

ENG100 Materials in Engineering

School: School of Science, Technology and Engineering

2024 | Semester 1

UniSC Sunshine Coast
UniSC Moreton Bay

**BLENDED
LEARNING**

Most of your course is on campus but you may be able to do some components of this course online.

Please go to usc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

For all engineering disciplines, understanding how materials behave is core to selecting the right material to design innovative structures and devices. This course will introduce you to the most commonly used engineering materials' fundamental atomic structures and basic properties. It will develop your understanding of the micro- and macroscopic structures and behaviours of materials. You will gain an appreciation of a material's structure and how processing influences properties and performance to meet its engineering function.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	13 times
Seminar – First Seminar on campus, second seminar online	2hrs	Week 1	2 times
Tutorial/Workshop 1 – On campus	2hrs	Week 2	12 times
Laboratory 1 – On campus	2hrs	Week 4	2 times

1.3. Course Topics

Topics may include:

- General and functional classification of materials
- Atomic structure, crystalline structure and microstructure
- Electrical and magnetic properties of materials
- Mechanical characterisation of materials
- Deformation and strengthening
- Phase diagrams and microstructures in metallic materials
- Metals and alloys processing
- Ceramics, glasses, polymers, composites
- Construction materials

2. What level is this course?

100 Level (Introductory)

Engaging with discipline knowledge and skills at foundational level, broad application of knowledge and skills in familiar contexts and with support. Limited or no prerequisites. Normally, associated with the first full-time study year of an undergraduate program.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Competencies from multiple Professional Bodies (see below) *
1 Explain how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.	Knowledgeable	1, 1, 1.1.a, 1.1.a, 1.3.a, 1.3.a, 1.1, 1.1, 1.3, 1.3
2 Investigate the functional requirements of engineering devices and structures and match these with enabling materials properties to aid material selection for common engineering applications.	Creative and critical thinker	2, 2, 2.1.a, 2.1.a, 2.1.d, 2.1.d, 2.1, 2.1
3 Conduct collaborative laboratory experiments, applying theoretical and team-working skills.	Empowered Engaged	2, 2, 2.2.f, 2.2.f, 2.2, 2.2, 3.6.b, 3.6.b
4 Interpret and critically review information on environmental, economic and social issues involved in material selection and appreciate alternative solutions for sustainable engineering practice.	Ethical Sustainability-focussed	1, 1, 1.6.c, 1.6.c, 1.6, 1.6, 3, 3, 3.1.a, 3.1.a, 3.1, 3.1
5 Prepare a technical report based on materials engineering laboratory experiments.	Engaged	3, 3, 3.2.b, 3.2.b, 3.2, 3.2

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 ENGINEERING TECHNOLOGIST COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.1.a	Knowledge and Skill Base - Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain: Engages with the technology domain at a phenomenological level, applying sciences and engineering fundamentals to systematic investigation, interpretation, analysis and innovative solution of broadly-defined problems and engineering technology practice.
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the technology domain: Proficiently applies advanced technical knowledge and skills to deliver engineering outcomes in specialist area(s) of the technology domain and associated industry, commercial and community sectors.
1.6.c	Knowledge and Skill Base - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain: Appreciates the social, environmental and economic principles of sustainable engineering practice.
1.1	Knowledge and Skill Base: Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the technology domain.
1.6	Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain.
2	Elements of competency: Engineering Application Ability

