

MEC221 Mechanics of Materials

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

In Mechanics of Materials you will learn how to analyse and design structures and calculate the allowable design loads and stresses within their members. Mechanics of Materials is a branch of mechanics that studies the relationships between the external loads applied to a deformable body and the intensity of the internal forces, and resulting stresses acting within the body.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous learning material	2.5hrs	Week 1	13 times
Tutorial/Workshop 1 – Tutorial - on-campus only	2hrs	Week 1	13 times
Laboratory 1 – Workshop - on-campus only	2hrs	Week 1	13 times

1.3. Course Topics

Topics may include:

- Moment of Inertia
- Shear Force and Bending Moment Diagrams
- Normal Stress and Strain
- Shear Stress and Strain
- Statically Indeterminate Axially Loaded Members
- Torsion
- Stress and Strain Transformations
- Bending and Shear Stresses in Beams
- Column Buckling
- Combined Loading

2. What level is this course?

200 Level (Developing)

Building on and expanding the scope of introductory knowledge and skills, developing breadth or depth and applying knowledge and skills in a new context. May require pre-requisites where discipline specific introductory knowledge or skills is necessary. Normally, undertaken in the second or third full-time year of an undergraduate programs.

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 Explain the relationship between the external forces acting on a structure and the resulting internal stresses in its members	Knowledgeable	1, 2, 2.2.b, 2.2
2 Justify the effects of combined loading on beam sections	Creative and critical thinker	2, 2.1.c, 2.1
3 Perform laboratory experiments to observe the behaviour of structural members under given conditions and conduct theoretical and comparative analyses to solve stress/strain analysis problems.	Empowered	2, 2.2.f, 2.2
4 Interpret experimental and test results and present these in an appropriate engineering report format	Creative and critical thinker Engaged	2, 2.2, 3, 3.5
5 Collaborate with others in a team project environment to conduct engineering investigations and produce engineering reports	Engaged	3, 3.5, 3.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
2	Elements of competency: Engineering Application Ability
2.2.b	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Constructs or selects and applies from a qualitative description of a phenomenon, process, system, component or device a mathematical, physical or computational model based on fundamental scientific principles and justifiable simplifying assumptions.
2.1.c	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Competently addresses complex engineering problems which involve uncertainty, ambiguity, imprecise information and wide-ranging and sometimes conflicting technical and non-technical factors.
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	Elements of competency: Professional and Personal Attributes

CODE	COMPETENCY
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

ENG102 or ENG105

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG221

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

The engagement in weekly formative tutorial exercises will demonstrate the level of proficiency and understanding of the course material

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	Written Piece	Individual	8%	This assignment would, on average, require 2 hours of independent effort.	Week 4	Online Submission
All	1b	Written Piece	Individual	10%	This assignment would, on average, require 3 hours of independent effort.	Week 8	Online Submission
All	1c	Written Piece	Individual	12%	This assignment would, on average, require 4 hours of independent effort	Week 12	Online Submission
All	2	Portfolio	Group	20%	Project portfolio comprising of workshop practical and design reports (maximum of a 10 page portfolio + appropriate diagrams)	Week 13	Online Submission
All	3	Examination - Centrally Scheduled	Individual	50%	2 hrs	Exam Period	Online Submission

All - Assessment Task 1a: Assignment 1

GOAL:	These assignments allow you to demonstrate your understanding of the theory and also enable you to identify any problem areas in your understanding
PRODUCT:	Written Piece
FORMAT:	Questions will be set for each of the assignments, from the material covered in the on-line learning resources and tutorials up to and including the week of the submission. You are required to use the theory introduced in the online learning resources to solve the assignment questions. The assignments will be provided to you on CANVAS on the Wednesday of the week preceding the submission date. Assignment solutions must be hand-written, showing all working and calculations. You must scan and submit your assignment online (Instructions will be provided on CANVAS). Solutions produced in WORD or EXCEL will NOT be accepted

CRITERIA:	No.	Learning Outcome assessed
	1	1

Correct answers to the problems using appropriate theory and methodology showing a logical sequence to the problem solution.

All - Assessment Task 1b: Assignment 2

GOAL:	These assignments allow you to demonstrate your understanding of the theory and also enable you to identify any problem areas in your understanding	
PRODUCT:	Written Piece	
FORMAT:	Questions will be set for each of the assignments, from the material covered in the on-line learning resources and tutorials up to and including the week of the submission. You are required to use the theory introduced in the online learning resources to solve the assignment questions. The assignments will be provided to you on CANVAS on the Wednesday of the week preceding the submission date. Assignment solutions must be hand-written, showing all working and calculations. You must scan and submit your assignment online (Instructions will be provided on CANVAS). Solutions produced in WORD or EXCEL will NOT be accepted	
CRITERIA:	No.	Learning Outcome assessed
	1	1
	2	1
	3	1

Correct answers to the problems using appropriate theory and methodology showing a logical sequence to the problem solution.

