COURSE OUTLINE

MEC301 Materials Technology

School: School of Science, Technology and Engineering

2023 | 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

In this course, you will learn about the processes involved in engineering the functional properties of materials to fit different applications. Engineers make devices that require the selection of materials fit for specific purposes. These materials are processed by shaping, joining and surface treating; all of which affects the material's microstructure and final properties. An important role for the engineer is to make meaningful connections between processed materials and its properties and performance in applications. This course is supported by labs and workshops that allow you to apply this knowledge to select materials and asses the required processing

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – 2 X 30 min narrated audio presentation of concepts	1hr	Week 1	13 times
Tutorial/Workshop 1 – Tutorial/workshop First 2 weeks on workshop working in small groups (1) in Materials selection software 3weeks, subsequent weeks are for a workshop on concepts in materials processing.	2hrs	Week 2	12 times
Tutorial/Workshop 2 – Online Course overview in Week 1, online overview in week 8 and week 13	2hrs	Week 1	3 times
Laboratory 1 – Labs run over 2 weeks where students rotate between microhardness and impact tests in weeks 5, and 6.	2hrs	Week 5	2 times

1.3. Course Topics

- Choosing from families of engineering materials
- Thermal processing of Materials
    - Diffusional processes
    - Phase diagrams
    - Heat treatments
- Engineering alloys
    - Steels
    - Non Ferrous alloys
- Degradation and failure of materials
    - Fracture
    - Fatigue
    - Corrosion
    - Wear

Materials selection process

2. What level is this course?

300 Level (Graduate)

Demonstrating coherence and breadth or depth of knowledge and skills. Independent application of knowledge and skills in unfamiliar contexts. Meeting professional requirements and AQF descriptors for the degree. May require pre-requisites where discipline specific introductory or developing knowledge or skills is necessary. Normally undertaken in the third or fourth 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...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Describe, explain and select appropriate materials for various engineering applications	Knowledgeable Creative and critical thinker	1.1, 1.4, 1.5, 2.1
2 Demonstrate and apply theoretical knowledge of material processing: fundamental atomistic transport phenomena, Phase diagrams, Non equilibrium processing, Heat treatment, Welding structures	Knowledgeable Creative and critical thinker	1.1, 1.2, 2.3
3 Demonstrate and apply the knowledge of mechanism of materials failure and degradation	Empowered	1.1, 1.4, 2.2
4 Interpret experimental and test results	Empowered	1.4, 2.1, 2.2, 3.2
5 Work together in a team to solve engineering problem	Engaged	2.2, 3.2, 3.5, 3.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
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.
1.2	Knowledge and Skill Base: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.

CODE	COMPETENCY
1.4	Knowledge and Skill Base: Discernment of knowledge development and research directions within the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting the engineering discipline.
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.
2.3	Engineering Application Ability: Application of systematic engineering synthesis and design processes.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
3.5	Professional and Personal Attributes: Orderly management of self, and professional conduct.
3.6	Professional and Personal Attributes: Effective team membership and team leadership.

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

(MTH102 or MTH103) and (ENG225 or MEC225) and enrolled in Program SC411

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG301 or MEC3203

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

Data handling using spreadsheet, graphing and basic calculus

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

Weekly tutorials from Week 2 and a formative assessment in week 3.

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	1	Written Piece	Individual	0%	500 words	Week 3	Online Submission
All	2	Written Piece	Group	0%	8 sets of exercises - 200 word equivalent each	Refer to Format	In Class
All	3	Report	Individual and Group	30%	2,000-word equivalent	Week 8	Online Submission
All	4	Examination - not Centrally Scheduled	Individual	20%	3 hours to allow for file upload and access to published materials.	Week 9	Online Assignment Submission with plagiarism check and in class
All	5	Examination - Centrally Scheduled	Individual	50%	4 hours, allowing for file upload and access to online engineering databases.	Exam Period	Online Assignment Submission with plagiarism check and in class

All - Assessment Task 1: Engineering alloys test

GOAL:	The purpose of this formative assessment is to reinforce your previous learning on the types and classification of engineering materials. This knowledge is critical for your understanding of terminologies used in materials processing. This exercise will provide a foundation for understanding the heat treatment of engineering alloys.
PRODUCT:	Written Piece
FORMAT:	A number of short answers questions would require research and revisiting previous knowledge. You will need the "Granta CES edupack" software (provided) to address some of the questions.
CRITERIA:	