CODE	COMPETENCY
2.1.a	Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: Identifies, discerns and characterises salient issues, determines and analyses causes and effects, justifies and applies appropriate simplifying assumptions, predicts performance and behaviour, synthesises solution strategies and develops substantiated conclusions.
2.1.d	Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: Recognises problems which have component elements and/or implications beyond the engineering technologist's personal expertise and correctly identifies the need for supplementary professional input.
2.2.f	Engineering Application Ability - Application of engineering techniques, tools and resources within the technology domain: Designs and conducts experiments, analyses and interprets result data and formulates reliable conclusions.
2.1	Engineering Application Ability: Application of established engineering methods to broadly-defined problem solving within the technology domain.
2.2	Engineering Application Ability: Application of engineering techniques, tools and resources within the technology domain.
3.6.b	Professional and Personal Attributes - Effective team membership and team leadership: Functions as an effective member or leader of diverse engineering teams, including those with multi-level, multi-disciplinary and multi-cultural dimensions.
3	Elements of competency: Professional and Personal Attributes
3.1.a	Professional and Personal Attributes - Ethical conduct and professional accountability: Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the technology domain.
3.2.b	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the technology domain.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.1.a	Knowledge and Skill Base - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline: Engages with the engineering discipline at a phenomenological level, applying sciences and engineering fundamentals to systematic investigation, interpretation, analysis and innovative solution of complex problems and broader aspects of engineering practice.
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the engineering discipline: Proficiently applies advanced technical knowledge and skills in at least one specialist practice domain of the engineering discipline.
1.6.c	Knowledge and Skill Base - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline: Appreciates the social, environmental and economic principles of sustainable engineering practice.
1.1	Knowledge and Skill Base: Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
1.6	Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline.
2	Elements of competency: Engineering Application Ability
2.1.a	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Identifies, discerns and characterises salient issues, determines and analyses causes and effects, justifies and applies appropriate simplifying assumptions, predicts performance and behaviour, synthesises solution strategies and develops substantiated conclusions.
2.1.d	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Investigates complex problems using research-based knowledge and research methods.

CODE	COMPETENCY
2.2.f	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Designs and conducts experiments, analyses and interprets result data and formulates reliable conclusions.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
2.2	Engineering Application Ability: Fluent application of engineering techniques, tools and resources.
3.6.b	Professional and Personal Attributes - Effective team membership and team leadership: Functions as an effective member or leader of diverse engineering teams, including those with multi-level, multi-disciplinary and multi-cultural dimensions.
3	Elements of competency: Professional and Personal Attributes
3.1.a	Professional and Personal Attributes - Ethical conduct and professional accountability: Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the engineering discipline.
3.2.b	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the engineering discipline.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.

5. Am I eligible to enrol in this course?

Refer to the [UniSC Glossary of terms](#) for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1. Pre-requisites

Not applicable

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

Early feedback will be provided through completion of weekly activities in workshops. Furthermore, feedback on each assessment will be provided which will be used to help with the following assessment.

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1a	Quiz/zes	Individual	10%	30 minutes	Week 4	Online Test (Quiz)
All	1b	Quiz/zes	Individual	10%	30 mins	Week 8	Online Test (Quiz)
All	1c	Quiz/zes	Individual	10%	30 mins	Week 11	Online Assignment Submission with plagiarism check
All	2	Practical / Laboratory Skills, and Written Piece	Individual	20%	1 Hours	Week 9	Online Assignment Submission with plagiarism check
All	3	Examination - Centrally Scheduled	Individual	50%	4 Hours	Exam Period	Online Assignment Submission with plagiarism check

All - Assessment Task 1a: Online Quiz

GOAL:	To apply theoretical knowledge of the fundamental properties of engineering materials, explaining how materials can be classified into different families and solve problems relating to the behaviour of materials in service.													
PRODUCT:	Quiz/zes													
FORMAT:	Online Quiz													
CRITERIA:	<table border="1"> <thead> <tr> <th>No.</th> <th></th> <th>Learning Outcome assessed</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Explanation for how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.</td> <td>1</td> </tr> <tr> <td>2</td> <td>Interpretation and critically review information on engineering, economic and social issues involved in material selection.</td> <td>4</td> </tr> <tr> <td>3</td> <td>Explain how to match function requirements to enabling materials properties.</td> <td>2</td> </tr> </tbody> </table>	No.		Learning Outcome assessed	1	Explanation for how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.	1	2	Interpretation and critically review information on engineering, economic and social issues involved in material selection.	4	3	Explain how to match function requirements to enabling materials properties.	2	
No.		Learning Outcome assessed												
1	Explanation for how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.	1												
2	Interpretation and critically review information on engineering, economic and social issues involved in material selection.	4												
3	Explain how to match function requirements to enabling materials properties.	2												

