USC

Course Outline

Code: MEC301
Title: Materials Technology

School: Science & Engineering
Teaching Session: Semester 1
Year: 2020
Course Coordinator: Dr Ayodele Olofinjana Email: aolofinj@usc.edu.au
Course Moderator: Dr Rezwanul Haque Email: rhaque@usc.edu.au

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 Field trips, WIL placements or activities required by professional accreditation

Activity	Details
NA	NA

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 - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 3rd or 4th 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:
Describe, explain and select appropriate materials for various engineering applications	Task 1: Open book take home exercise Task 2: Tutorial and workshop exercises	Creative and critical thinkers. Knowledgeable.
Demonstrate and apply theoretical knowledge of material processing • fundamental atomistic transport phenomena • Phase diagrams • Non equilibrium processing • Heat treatment • Welding structures	Task 3 Laboratory report Task 4 Mid semester exam Task 5: Final exams	Creative and critical thinkers. Knowledgeable.
Demonstrate and apply the knowledge of mechanism of materials failure and degradation	Task 3 Laboratory report Task 5: Final exams	Empowered.
Interpret experimental and test results	Task 3: Lab report	Empowered.
Work together in a team to solve engineering problem	Task 2: Tutorial and workshop exercises Task 3: Lab reports	Engaged.

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

This course is only available to students enrolled in SC411 program

5.2 Pre-requisites

(MTH102 or MTH103) and (ENG225 or MEC225)

5.3 Co-requisites

Nil

5.4 Anti-requisites

ENG301 or MEC3203 (USQ course)

5.5 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 – 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

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	500 words	Friday Week 3	Online Assignment Submission
2	Written Piece	Group	Formative	8 sets of exercises – 200 word equivalent each	End of each tutorial weekly except weeks 1, 2, 4, 5 & 13	In Class
3	Report	Choice	20 10	2,000 word equivalent	Friday week 5 Friday wk 7 Friday wk 8	Online Assignment Submission
4	Examination	Individual	20	1.5 hours	Week 9	In Class
5	Examination	Individual	50	2 hours	Central Exam period	Exam Venue
			100%			

Assessment Task 1: Engineering alloys test

Goal:	The purpose of this formative assessment is to reinforce your previous learning on 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 heat treatment of engineering alloys.
Product:	Written Piece
Format:	A number of short answers questions that would require research and revisiting previous knowledge. You will need the "Granta CES edupack" software (provided) to address some of the questions.
Criteria:	Demonstrate an understanding of the classifications and selection of engineering materials • A general understanding of the classes of engineering materials • Use software to choose material group for a specific application • Understand the generic properties of functional materials

Generic skill assessed	**Skill assessment level**
Information literacy	Graduate
Applying technologies	Graduate
Engineers Australia competencies assessed in this task	
1.3. In-depth understanding of specialist bodies of knowledge within the engineering Discipline	

Assessment Task 2: Tutorial exercises

Goal:	It is critical for practicing engineers to understand the fundamental microstructural changes that accompany 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 discussion with each other and through the use of online resources, ASM Materials handbook and Granta CES Edupack, software. You submit the solution to the tutor on the day and the tutor will provide feedback.
Criteria:	Formative feedback given

Generic skill assessed	**Skill assessment level**
Problem solving	Graduate
Collaboration	Graduate

Engineers Australia competencies assessed in this task

1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2.2. Fluent application of engineering techniques, tools and resources.
3.3. Creative, innovative and pro-active demeanour.

Assessment Task 3: Laboratory 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. These experiments are aimed at relating microstructure, properties and processing. You will perform experiments to determine phase relationships in a binary system and you will also evaluate the mechanical properties of thermally processed materials.
Product:	Report
Format:	In groups you will conduct thermal experiments and also test heat-treated samples. The raw data from thermal analysis by each group will be posted on BB. You will then prepare individual reports by responding to questions on a template. Your report will address the evolution of microstructure in alloys, the role of thermal processing on microstructure and the relationship of structure and properties in engineering alloys.
Criteria:	Demonstrate and apply theoretical knowledge of material processing • fundamental atomistic transport phenomena • Phase diagrams • Non equilibrium processing • Heat treatment Demonstrate and apply the knowledge of mechanism of materials failure • Interpret impact test results • Discuss the principle of ductile to brittle transition in materials

Generic skill assessed	**Skill assessment level**
Communication	Graduate
Problem solving	Graduate
Collaboration	Graduate

Engineers Australia competencies assessed in this task

1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
1.4. Discernment of knowledge development and research directions within the engineering discipline.

2.2. Fluent application of engineering techniques, tools and resources.

Assessment Task 4: Mid semester exam

Goal:	This midterm exam will allow you to demonstrate your understanding of the theory and application thermal processing and how these affect the functional properties of materials used in special applications.
Product:	Examination
Format:	A number of multiple and short answer questions will be set to cover lectures for the first 7 weeks. Questions will include diagrams and tabular set of materials properties.
Criteria:	Demonstrate and apply theoretical knowledge of the fundamentals of material processing • Fundamental atomistic transport phenomena • Phase diagrams • Non- equilibrium processing • Heat treatment • Welding structures Demonstrate and apply the knowledge of mechanism of materials failure and degradation

Generic skill assessed	**Skill assessment level**
Problem solving	Graduate
Communication	Graduate
Information literacy	Graduate

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.
1.3 In-depth understanding of specialist bodies of knowledge within 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 5: Final exam

Goal:	This final exam will cover the entire course and 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
Format:	The exam consists of two sections: short answers questions that covers all part of the areas covered and choose any two of three application type questions that will address three areas: Alloys systems and phase diagrams; Thermal processing; and Failure and degradation of materials.
Criteria:	Demonstrate and apply theoretical knowledge of the fundamentals of material processing • Fundamental atomistic transport phenomena • Phase diagrams • Non- equilibrium processing • Heat treatment • Welding structures Demonstrate and apply the knowledge of mechanism of materials failure and degradation

Generic skill assessed	**Skill assessment level**
Problem solving	Graduate
Communication	Graduate
Information literacy	Graduate

Engineers Australia competencies assessed in this task
1.2 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
1.3 In-depth understanding of specialist bodies of knowledge within 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 weeks 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
1. ASM Materials Handbook Accessible online from USC library: http://products.asminternational.org/hbk/index.jsp	2016	ASM Materials Hand book	ASM
2. William D. Callister Jr. , & David G. Rethwisch	2014	Materials Science and Engineering: An Introduction 9E	John Wiley Held in library collection TA403.C23 2010

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 for this course have been assessed as low.

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