No.		Learning Outcome assessed
1	A general understanding of the classes of engineering materials	1 5
2	Use software to choose material group for a specific application	5
3	Understand the generic properties of functional materials	1 2

All - Assessment Task 2: Tutorial Exercises

GOAL:	It is critical for practising engineers to understand the fundamental microstructural changes that accompany the processing of materials and to be able to link these to the functional properties. These exercises are designed to reinforce the concepts of structure-property relationships. These practice questions will assist you in preparing for the midterm exam, lab reports and final year exam.
PRODUCT:	Written Piece
FORMAT:	In groups, you will engage with a set of exercises to develop solutions by discussing with each other and using online resources of the ASM Materials handbook and Granta CES Edupack software. You submit the solution to the tutor on the day and the tutor will provide feedback. Submit End of each tutorial weekly except weeks 1, 2, 4, 5 & 13

CRITERIA:	No.		Learning Outcome assessed
	1	Formative feedback given	1 2 3 5

All - Assessment Task 3: Lab reports

GOAL:	Understanding the connection between the processing, the structure, and the functional properties of materials is essential to effectively select the right materials to meet the design objectives of any device. You will perform experiments to determine phase relationships in a binary system and you will also evaluate the mechanical properties of thermally processed materials. These experiments are aimed at relating microstructure, properties and processing.
PRODUCT:	Report
FORMAT:	You will perform tests on microhardness and brittle failure in heat-treated samples. The raw data from the tests will be used to prepare individual reports (20%) by responding to questions on a template. A group report (10%) on the Materials selection exercise from CES Edupack will be submitted separately.

CRITERIA:	No.		Learning Outcome assessed
	1	fundamental atomistic transport phenomena, Phase diagrams, Non equilibrium processing, Heat treatment	2 4 5
	2	Demonstrate and apply the knowledge of mechanism of materials failure i) Interpret impact test results ii) Discuss the principle of ductile to brittle transition in materials	3 4 5

All - Assessment Task 4: Mid semester exam

GOAL:	This midterm exam will allow you to demonstrate your understanding of the theory and application of thermal processing and how these affect the functional properties of materials used in special applications.
PRODUCT:	Examination - not Centrally Scheduled
FORMAT:	This will be an online exam that will consist of short answers, write-in and application-type as file upload response. This exam will cover learning materials for the first 7 weeks. Questions will include diagrams and tabular set of materials properties.

CRITERIA:	No.		Learning Outcome assessed
	1	Demonstrate and apply theoretical knowledge of the fundamentals of material processing: Fundamental atomistic transport phenomena, Phase diagrams, Non- equilibrium processing, Heat treatment, Welding structures	1 2
	2	Demonstrate and apply the knowledge of mechanism of materials failure and degradation	3 4

All - Assessment Task 5: Final exam

GOAL:	This final exam will cover the entire course. It will allow you to demonstrate your understanding of the theory and application of materials processing and how these affect the functional properties of materials used in special applications.
PRODUCT:	Examination - Centrally Scheduled
FORMAT:	The exam consists of two sections: (1) Short answer questions that cover all descriptive, data test, and awareness level technical explanations of concepts in materials processing. (2) File upload questions addressing engineering principles and applications in engineering alloy systems and phase diagrams; Thermal processing; and Failure and degradation of materials.

CRITERIA:

No.		Learning Outcome assessed
1	Demonstrate and apply theoretical knowledge of the fundamentals of material processing: Fundamental atomistic transport phenomena, Phase diagrams, Non- equilibrium processing, Heat treatment, Welding structures	1 2 3
2	Demonstrate and apply the knowledge of mechanism of materials failure and degradation	3 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

Please note that you need to have regular access to the resource(s) listed below. Resources may be required or recommended.

REQUIRED?	AUTHOR	YEAR	TITLE	EDITION	PUBLISHER
Required	A. S. M. International	0	ASM Handbook Set - Available online at USC library	n/a	n/a
Required	William D. Callister,David G. Rethwisch	2013	Materials Science and Engineering	9th ed.	Wiley

8.2. Specific requirements

You must wear protective covered shoes and safety glasses in the laboratory. The glasses are provided.

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 may be penalised at the following maximum rate:
- 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 after 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 to negotiate an outcome.

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 or using the SafeZone app. For general enquires contact the SafeUniSC team by phone 07 5456 3864 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 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