All - Assessment Task 1b: Online Quiz

GOAL:	To demonstrate and apply theoretical knowledge to the function of engineering materials relating to structural, thermal, electrical and magnetic applications.							
PRODUCT:	Quiz/zes							
FORMAT:	Online Quiz							
CRITERIA:	<table border="1"> <thead> <tr> <th>No.</th> <th></th> <th>Learning Outcome assessed</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Describe and explain how to match engineering function to enabling materials properties.</td> <td>1 2 4</td> </tr> </tbody> </table>	No.		Learning Outcome assessed	1	Describe and explain how to match engineering function to enabling materials properties.	1 2 4	
No.		Learning Outcome assessed						
1	Describe and explain how to match engineering function to enabling materials properties.	1 2 4						

All - Assessment Task 1c: Online Quiz

GOAL:	To demonstrate an understanding of microstructures and phase diagrams in engineering alloys and how this relates to mechanical properties.	
PRODUCT:	Quiz/zes	
FORMAT:	Online Quiz	

CRITERIA:	No.	Learning Outcome assessed
	1 Describe microstructures and relate to engineering properties.	1 2 4

All - Assessment Task 2: Laboratory report

GOAL:	To apply theoretical knowledge of the fundamental properties of engineering materials, explaining how materials can be classified into different families and solve problems relating to the behaviour of materials in service.	
PRODUCT:	Practical / Laboratory Skills, and Written Piece	
FORMAT:	Online Assignment	
CRITERIA:	No.	Learning Outcome assessed
	1 Explanation for how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.	1
	2 Investigation of principles of materials and manufacturing process selection to solve problems in materials and material selection for common engineering applications.	2
	3 Conduction of collaborative laboratory experiments, application of theoretical and team-working skills.	3
	4 Interpretation and critical review of information on engineering, economic and social issues involved in material selection.	4
	5 Preparation of a technical report based on materials engineering laboratory experiments.	5

All - Assessment Task 3: Examination

GOAL:	To demonstrate and apply theoretical knowledge of the properties of engineering materials and solve problems based on making an informed and reasoned choice for materials selection decisions in engineering practice.	
PRODUCT:	Examination - Centrally Scheduled	
FORMAT:	End of semester exam	
CRITERIA:	No.	Learning Outcome assessed
	1 Explanation of how material properties and behaviour are dependent on the crystallinity, microstructure, and phase composition and how these can be controlled by processing.	1
	2 Review of the common manufacturing processes available for engineering materials and the role of life cycle analysis.	
	3 Investigation of principles of materials and manufacturing process selection to solve problems in materials and material selection for common engineering applications.	2
	4 Interpretation and critical review of information on engineering, economic and social issues involved in material selection.	4

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

There are no required/recommended resources for this course.

8.2. Specific requirements

Not applicable

9. How are risks managed in this course?

Health and safety risks for this course have been assessed as low. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the health and safety risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training for students](#), and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

- The final mark is in the percentage range 47% to 49.4%
- The course is graded using the Standard Grading scale
- You have not failed an assessment task in the course due to academic misconduct

10.3. Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate (the rates are cumulative):

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task
- A result of zero is awarded for an assessment task submitted seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

Refer to the Assessment: Courses and Coursework Programs – Procedures

10.4. SafeUniSC

UniSC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUniSC by phone: [07 5430 1168](tel:0754301168) or using the [SafeZone](#) app. For general enquires contact

the SafeUniSC team by phone [07 5456 3864](tel:0754563864) or email safe@usc.edu.au.

The SafeUniSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call [07 5430 1226](tel:0754301226) or email studentwellbeing@usc.edu.au.

10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au.

10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email studentwellbeing@usc.edu.au or call 07 5430 1226.

10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email AccessAbility@usc.edu.au or call 07 5430 2890.

10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit <https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

10.9. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The [Student Charter](#) sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.10. General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au