USC

Course Outline

Code: MEC225
Title: Engineering Materials

School: Science & Engineering
Teaching Session: Semester 1
Year: 2020
Course Coordinator: Dr Ayodele Olofinjana Email: aolofinj@usc.edu.au
Course Moderator: Associate Professor Christophe Gerber Email: cgerber@usc.edu.au

Please go to the USC website 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

The use of smart engineered materials is the bedrock of innovations in engineering structures and devices. In this course you will learn that microstructure controls properties and processing controls microstructure, and, through processing, the properties of materials can be engineered for different applications. You will apply this knowledge to solve simple problems by conducting tests, interpreting results and selecting materials based on performance indices to suit design specifications.

1.2 Field trips, WIL placements or activities required by professional accreditation

Activity	Details
NA	NA

3 Course topics

Classification of Materials
Atomic structure, crystalline structure and microstructure
Mechanical characterisation of materials
Deformation and strengthening
Phase diagrams and alloy systems
Metals and alloys processing
Ceramics, glasses, polymers, composites
Construction materials

2. What level is this course?

200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd 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?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
Demonstrate and apply theoretical knowledge of materials (metals, ceramics & polymers): • atomic and crystalline structures to predict their mechanical properties • equilibrium phase diagrams to determine the processing sequence to manipulate their microstructure • failure and degradation process	Task 1 Task 2 Task 3 Task 5	Knowledgeable
Solve simple materials problems by: • conducting stress and strain tests and calculating the main mechanical indices from the data • interpreting and analysing test results to derive performance indices • selecting materials based on mechanical properties and performance indices (e.g. mechanical, physical, cost, sustainability) to suit design specifications • evaluate the effect of the environment on materials performance	Task 1 Task 2 Task 3 Task 4 Task 5	Knowledgeable. Engaged Sustainability-focussed.
Communicate in writing to specialist audiences	Task 4	Empowered.

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 Enrolment restrictions

You must be enrolled in Program SC367, SC404, SC405, SC410, SC411, SC425, AB101, UU301, UU302 or XU301.

5.2 Pre-requisites

MTH102 or MTH103

5.3 Co-requisites

Nil

5.4 Anti-requisites

ENG225 or MEC1201

5.5 Specific assumed prior knowledge and skills (where applicable)

Graphing, solving equations, basic calculus

6. How am I going to be assessed?

6.1 Grading scale

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

6.2 Details of early feedback on progress

A formative assessment is given in week 2 and feedback provided as submitted in tutorial groups or as an individual during tutorials. Tutorial exercises every week from week 2 to 10.

6.3 Assessment tasks

Task No.	Assessment Product	Individual or Group	Weighting	What is the duration / length?	When should I submit?	Where should I submit it?
1	Written Piece	Individual	Formative	2 weeks to respond	Friday Week 4	To be negotiated
2	Quiz/zes	Group	Formative	10 exercises – 200 words equivalent	End of each tutorial - weekly except Weeks 1 & 13	To Supervisor
3	Examination	Individual	30%	2 hours	Week 7	Exam Venue
4	Report	Individual	20%	500 words (equivalent)	Friday Week 9	Online Assignment Submission with Plagiarism check
5	Examination	Individual	50%	2 hours	Central exam period	Exam Venue
			100%			

Assessment Task 1: Open book take home test

Goal:	The purpose of this formative task is to ensure you understand the theoretical knowledge of atomic and crystalline structures to solve problems and explain the origin of the properties of engineering materials. This knowledge is critical for your success in this course and therefore you will be given feedback to support your learning with this content. This exercise will prepare you for the mid-term exam.	
Product:	Written Piece	
Format:	A number of multiple choice and short answer questions will be set to cover lectures from the first three weeks. Questions include diagrams and tables. You respond using a given template. Solutions will be provided online Friday week 5.	
Criteria:	Formative feedback will be given	
Generic skill assessed		**Skill assessment level**
Problem solving		Developing
Engineers Australia competencies assessed in this task		
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 2.1 Application of established engineering methods to complex engineering problem solving.		

Assessment Task 2: Tutorial exercises

Goal:	It is critical for Engineers to develop their application skills for specific problem sets. These exercises will test your knowledge of materials (metals, ceramics & polymers) to solving simple real-life problems and communicating these solutions. These practice questions will assist you for the mid-term, lab report and final exam.
Product:	**Quiz/zes**
Format:	In groups you work on the exercises to develop solutions by discussing with each other and with guidance from the tutor. You submit the group solutions to the tutor on the day. The tutor will give feedback.
Criteria:	Formative feedback given.

