



ENEG11008 *Materials for Engineers*

Term 1 - 2023

Profile information current as at 05/10/2023 08:53 am

All details in this unit profile for ENEG11008 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

ENEG11008: Materials for Engineers introduces you to the essential knowledge of materials science and the ways in which engineers understand, select and use materials and processes for engineering applications. In this unit, you will gain knowledge of engineering materials, microstructure and its effect on the material properties. You will learn how to identify and explain the properties of engineering materials and processes and how to classify these materials. You will also learn how to select engineering materials and processes for engineering applications, as well as to conduct material tests and report on their results. Throughout this unit, you will develop teamwork, research and communication skills. In this unit, you must complete compulsory practical activities. Refer to the Engineering Undergraduate Course Moodle site for proposed dates.

Details

Career Level: *Undergraduate*

Unit Level: *Level 1*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

There are no requisites for this unit.

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

Offerings For Term 1 - 2023

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Mixed Mode
- Rockhampton

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Residential Schools

This unit has a Compulsory Residential School for distance mode students and the details are:

Click here to see your [Residential School Timetable](#).

Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

[Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

[Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Online Quiz(zes)**

Weighting: 20%

2. **Practical and Written Assessment**

Weighting: 20%

3. **Written Assessment**

Weighting: 25%

4. **Online Test**

Weighting: 35%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the [CQUniversity Policy site](#).

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Student unit evaluation

Feedback

It was pointed out that the unit coordinator sometimes mentioned there were good discussions at local / Zoom tutorial classes. This made other students feel disadvantaged.

Recommendation

Ensure that the same and consistent messages are delivered across cohorts.

Feedback from Email and direct interaction

Feedback

Students commented that the additional online materials for the lab preparation were very useful and easy to follow.

Recommendation

Improve the unit contents and introduce more modules to reinforce students' understanding and preparedness.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Define the atomic and microstructure of engineering materials and their relationship to physical behaviour
2. Classify engineering materials into metals, ceramics, polymers and composites
3. Characterise materials for mechanical properties based on Australian Standards and ASTM methods
4. Explain the role of mechanical, electrical, optical and thermal properties of materials in engineering
5. Apply the frameworks used to select materials for engineering applications.

The Learning Outcomes for this unit are linked with the Engineers Australia Stage 1 Competency Standards for Professional Engineers in the areas of 1. Knowledge and Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:

Introductory

- 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1N 3N)
- 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 2N 4N 5N)
- 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1N 2N 3N 5N)
- 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1N 2N 3N 4N 5N)
- 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1N 5N)
- 2.3 Application of systematic engineering synthesis and design processes. (LO: 5N)
- 3.2 Effective oral and written communication in professional and lay domains. (LO: 1N 2N 3N 4N 5N)
- 3.4 Professional use and management of information. (LO: 5N)
- 3.5 Orderly management of self, and professional conduct. (LO: 5N)
- 3.6 Effective team membership and team leadership. (LO: 5N)

Intermediate

- 1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1I 2N 3I 4N)
- 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 2N 4I 5N)
- 2.2 Fluent application of engineering techniques, tools and resources. (LO: 3N 4N 5I)
- 3.3 Creative, innovative and pro-active demeanour. (LO: 5I)

Note: LO refers to the Learning Outcome number(s) which link to the competency and the levels: N - Introductory, I - Intermediate and A - Advanced.

Refer to the Engineering Undergraduate Course Moodle site for further information on the Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course level mapping information
<https://moodle.cqu.edu.au/course/view.php?id=1511>

Alignment of Learning Outcomes, Assessment and Graduate Attributes



Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Online Quiz(zes) - 20%	•	•			
2 - Written Assessment - 25%				•	•
3 - Practical and Written Assessment - 20%	•		•		
4 - Online Test - 35%		•	•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
1 - Communication	•	•	•	•	•
2 - Problem Solving	•				•
3 - Critical Thinking				•	•
4 - Information Literacy	•	•			•
5 - Team Work			•		•
6 - Information Technology Competence			•		•
7 - Cross Cultural Competence					
8 - Ethical practice					
9 - Social Innovation					
10 - Aboriginal and Torres Strait Islander Cultures					

Textbooks and Resources

Textbooks

ENEG11008

Prescribed

Materials Science and Engineering: an introduction

Edition: 10th edn (2019)

Authors: David G. Rethwisch and William Callister

John Wiley & Sons

Milton, QLD, Australia

ISBN: 9781119594178

Binding: Paperback

Additional Textbook Information

This text can be accessed online at the CQUni Library website. If you prefer your own copy, you can purchase one at the CQUni Bookshop here: <http://bookshop@cqu.edu.au> (search on the unit code)

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)

Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)
For further information, see the Assessment Tasks.

