COURSE OUTLINE

# MCH300 Machine Component Design

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

2025 | 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 provide you with the knowledge and skills to analyse various machine components. You will learn the design principles of key mechanical and electromechanical elements that constitute a machine (including gears, bolts, and shafts). You will further learn synthesis of kinematic systems and analysis of mechanisms. You will design and fabricate custom components to develop solutions for given design tasks. The course will also provide knowledge on industry standard controllers, which will enable you to understand an integrated approach towards machine design and control.

### 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 | 2 times |
| **Tutorial/Workshop 1** – On campus | 2hrs | Week 1 | 10 times |
| **Laboratory 1** – On campus | 2hrs | Week 2 | 9 times |

### 1.3. Course Topics

Topics may include:

- Stress and fatigue
- Physical elements of machines
- Power transmission systems
- Machine synthesis
- Machine kinematic analysis
- Electromechanical sensors and actuators
- Solid modelling
- PLC Programming

## 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 Demonstrate advanced knowledge of appropriate analytical principles to describe, design and predict the behaviour of machine components and mechanical sub-systems. | Knowledgeable | 1, 1, 1.3.a, 1.3.a, 1.3, 1.3 |
| 2 Identify appropriate analytical models to describe and predict the behaviour of standard machine components against desired outcomes. | Creative and critical thinker | 2, 2, 2.1.a, 2.1.a, 2.1, 2.1 |
| 3 Analyse the behaviour of complex machine components and sub-systems to evaluate the overall system. | Creative and critical thinker | 2, 2, 2.1.e, 2.1.e, 2.1, 2.1 |
| 4 Apply technical knowledge and tools (appropriate computer aided design software) from different engineering disciplines in designing machine components to suit specific requirements. | Empowered | 2, 2, 2.3.a, 2.3.a, 2.3, 2.3 |
| 5 Demonstrate creativity, design skills, appropriate methodology and clarity in communicating design of machine components through preparation of high-quality drawings and a design report. | Engaged | 3, 3, 3.2.b, 3.2.b, 3.2, 3.2 |
| 6 Apply codes and standards to machine component design. | Sustainability-focussed | 1, 1, 1.6.a, 1.6.a, 1.6, 1.6 |

* Competencies by Professional Body

| CODE | COMPETENCY |
|---|---|
| **ENGINEERS AUSTRALIA STAGE 1 ENGINEERING TECHNOLOGIST COMPETENCY STANDARDS** | |
| 1 | Elements of competency: Knowledge and Skill Base |
| 1.3.a | Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the technology domain: Proficiently applies advanced technical knowledge and skills to deliver engineering outcomes in specialist area(s) of the technology domain and associated industry, commercial and community sectors. |
| 1.6.a | Knowledge and Skill Base - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain: Understands the standards and codes of practice, as well as the legislative and statutory requirements associated with specialist practice area(s) of the technology domain. |
| 1.3 | Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the technology domain. |

| CODE | COMPETENCY |
|---|---|
| 1.6 | Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain. |
| 2 | Elements of competency: Engineering Application Ability |
| 2.1.a | Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: Identifies, discerns and characterises salient issues, determines and analyses causes and effects, justifies and applies appropriate simplifying assumptions, predicts performance and behaviour, synthesises solution strategies and develops substantiated conclusions. |
| 2.1.e | Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: Manages conflicting issues associated with interfacing, integrating and adapting specialist technologies where complex problems, processes or systems that have been partitioned into manageable elements for the purposes of analysis, modelling, design, prototyping, commissioning or testing, are recombined. |
| 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. |
| 2.3 | Engineering Application Ability: Application of systematic synthesis and design processes within the technology domain. |
| 3 | Elements of competency: Professional and Personal Attributes |
| 3.2.b | Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the technology domain. |
| 3.2 | Professional and Personal Attributes: Effective oral and written communication in professional and lay domains. |
| **ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS** | |
| 1 | Elements of competency: Knowledge and Skill Base |
| 1.3.a | Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the engineering discipline: Proficiently applies advanced technical knowledge and skills in at least one specialist practice domain of the engineering discipline. |
| 1.6.a | Knowledge and Skill Base - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline: Appreciates the basis and relevance of standards and codes of practice, as well as legislative and statutory requirements applicable to the engineering discipline. |
| 1.3 | Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within 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 | Elements of competency: Engineering Application Ability |
| 2.1.a | Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Identifies, discerns and characterises salient issues, determines and analyses causes and effects, justifies and applies appropriate simplifying assumptions, predicts performance and behaviour, synthesises solution strategies and develops substantiated conclusions. |
| 2.1.e | Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Partitions problems, processes or systems into manageable elements for the purposes of analysis, modelling or design and then re-combines to form a whole, with the integrity and performance of the overall system as the paramount consideration. |
| 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. |
| 2.3 | Engineering Application Ability: Application of systematic engineering synthesis and design processes. |

