

ENG306

Engineering System Design

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

This course will develop advanced principles of engineering design. The design process includes consideration of safety and compliance with standards and assessment of failure. For an engineering technologist, this course will develop core skills in detailing the design process and develop clear understanding of the levels of responsibility.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	13 times
Seminar – On campus	1hr	Week 1	3 times
Tutorial/Workshop 1 – On campus	2hrs	Week 1	10 times
Laboratory 1 – On campus	2hrs	Week 2	5 times

1.3. Course Topics

Topics may include:

- Higher level design theory e.g. design specifications, concept selection methods, standards, patents, design of components & human factors.
- Introduction to the application of digital design tools appropriate to the engineering discipline.
- Topics relevant to the individual engineering discipline

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...	Competencies from multiple Professional Bodies (see below) *
1 Explain the principles and practices of engineering design required to successfully implement complex engineering solutions.	Knowledgeable	1, 1, 1.5.a, 1.5.a, 1.5, 1.5
2 Investigate and assess scientific material to effectively synthesise relevant information to develop innovative design solutions	Creative and critical thinker	2, 2, 2.1.d, 2.1.d, 2.1, 2.1
3 Analyse potential failure modes in engineering systems and evaluate their impact to develop strategies to mitigate and prevent failures.	Creative and critical thinker	2, 2, 2.2.c, 2.2.c, 2.2, 2.2
4 Apply appropriate design concepts to deliver a desired engineering outcome.	Empowered	2, 2, 2.3.a, 2.3.a, 2.3, 2.3
5 Manage time and resources (independently and/or as a member of a team).	Empowered Engaged	3, 3, 3.2.a, 3.2.a, 3.5.d, 3.5.d, 3.2, 3.2, 3.5, 3.5
6 Develop Workplace, Health and Safety risk management knowledge and skills, including WHS frameworks, legislation, standards, procedures and guidance.	Ethical	3, 3, 3.1.a, 3.1.a, 3.1.b, 3.1.b, 3.1.c, 3.1.c, 3.1, 3.1

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 ENGINEERING TECHNOLOGIST COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.5.a	Knowledge and Skill Base - Knowledge of engineering design practice and contextual factors impacting the technology domain: Identifies and applies systematic principles of engineering design relevant to the technology domain.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting the technology domain.
2	Elements of competency: Engineering Application Ability
2.1.d	Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: Recognises problems which have component elements and/or implications beyond the engineering technologist's personal expertise and correctly identifies the need for supplementary professional input.
2.2.c	Engineering Application Ability - Application of engineering techniques, tools and resources within the technology domain: Selects and applies such models in the representation of phenomenon, processes, systems, components or devices.
2.3.a	Engineering Application Ability - Application of systematic synthesis and design processes within the technology domain: Proficiently applies technological knowledge and problem solving skills as well as established tools and procedures to design components, system elements, plant, facilities and/or processes to meet technical specifications and performance criteria.
2.1	Engineering Application Ability: Application of established engineering methods to broadly-defined problem solving within the technology domain.
2.2	Engineering Application Ability: Application of engineering techniques, tools and resources within the technology domain.
2.3	Engineering Application Ability: Application of systematic synthesis and design processes within the technology domain.
3	Elements of competency: Professional and Personal Attributes

CODE	COMPETENCY
3.2.a	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Is proficient in listening, speaking, reading and writing English.
3.5.d	Professional and Personal Attributes - Orderly management of self, and professional conduct: Manages time and processes effectively, prioritises competing demands to achieve personal, career and organisational goals and objectives.
3.1.a	Professional and Personal Attributes - Ethical conduct and professional accountability: Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the technology domain.
3.1.b	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the need for 'due-diligence' in certification, compliance and risk management processes.
3.1.c	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the accountabilities of the engineering technologist and the broader engineering team for the safety of other people and for protection of the environment.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
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.
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.5.a	Knowledge and Skill Base - Knowledge of engineering design practice and contextual factors impacting the engineering discipline: Identifies and applies systematic principles of engineering design relevant to the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting the engineering discipline.
2	Elements of competency: Engineering Application Ability
2.1.d	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Investigates complex problems using research-based knowledge and research methods.
2.2.c	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Determines properties, performance, safe working limits, failure modes, and other inherent parameters of materials, components and systems relevant to the engineering discipline.
2.3.a	Engineering Application Ability - Application of systematic engineering synthesis and design processes: Proficiently applies technical knowledge and open ended problem solving skills as well as appropriate tools and resources to design components, elements, systems, plant, facilities and/or processes to satisfy user requirements.
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	Elements of competency: Professional and Personal Attributes
3.2.a	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Is proficient in listening, speaking, reading and writing English.
3.5.d	Professional and Personal Attributes - Orderly management of self, and professional conduct: Manages time and processes effectively, prioritises competing demands to achieve personal, career and organisational goals and objectives.
3.1.a	Professional and Personal Attributes - Ethical conduct and professional accountability: Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the engineering discipline.
3.1.b	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the need for 'due-diligence' in certification, compliance and risk management processes.
3.1.c	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the accountabilities of the professional engineer and the broader engineering team for the safety of other people and for protection of the environment.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.

CODE	COMPETENCY
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3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
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3.5	Professional and Personal Attributes: Orderly management of self, and professional conduct.
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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

ENG206 or ENG104

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

MEC336

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 delivery and facilitation of the tutorials 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	1	Report	Individual	50%	2500 words	Week 7	Online Assignment Submission with plagiarism check
All	2	Report	Individual	50%	2500 words	Week 13	Online Assignment Submission with plagiarism check

All - Assessment Task 1: Report

GOAL:	Intermediate engineering design report, focusing upon a relevant engineering area, with demonstrated digital engineering skills, completed mid way through the study period.	
PRODUCT:	Report	
FORMAT:	Report	
CRITERIA:	No.	Learning Outcome assessed
	1	Critical appraisal of the principles and practices of engineering design required to successfully implement complex engineering solutions. 1
	2	Investigation and assessment of scientific material to effectively synthesise relevant information to develop innovative design solutions 2
	3	Application of appropriate design concepts to deliver a desired engineering outcome. 4
	4	Management of time and resources (independently and/or as a member of a team). 5
GENERIC SKILLS:	Organisation, Information literacy	

All - Assessment Task 2: Report

GOAL:	Final report detailing the engineering design and its analysis.	
PRODUCT:	Report	
FORMAT:	Report	
CRITERIA:	No.	Learning Outcome assessed
	1	Critical appraisal of the principles and practices of engineering design required to successfully implement complex engineering solutions. 1
	2	Investigation and assessment of scientific material to effectively synthesise relevant information to develop innovative design solutions 2
	3	Application of appropriate design concepts to deliver a desired engineering outcome. 4
	4	Analysis of potential failure modes in engineering systems and evaluation of their impact to develop strategies to mitigate and prevent failures. 3
	5	Management of time and resources (independently and/or as a member of a team). 5
	6	Development of Workplace, Health and Safety risk management knowledge and skills, including WHS frameworks, legislation, standards, procedures and guidance. 6
GENERIC SKILLS:	Organisation, Information literacy	

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
1	Introduction; Revision of Fundamentals of Machine Elements – ENG228 Mechanical Design 2; Introduction to Module 1: Electrical Theory
2	Introduction to Embedded Control Systems; Basic electric circuits
3	Sensors and Measurements
4	Operational amplifiers
5	Embedded Control; PID controller
6	Introduction to Module 2: System Design; Design Philosophy
7	System Reliability
8	Design for Manufacture; Design for Ergonomics
9	Design for the Environment: Design Standards
10	Introduction to Module 3: Introduction to PLCs
11	Hydraulic Systems
12	Pneumatic Systems
13	Introduction to CoBOTS

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. 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