Teaching Contacts

Jay Sul Unit Coordinator

j.sul@cqu.edu.au

Schedule

Week 1 - 06 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Introduction to the unit and information session• Introduction to materials science and engineering• Materials classification and their key characteristics	<ul style="list-style-type: none">• Chapter 1: 1.2 - 1.5• Lecture note	

Week 2 - 13 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Mechanical properties of materials• Standards for materials testing	<ul style="list-style-type: none">• Chapter 6: 6.1 - 6.3, 6.5 - 6.7 & 6.10• Lecture note	

Week 3 - 20 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Failure of engineering materials: ductile and brittle failure• Examples and case studies	<ul style="list-style-type: none">• Chapter 8: 8.1 - 8.6• Lecture note	<ul style="list-style-type: none">• Online Quiz #1 open

Week 4 - 27 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Principles of materials selection and materials selection process Introduction to Granta EduPack Examples and case studies 	<ul style="list-style-type: none"> Unit Moodle page and lecture note 	<ul style="list-style-type: none"> Online Quiz #1 close Residential school

Week 5 - 03 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Microstructural aspects of engineering materials: bonding Microstructural aspects of engineering materials: crystal structures 	<ul style="list-style-type: none"> Chapter 2: 2.1 - 2.7 Chapter 3: 3.1 - 3.5, 3.7 & 3.13 - 3.15 Lecture note 	

Vacation Week - 10 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 17 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Microstructural aspects of engineering materials: Imperfection in solids Dislocations and strengthening mechanisms Applications and processing 	<ul style="list-style-type: none"> Chapter 4: 4.1 - 4.4 Chapter 7: 7.1 - 7.4, 7.6 & 7.8 - 7.13 Lecture note 	<ul style="list-style-type: none"> Online Quiz #2 open

Week 7 - 24 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Microstructural aspects of engineering materials: Diffusion in solids Fick's first law Fick's second law 	<ul style="list-style-type: none"> Chapter 5: 5.1 - 5.3 & 5.5 Lecture note 	<ul style="list-style-type: none"> Online Quiz #2 close <p>Lab worksheet Due: Week 7 Monday (24 Apr 2023) 11:59 pm AEST</p>

Week 8 - 01 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Phase diagram and phase transformations Alteration of mechanical properties 	<ul style="list-style-type: none"> Chapter 9: 9.1 - 9.13, 9.6 - 9.12, 9.18 Chapter 10: 10.5, 10.7 Chapter 11: 11.1 - 11.3 Lecture note 	

Week 9 - 08 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Thermal properties of materials Electrical and magnetic properties of materials 	<ul style="list-style-type: none"> Chapter 18: 18.2, 18.3, 18.7, 18.8, 18.11, 18.13, 18.15, 18.18 Chapter 19: 19.1 - 19.5 Chapter 20: 20.2, 20.7, 20.9 & 20.11 Lecture note 	<ul style="list-style-type: none"> Online Quiz #3 open <p>Materials selection process Due: Week 9 Monday (8 May 2023) 11:59 pm AEST</p>

Week 10 - 15 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Non-metallic materials: ceramic, polymers and composites Environmental issues and recycling of materials 	<ul style="list-style-type: none"> Tutorial materials Lecture note 	<ul style="list-style-type: none"> Online Quiz #3 close

Week 11 - 22 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Materials in the resources industry 	<ul style="list-style-type: none"> Lecture note 	

Week 12 - 29 May 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> Corrosion and materials for batteries Unit review and tips on preparing for the final test 	<ul style="list-style-type: none"> Chapter 17: 17.2 - 17.10 Lecture note 	<ul style="list-style-type: none"> Online Quiz #4 open

Review/Exam Week - 05 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 12 Jun 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Assessment Tasks

1 Tri-weekly online quiz

Assessment Type

Online Quiz(zes)

Task Description

This assessment consists of four tri-weekly online quizzes which can be accessed via the unit's Moodle site. A set of multiple-choice, short answer, drag-and-drop, and calculation questions is assigned every three weeks (viz. weeks 3, 6, 9 and 12). Each online quiz will cover the contents in the previous two weeks and the corresponding week (e.g. Online quiz 1 covers the contents in Weeks 1 to 3).

Each online quiz will remain open from Wednesday in the testing weeks until midnight Sunday in the following weeks so that you can take the online quizzes whenever you are available and ready. You will be allowed to attempt each quiz twice and the highest mark of the two attempts will be registered in Moodle Grade. There will be a time limit of an hour for 12 questions for each quiz. Once started, it cannot be paused and it will become inaccessible after its closure. There is no restriction on the venue and materials you can use. However, you are strongly recommended to prepare for the quizzes due to their time limit.

Number of Quizzes

4

Frequency of Quizzes

Other

Assessment Due Date

Four tri-weekly online quizzes are held in Weeks 3, 6, 9 and 12.

Return Date to Students

Students will receive their marks immediately after the due date of each quiz.

