COURSE OUTLINE

MEC227 Mechanical Design 1

School: School of Science, Technology and Engineering

2026 | Semester 2

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 unisc.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

We live in a world of change, driven by increasing demands for better, more efficient products. Mechanical engineering is at the forefront of this change; providing the knowledge, technology and skills to meet the requirements of a consumer-driven society. This course provides the foundations which converts ideals into new products and will provide you with skills to produce feature-based, parametric solid models and the foundations for the accurate design specifications of dimensions, tolerances and load bearing ability of simple machine components.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – On-line Learning Materials	1hr	Week 1	13 times
Laboratory 1 – Learning to use Solidworks. On-campus only in a computer lab.	2hrs	Week 1	13 times
Tutorial/Workshop 1 – Undertaking the development of four design-based projects. On-campus only	2hrs	Week 1	13 times

1.3. Course Topics

Stress Analysis

Thoeries of Failure

Factors of Safety

Stress Concentrations

The Design Process

Introduction to Industrial Design

Design for Sustainability

Introduction to Solid Modeling : SolidWorks

Part and Assembly creations

Engineering drawings

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 On successful completion of this course, you should be able to...	GRADUATE QUALITIES MAPPING Completing these tasks successfully will contribute to you becoming...	PROFESSIONAL STANDARD MAPPING * Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Demonstrate an understanding of the principles of mechanical engineering design.	Knowledgeable Empowered	1.1, 1.6
2 Apply appropriate methodologies, including the correct use of theory, formula and units, to solve design-based problems.	Knowledgeable Engaged	1.5, 2.2
3 Analyse fail modes and suggest appropriate design revisions and present these in an appropriate engineering report format.	Creative and critical thinker Engaged	1.3, 2.3
4 Demonstrate the mastering of 3D solid modelling techniques and skills.	Knowledgeable Creative and critical thinker	2.2, 2.3
5 Design a creative device, which demonstrates simple mechanisms.	Creative and critical thinker	3.2, 3.3, 3.6
6 Present clarity of thought and expression in written and oral communication of design.	Creative and critical thinker Engaged	2.3, 3.2

* 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.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting 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.
2.2	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.
3.3	Professional and Personal Attributes: Creative, innovative and pro-active demeanour.
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

(ENG202 or ENG104 or ENG1100 and enrolled in Program SC013, SC410, SC411, SC425, SC404, SC405) or

5.2. Co-requisites

ENG104 and enrolled in program SC013

5.3. Anti-requisites

ENG227 or MEC2304

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

Not applicable

5.5. Microcredential Information

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 delivery and facilitation of the computer laboratory sessions and workshop projects will provide regular feedback throughout the semester.

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	5%	Answer to ALL assignment questions	Week 4	Online Submission
All	1b	Practical / Laboratory Skills	Individual	5%	Answer to ALL assignment questions and tasks	Week 5	Online Submission
All	1c	Written Piece	Individual	10%	Answer to ALL assignment questions and tasks	Week 7	Online Submission
All	1d	Practical / Laboratory Skills	Individual	25%	Answer to ALL assignment tasks.	Week 12	Online Submission
All	2	Portfolio	Group	25%	Design artifacts and associated report (max 10 pages + appropriate diagrams/ drawings)	Week 12	Online ePortfolio Submission
All	3	Examination - Centrally Scheduled	Individual	30%	2 hrs	Exam Period	Online Submission

All - Assessment Task 1a: Assignment 1: Design Assignment

GOAL:	Solutions to design assignment questions.
PRODUCT:	Written Piece
AUTHORSHIP STATEMENT:	
FORMAT:	Design Assignment: Questions will be set for each of the assignments, from the material covered in on-line lessons up to and including the week prior to the submission. You are required to use the theory introduced in the lessons to respond to the assignment questions. The assignments will be provided to you on Canvas. You are required to complete the assignment and submit on Canvas. Weighting for this assignment: Assignment 1 (Design)= 5%; Design Assignment submissions can either be hand-written or word-processed, showing all working and calculations (where relevant).
CRITERIA:	

No.		Learning Outcome assessed
1	Correct responses to the questions;	1
2	Demonstrated understanding through use of correct formulae;	2
3	Inclusion of all workings showing a logical sequence to the problem solution.	6

GENERIC SKILLS:	Communication, Problem solving

All - Assessment Task 1b: Solid Modelling

GOAL:	Generation of parametric solid models of drafting questions.
PRODUCT:	Practical / Laboratory Skills
AUTHORSHIP STATEMENT:	
FORMAT:	Solid Modelling Assignments: Solid Modelling tasks would be set from the material and techniques covered in the Modelling tutorials. The assignments will be provided to you on Canvas. You are required to complete the assignment and submit on Canvas. You must submit all relevant solid modelling files (in a zipped folder) for the Solid Modelling assignment.
CRITERIA:	

No.		Learning Outcome assessed
1	Correct responses to the questions; Use of correct Solid Modelling techniques	4
2	Presentation of accurate parametric models and engineering drawings;	6