Generic skill assessed	**Skill assessment level**
Problem solving	Developing

Engineers Australia competencies assessed in this task

1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
2.1 Application of established engineering methods to complex engineering problem solving.
2.2 Fluent application of engineering techniques, tools and resources
3.2 Effective (oral and) written communication in professional and lay domains

Assessment Task 3: Mid-semester exam

Goal:	You will demonstrate and apply theoretical knowledge of equilibrium phase diagrams and non-equilibrium TTT isothermal curves to solve problems and interpret engineering behaviour of materials.
Product:	Examination
Format:	A number of multiple choice and short answer questions will be set to cover lectures from the first six weeks. Questions include diagrams and tables. You respond using a given template. It will be held during lecture hours of week 7.
Criteria:	You will be assessed on: Application of knowledge of materials (metals, ceramics & polymers) to: • predict microstructures from equilibrium phase diagrams • determine the processing sequence to manipulate microstructure • explain types of failures and reasons for degradation Solving simple materials problems by: • interpreting and analysing test results to derive performance indices • selecting materials based on mechanical properties and performance indices (e.g. mechanical, physical, cost, sustainability) to suit design specifications

Generic skill assessed	**Skill assessment level**
Problem solving	Developing
Applying technologies	Developing

Engineers Australia competencies assessed in this task

1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
2.1 Application of established engineering methods to complex engineering problem solving.
2.2 Fluent application of engineering techniques, tools and resources.

Assessment Task 4: Laboratory Report

Goal:	Testing and working with materials is a core part of the work of engineers. For this report you will work in a team to solve simple material problems by conducting tests, interpreting and analysing the data to determine mechanical properties of materials and reporting results.
Product:	Report
Format:	In groups you conduct a series of mechanical tests in the laboratory, collect the raw data which is posted on Blackboard for every group. You prepare an individual report by responding to questions on a template. This involves processing the raw data and then graphing the processed data. You then interpret and analyse the results to derive materials performance indices and compare mechanical properties. You write one report about the testing conducted in two laboratory sessions.
Criteria:	Solve simple materials problems by: • conducting stress and strain tests, processing the raw data and calculating the main mechanical indices from the data • interpreting and analysing test results to derive performance indices • comparing mechanical properties of different materials including elastic behaviour Communicate in writing in the form of a lab report to specialist audiences • adhere to prescribed report structure and word count • English expression and conventions • terminology, nomenclature and units • adhere to established conventions for presenting graphs, diagrams and solutions

Generic skill assessed	**Skill assessment level**
Problem solving	Developing

Engineers Australia competencies assessed in this task
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 3.1 Ethical conduct and professional accountability. 3.2 Effective (oral and) written communication in professional and lay domains.

Assessment Task 5: Final Exam

Goal:	This exam will cover the entire course and will allow you to demonstrate and apply theoretical knowledge of materials (metals, ceramics & polymers) to solve simple problems.
Product:	Examination
Format:	The exam consists of two sections: multiple choice questions that cover all lecture materials during the semester; and short answer questions, including diagrams and tables.
Criteria:	Demonstrate and apply theoretical knowledge of materials (metals, ceramics & polymers): • atomic and crystalline structures to predict their mechanical properties • equilibrium phase diagrams to determine the processing sequence to manipulate their microstructure • failure and degradation Solve simple materials problems by: • calculating the main mechanical indices from the data • interpreting and analysing test results to derive performance indices • selecting materials based on mechanical properties and performance indices (e.g. mechanical, physical, cost, sustainability) to suit design specifications • evaluate the effect of the environment on materials performance

Generic skill assessed	**Skill assessment level**
Problem solving	Developing

Engineers Australia competencies assessed in this task
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 2.1 Application of established engineering methods to complex engineering problem solving. 2.2 Fluent application of engineering techniques, tools and resources.

7. Directed study hours

The directed study hours listed here are a portion of the workload for this course. 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. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

Location:	Directed study hours for location:
USC Sunshine Coast	1x 2 hour lecture per week 1x2 hour tutorial per week except for week 1, 4 & 5, 1x2 hour engineering lab weeks 4 & 5

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

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

8.1 Prescribed text(s)

Please note that you need to have regular access to the resource(s) listed below as they are required:

Author	Year	Title	Publisher
William D. Callister Jr. , & David G. Rethwisch	2014	Materials Science and Engineering: An Introduction 9E	John Wiley Held in library collection TA403.C23 2010
D. R. Askeland	2010	The Science and Engineering of Materials	PWS Print version held in collection TA403.A74 2011

8.2 Specific requirements

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

9. Risk management

Health and safety risks have been assessed as minimal.

It is your responsibility as a student 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. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module 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 Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

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

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) 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:

- 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 and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Wellbeing Services

Student Wellbeing Support Staff are available to assist on a wide range of personal, academic, social and psychological matters to foster positive mental health and wellbeing for your success. Student Wellbeing is comprised of professionally qualified staff in counselling, health and disability Services.

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, mental health issue, learning disorder, injury or illness, or you are a primary carer for someone with a disability, AccessAbility Services can provide assistance, advocacy and reasonable academic adjustments.

To book an appointment with either service go to Student Hub, email studentwellbeing@usc.edu.au or accessability@usc.edu.au or call 07 5430 1226

10.6 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
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.7 General Enquiries

In person:

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

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au