Demonstrated understanding through use of correct formulae

Explain the relationship between the external forces acting on a structure and the resulting internal stresses in its members

All - Assessment Task 1c: Assignment 3

GOAL:	These assignments allow you to demonstrate your understanding of the theory and also enable you to identify any problem areas in your understanding	
PRODUCT:	Written Piece	
FORMAT:	Questions will be set for each of the assignments, from the material covered in the on-line learning resources and tutorials up to and including the week of the submission. You are required to use the theory introduced in the online learning resources to solve the assignment questions. The assignments will be provided to you on CANVAS on the Wednesday of the week preceding the submission date. Assignment solutions must be hand-written, showing all working and calculations. You must scan and submit your assignment online (Instructions will be provided on CANVAS). Solutions produced in WORD or EXCEL will NOT be accepted.	
CRITERIA:	No.	Learning Outcome assessed
	1	1
	2	1
	3	1

Correct answers to the problems using appropriate theory and methodology showing a logical sequence to the problem solution

Demonstrated understanding through use of correct formulae

Explain the relationship between the external forces acting on a structure and the resulting internal stresses in its members

All - Assessment Task 2: Workshop Project Portfolio

GOAL:	As an engineer, you will be required to apply theory to practical engineering problems. In this task you will design, build and test a structural component, interpret experimental and test results, undertake an analytical evaluation and design of a device, and present these in an appropriate engineering report format. During these workshop tasks, you will develop and advance your skills and understanding of materials engineering theory, and work towards meeting your Engineers Australia competencies.	
PRODUCT:	Portfolio	
FORMAT:	Working in a group of 4 students, you will produce a Workshop Project portfolio of all the individual practical exercises. The portfolio should NOT be longer than 10 pages. More information on the tasks and the structure of the reports will be provided on CANVAS.	
CRITERIA:	No.	Learning Outcome assessed
	1	The effective design, build and testing of a balsawood bridge as per the project brief. 2
	2	Performance in laboratory experiments to observe the behaviour of structural members under given conditions and conduct theoretical and comparative analyses to solve stress/strain analysis problems. 3
	3	Interpretation of experimental and test results and present these in an appropriate engineering report format 4
	4	Collaboration with others in a team project environment to conduct engineering investigations. 5

All - Assessment Task 3: Final Examination

GOAL:	Demonstrate your understanding of all theory of this course by answering problems during a time constrained on-line examination.	
PRODUCT:	Examination - Centrally Scheduled	
FORMAT:	The on-line final exam will assess your understanding of the course content as presented in the on-line learning resources. The duration of the final exam will be 2 hours (during centrally scheduled exam period). You will be required to solve a number of typical Mechanics of Materials problems similar to those given in the tutorial and assignment questions throughout the semester.	
CRITERIA:	No.	Learning Outcome assessed
	1	Correct answers to the problems using appropriate theory and methodology showing a logical sequence to the problem solution 1
	2	Demonstrated understanding through use of correct formulae

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.

7.1. Schedule

PERIOD AND TOPIC	ACTIVITIES
Week 1 Introduction, Revision of Centroid and Moment of Inertia	Engage with on-line learning resources and undertake tutorial exercises (problem solving) Revise ENG102 Engineering Statics Course topics, Workshop Project 1 (Bridge Project)
Week 2 Normal Stress and Strain; Shear Stress and Strain	Engage with on-line learning resources, Workshop project 1 (Bridge Project), tutorial exercise, and revision examples
Week 3 Stress and Strain in Axially-loaded members	Engage with on-line learning resources, Workshop project 1 (Bridge Project), tutorial exercise, and revision examples
Week 4 Statically Indeterminate Axially Loaded Members	Engage with on-line learning resources, Workshop project 1 (Bridge Project), tutorial exercise, and revision examples.
Week 5 Torsion	Engage with on-line learning resources, Workshop project 1 (Bridge Testing), tutorial exercise, and revision examples.
Week 6 Buckling	Engage with on-line learning resources, Workshop Project 2 (Beam Deflection), tutorial exercise, and revision examples.
Week 7 Shear Force and Bending Moment Diagrams	Engage with on-line learning resources, Workshop Project 2 (Beam Deflection), tutorial exercise, and revision examples.
Week 8 Beam Bending – symmetrical	Engage with on-line learning resources, Workshop Project 2 (Column Buckling / Bending of Beams), tutorial exercise, and revision examples.
Week 9 Beam Bending unsymmetrical	Engage with on-line learning resources, Workshop Project 2 (Column Buckling / Bending of Beams), tutorial exercise, and revision examples.
Week 10 Shear Stress in Beams	Engage with on-line learning resources, Workshop Project 4 (Design), tutorial exercise, and revision examples.
Week 11 Combined Loadings	Engage with on-line learning resources, Workshop Project 4 (Design), tutorial exercise, and revision examples.
Week 12 Stress Transformations	Engage with on-line learning resources, Workshop Project 4 (Design), tutorial exercise, and revision examples.
Week 13 Strain Transformations	Engage with on-line learning resources, Workshop Project 4 (Design), tutorial exercise, and revision examples.

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
Recommended	Russell C. Hibbeler	0	Mechanics of Materials in SI Units	10th Ed	n/a

8.2. Specific requirements

Fully enclosed shoes must be worn in the engineering laboratory. If you do not have the correct shoes you will not be allowed to do the practical. You must also undertake the laboratory induction before you can undertake any practical.

9. How are risks managed in this course?

Risk assessments have been performed for all studio and laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the 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](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