GENERIC SKILLS:	Communication, Applying technologies

All - Assessment Task 1c: Design

GOAL:	Solutions to design assignment questions.
PRODUCT:	Written Piece
AUTHORSHIP STATEMENT:	
FORMAT:	Design Assignments: Questions will be set from the material covered in the on-line lessons up to and including the week prior to the submission. You are required to use the theory introduced in the lessons to respond to the assignment questions. The assignment will be provided to you on Canvas. You are required to complete the assignment and submit on Canvas. Design Assignment submissions can either be hand-written or word-processed, showing all workings and calculations (where relevant).
CRITERIA:	

No.		Learning Outcome assessed
1	Correct responses to the questions;	1
2	Demonstrated understanding through use of correct formulae;	2
3	Inclusion of all workings showing a logical sequence to the problem solution.	3 6

GENERIC SKILLS:	Problem solving, Applying technologies

All - Assessment Task 1d: Major Solid Modelling Assignment

GOAL:	Generation of accurate parametric solid part models, development of assemblies of part models and generation of engineering drawings.
PRODUCT:	Practical / Laboratory Skills
AUTHORSHIP STATEMENT:	
FORMAT:	Solid Modelling Assignments: Solid Modelling tasks would be set from the material and techniques covered in the Modelling tutorials. The assignment will be provided to you on Canvas. You are required to complete the assignment and submit on Canvas. You must submit all relevant solid modelling files (in a zipped folder) for the Solid Modelling assignment.
CRITERIA:	

No.		Learning Outcome assessed
1	Use of correct Solid Modelling techniques	4
2	Presentation of accurate Engineering drawings;	6

GENERIC SKILLS:	Communication, Applying technologies

All - Assessment Task 2: Workshop Portfolio - Design Projects (25% of the final grade)

GOAL:	The four projects are designed as hands-on activities that demonstrate creativity, innovation and the application of the design methodology in designing and building of displays and devices which meet the proposed design brief.
PRODUCT:	Portfolio
AUTHORSHIP STATEMENT:	
FORMAT:	The projects are completed by groups of 3 or 4 students. The portfolio and the built displays and devices are to be submitted by the group. Presentations (in the form of an Exhibition) will be conducted in Week 12. The portfolio should NOT be longer than 10 pages.
CRITERIA:	

No.		Learning Outcome assessed
1	Structured approach to design, test and build (Design methodology)	3 5
2	Performance of the device, measured against performance criteria stated in the design brief	2
3	Degree to which the report adheres to the specified structure;	6
4	Depth of discussion and reflection on the project (Design Review).	5 6

GENERIC SKILLS:	Communication, Collaboration, Applying technologies

All - Assessment Task 3: Final Examination (2 hrs - 30% of final grade)

GOAL:	The final exam will allow you to demonstrate your understanding of the theory presented in this course, by accurately answering short problem-based questions.
PRODUCT:	Examination - Centrally Scheduled
AUTHORSHIP STATEMENT:	
FORMAT:	The final exam will assess the content of lessons presented in the course. The duration of the final exam will be 2 hours (during centrally scheduled exam period, open book).You will be required to provide responses to a number of typical problems similar to those given in the assignment questions.
CRITERIA:	

No.		Learning Outcome assessed
1	Correct answers to the problems	1 6
2	Use of correct terminology, diagrams and methodology	2

GENERIC SKILLS:	Communication, Problem solving

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 content of Introduction to Engineering Design, Statics and Mechanics of Materials Introduction to SolidWorks – Solid Modelling software
Week 2	Design: Normal Stress and Strains Solid Modelling: Introduction to Sketching
Week 3	Design: Stress and Strength; Factor of Safety Solid Modelling: Layers; Sections; Revolved features
Week 4	Design: Theories of Failure Solid Modelling: Parametric modelling; Part Drawings, Sections
Week 5	Design: Analysis of Component Failure Solid Modelling: Assembly drawings
Week 6	Design: Fits and Tolerances Solid Modelling: Exploded views and File Manager
Week 7	Design: Introduction to Design Methodology Solid Modelling: Engineering Drawings
Week 8	Design: Introduction to Industrial Design: The design Process Solid Modelling: Detailed drawings
Week 9	Design: The Design Process : Decision Matrices Solid Modelling: Complex profiles
Week 10	Design: Design for Sustainability Solid Modelling: Complex profiles
Week 11	Design: Design for Sustainability : Life Cycle Analysis Solid Modelling: Assembly and Part drawings
Week 12	Design: Human Factors Engineering Solid Modelling: Bill of Materials
Week 13	Design: Human Factors Engineering Solid Modelling: Assembly and Part drawings

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

Fully enclosed shoes (preferably safety shoes/boots) must be worn in the engineering laboratory. If you do not have the correct shoes you will not be allowed to do the workshop practical. You must also undertake the laboratory induction before you can undertake any practical. It is advisable to use a dust-coat (or overall) when in the laboratory.

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

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. 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

10.5. 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.

10.6. 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