday, 19 May 2014	Lecture 10	Composite materials (+ IN-CLASS TEST)
Week of 19 May	Tutorial 6	Composite Materials
Monday, 26 May 2014	Lecture 11	Composite Materials
Week of 26 May	Practical 4	Composite Materials
Monday, 2 June 2014	Lecture 12	Composite materials
Week of 2 June	Tutorial 8	Composite Materials
Monday 9 June	Public holiday	
Week of 9 June	Tutorial	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/

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 hece 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 materil 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 hece 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 materil 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

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 hece 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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