Weighting

20%

Minimum mark or grade

50%

Assessment Criteria

- The total marks of each of four online quizzes will be scaled to out of 5 marks for the unit total.
- Numerical answers must be entered to 3 significant figures.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Students can submit their attempt to check their answer or it will be submitted by itself on the due date.

Learning Outcomes Assessed

- Define the atomic and microstructure of engineering materials and their relationship to physical behaviour
- Classify engineering materials into metals, ceramics, polymers and composites

2 Lab worksheet

Assessment Type

Practical and Written Assessment

Task Description

This assessment pertains to the completion and submission of a laboratory worksheet. Four laboratory activities will be carried out as a group: Tensile test, Hardness test, Charpy impact test, and Piano wires. You will attend the residential school, participate in the activity, perform experiments, collect data and then carry out related tasks based on the experimental activity. You, as an individual, will be required to fill out the lab worksheet that will be provided on the unit's Moodle site for these four laboratory activities.

Assessment Due Date

Week 7 Monday (24 Apr 2023) 11:59 pm AEST

Students will submit it to the unit's Moodle site.

Return Date to Students

Week 9 Monday (8 May 2023)

Students can check their marks and feedback from the unit's Moodle site.

Weighting

20%

Assessment Criteria

Each of the tasks given in the lab worksheet template will be assessed for

- Accurate results
- Accurate plots with correct axis titles and legends
- Use of correct units and significant figures
- Relevant discussions with supporting references

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Define the atomic and microstructure of engineering materials and their relationship to physical behaviour
- Characterise materials for mechanical properties based on Australian Standards and ASTM methods

3 Materials selection process

Assessment Type

Written Assessment

Task Description

Your task is to complete the materials selection process template by analysing a product / application of your interest and suggesting an alternative material(s) to improve its design for any purpose (e.g. process and/or manufacturing cost, performance, better use and environmental friendliness, improved safety, improved operation conditions, etc.).

Your approach to this task should include (but not be limited to):

- Choose an engineering design (application) of your interest. This can be ANYTHING that is composed of materials. It can range from a small and simple object, such as a ballpoint pen or a bicycle, to a complex engineering structure, such as a spaceship or a modern building
- Investigate the chosen application to identify materials used and select a material (up to two) that has more room to improve
- Analyse the material(s) to identify its design requirements as per the following criteria: **Function**- What does the component do?, **Constraints**- What non-negotiable conditions must be met? What are negotiable?, **Objective**- What is to be maximised or minimised?, and **Free variables**- What parameters of the problem is the designer free to change?
- Look for possible alternatives and eliminate those that cannot meet the criteria set earlier
- Rank the short-listed materials after screening
- Further investigation into the top-ranked material to support
- Report your findings and the rationale behind your objectives and detail the procedures

Assessment Due Date

Week 9 Monday (8 May 2023) 11:59 pm AEST

Students will complete and submit the materials selection process template to the link provided in the unit's Moodle site.

Return Date to Students

Week 11 Monday (22 May 2023)

Students can check their mark and feedback through the link used for submission.

Weighting

25%

Assessment Criteria

- Report language (15%)
- Justification (15%)
- Methodology (20%)
- Results and discussion (25%)
- Conclusions and recommendations (15%)
- References (10%)

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Explain the role of mechanical, electrical, optical and thermal properties of materials in engineering
- Apply the frameworks used to select materials for engineering applications.

4 Final online test

Assessment Type

Online Test

Task Description

This final online test as a summative assessment will test your achievement of the learning outcomes. It will consist of various types of questions, including calculation questions, drag-and-drop questions, multiple-choice questions, short & long description questions, etc. This final online test will cover all contents from Week 1 to Week 12, including the assignment and laboratory items. You could sit for this online test wherever you want while it is a synchronous timed online test for three hours which means every student starts at the same time. Only one attempt is allowed and it will be a three-hour online test. You are required to upload your workings for calculation questions to the unit's Moodle page after you finish the test.

Assessment Due Date

Students will be notified of the exact date and time for this assessment towards the end of the term.

Return Date to Students

Students will be able to access their results on the grade certification day.

Weighting

35%

Minimum mark or grade

50%

Assessment Criteria

Students will be assessed for the correctness of their answers to the questions given in the final test. Drag-and-drop and multiple-choice questions will be marked automatically while short and long description questions will be marked manually. Your understanding and own interpretation of the topics will be sought. You will need to present your answer for the calculation questions with correct units and relevant significant figures. You are required to upload your workings for the calculation questions after the test to prove your genuine attempt and to receive partial marks where applicable.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

A link for this final online test will be provided on the day of this test. You will be informed of further instructions.

Learning Outcomes Assessed

- Classify engineering materials into metals, ceramics, polymers and composites
- Characterise materials for mechanical properties based on Australian Standards and ASTM methods
- Explain the role of mechanical, electrical, optical and thermal properties of materials in engineering
- Apply the frameworks used to select materials for engineering applications.

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?



Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem