

# MEC336 Engineering System Design

**School:** School of Science, Technology and Engineering

2023 | 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 [usc.edu.au](http://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

The success of most engineering systems depends on the effective and efficient synergy of a number of sub-assemblies which in turn comprise a number of individual integrated machine components. This course provides you with the theoretical knowledge and skills which underline the design philosophy required for effective engineering systems; which requires careful design synthesis and analysis to ensure that all components are integrated to provide for the best possible overall performance of the system. The design process will also provide you with an introduction to the impact that engineering systems have on natural resources, the environment and society.

### 1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
<b>BLENDED LEARNING</b>			
<b>Learning materials</b> – Asynchronous learning	2hrs	Week 1	13 times
<b>Tutorial/Workshop 1</b> – On campus Tutorial	2hrs	Week 1	13 times
<b>Tutorial/Workshop 2</b> – On campus Workshop	1hr	Week 1	13 times

### 1.3. Course Topics

- 2. Module: Embedded Control
  - 1. Basic electrical theory
  - 2. Electronic sensors and Control
  - 3. Embedded Control Systems
  - 4. Feedback Control (PID)
- 3. Module: System Design
  - 1. System Design Philosophy
  - 2. System Reliability
  - 3. Design for Sustainability
  - 4. Design for Ergonomics
  - 5. Design Standards
- 4. Module: Automation
  - 1. Pneumatic Systems
  - 2. Hydraulic Systems
  - 3. Programmable Logic Controllers (PLC's)

### 5. 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.

### 6. What is the unit value of this course?

12 units

### 7. 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 Demonstrate an understanding of the appropriate analytical principles to describe, design and predict the behaviour of standard engineering systems.	Knowledgeable Empowered	1.3, 3.2
2 Apply correct theoretical models to design appropriate engineering systems.	Creative and critical thinker Sustainability-focussed	2.2, 3.3, 3.6

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
3 Undertake design projects, encompassing the synergy of fundamental machine component theory in an engineering system.	Creative and critical thinker Engaged	2.2, 2.3

\* Competencies by Professional Body

CODE	COMPETENCY
<b>ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS</b>	
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering 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.

## 8. 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”.

### 8.1. Pre-requisites

ENG228 or MEC300 or MEC301 or MCH301 or MEC2301

### 8.2. Co-requisites

Not applicable

### 8.3. Anti-requisites

ENG336 or MEC3303

### 8.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

## 9. How am I going to be assessed?

### 9.1. Grading Scale

Standard Grading (GRD)

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

### 9.2. Details of early feedback on progress

The delivery and facilitation of the tutorials and workshop projects will provide regular feedback throughout the semester.

9.3. 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	Written Piece	Individual	30%	Solutions to project-based design problems, and/or reflection on case studies. It is a three parts assessment based on the three distinctive modules.	Refer to Format	Online ePortfolio Submission
All	2	Portfolio	Group	40%	Design output and associated reports (max 30 pages) + appropriate diagrams/drawings; 15 min Oral presentation of Design	Week 13	Online ePortfolio Submission
All	3	Examination - Centrally Scheduled	Individual	30%	3-6 hours	Exam Period	Online Test (Quiz)

**All - Assessment Task 1:** Written Piece

<b>GOAL:</b>	You will develop critical thinking and evaluation of engineering systems, and formulate and apply appropriate analytical principles to describe, design and predict the behaviour of standard engineering systems		
<b>PRODUCT:</b>	Written Piece		
<b>FORMAT:</b>	Questions will be set for each of the design requirements and/or case studies that cover the material of each module. You are required to use the theory introduced in the learning materials and workshop tasks to respond to these questions. The projects and/or case studies will be provided to you on Canvas. You are required to complete the written pieces during the module. Each of the three projects has an equal weighting of 10%. Task 1A is due in Week 5; Task 1B is due in Week 8; Task 1C is due in week 12. You must submit your portfolio online (Instructions will be provided on LMS).		
<b>CRITERIA:</b>	<b>No.</b>		<b>Learning Outcome assessed</b>
	1	Correct responses to the questions;	1 2
	2	Use of correct terminology, diagrams and methodology;	1 2
	3	Demonstrated understanding through use of correct formulae;	1 2
	4	Inclusion of all workings showing a logical sequence to the problem solution.	1

**All - Assessment Task 2:** Workshop Portfolio (40% of final grade)

<b>GOAL:</b>	These practical tasks will enable you to demonstrate your creativity, innovation and understanding of system design by designing effective engineering systems that meet the proposed design brief.
<b>PRODUCT:</b>	Portfolio
<b>FORMAT:</b>	The design projects are completed by groups of 2-4 students. The portfolio is to be submitted by the group. The portfolio should NOT be longer than 30 pages [5 pages each for Project A (Automation-Electrical) and C (Automation-mechanical, and 20 pages for Project B (Major Design Project)] Include, in an appendix, all appropriate drawings/sketches, product specifications and technical data of specified components. Project B also includes an oral presentation of your team's conceptual design.

CRITERIA:	No.	Learning Outcome assessed
	1	Appropriate use of materials, analysis of materials selection, and materials testing exercises. <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">2</span>
	2	A structured approach to the system design, performance of the device, measured against performance criteria stated in the design brief <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">1</span> <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">3</span>
	3	Completeness of all components of the report within the specified instruction. <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">1</span>
	4	Assessment of oral presentation <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">2</span> <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">3</span>

**All - Assessment Task 3:** Module Examinations (Total of 30% of final grade)

<b>GOAL:</b>	You will solve problems to demonstrate the application your knowledge to the design, behaviour and performance of engineering systems covered in each module.	
<b>PRODUCT:</b>	Examination - Centrally Scheduled	
<b>FORMAT:</b>	The exam will include content from each module. The duration of exams will be between 3-6 hours and will be conducted online (via canvas) at the end of the semester. You will be required to provide responses to a number of typical problems similar to those given in the tutorial questions for each of the modules. Your exam solutions will be used to evaluate your understanding of each module.	
<b>CRITERIA:</b>	No.	Learning Outcome assessed
	1	Correct answers to the problems <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">1</span>
	2	Use of correct terminology, diagrams and methodology <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">1</span> <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">2</span>
	3	Use of appropriate design standards <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">1</span> <span style="background-color: #0070c0; color: white; border-radius: 50%; padding: 2px 5px;">2</span>

## 10. 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.

## 10.1. 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

## 11. 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.

### 11.1. Prescribed text(s) or course reader

There are no required/recommended resources for this course.

### 11.2. 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.

## 12. 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.

## 13. What administrative information is relevant to this course?

### 13.1. 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.

### 13.2. 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

### 13.3. 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.

### 13.4. 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](mailto: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](mailto:studentwellbeing@usc.edu.au).

### 13.5. 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](mailto:studentcentral@usc.edu.au).

### 13.6. 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](mailto:studentwellbeing@usc.edu.au) or call 07 5430 1226.

### 13.7. 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](mailto:AccessAbility@usc.edu.au) or call 07 5430 2890.

### 13.8. 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>

### 13.9. 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.

### 13.10.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](mailto:studentcentral@usc.edu.au)