| CODE | COMPETENCY |
|---|---|
| 3 | Elements of competency: Professional and Personal Attributes |
| 3.2.b | Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the engineering discipline. |
| 3.2 | Professional and Personal Attributes: Effective oral and written communication in professional and lay domains. |

## 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

MCH301

### 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

Performance and feedback from class exercises and projects 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 | 1 | Practical / Laboratory Skills, and Written Piece | Individual | 40% | 2 x 1000 words | Throughout teaching period (refer to Format) | Online Assignment Submission with plagiarism check |
| All | 2 | Written Piece | Individual | 20% | 2 x 500 words | Throughout teaching period (refer to Format) | Online Assignment Submission with plagiarism check |
| All | 3 | Artefact - Technical and Scientific, and Written Piece | Group | 40% | 2000 words | Week 13 | Online Assignment Submission with plagiarism check |

**All - Assessment Task 1:** Practical / Laboratory Skills, and Written Piece

| | |
|---|---|
| **GOAL:** | This assessment will build your skills and knowledge in developing components, assembly models, component analysis, and prototyping. You will also learn to program logic controllers to drive mechanisms and integrated machine components. |
| **PRODUCT:** | Practical / Laboratory Skills, and Written Piece |
| **FORMAT:** | Experimental work and / or projects to verify students ability to apply knowledge and skills acquired in the course. Submit weeks 6 and 10 (20% each) |
| **CRITERIA:** | |

| No. | | Learning Outcome assessed |
|---|---|---|
| 1 | Demonstration of advanced knowledge of machine component design theory to evaluate key issues in design process, stress-strain based principles and failure criteria. | 1 |
| 2 | Identification of appropriate analytical models to describe and predict the behaviour of standard machine components against desired outcomes. | 2 |
| 3 | Analysis of the behaviour of a complex machine sub-systems/elements to evaluate the overall system. | 3 |
| 4 | Application of technical knowledge and tools (appropriate computer aided design software) from different engineering disciplines in designing machine components to suit specific requirements. | 4 |
| 5 | Application of codes and standards to machine component design. | 6 |

| | |
|---|---|
| **GENERIC SKILLS:** | Organisation |

**All - Assessment Task 2:** Written Piece

| | |
|---|---|
| **GOAL:** | These written assignments will develop your knowledge and understanding of fundamental failure design theories, analysis and design of machine components, synthesis of mechanisms, and logic controllers. |
| **PRODUCT:** | Written Piece |
| **FORMAT:** | Relevant tasks and problems to enforce understanding of the students and help in gradual development of knowledge and skills throughout the course. Submit weeks 4 and 8 (10% each). |
| **CRITERIA:** | |

| No. | | Learning Outcome assessed |
|---|---|---|
| 1 | Demonstratration of advanced knowledge of appropriate analytical principles to describe, design and predict the behaviour of machine components and mechanical sub-systems. | 1 |
| 2 | Identification of appropriate analytical models to describe and predict the behaviour of standard machine components against desired outcomes. | 2 |
| 3 | Analysis of the behaviour of a complex machine sub-systems/elements to evaluate the overall system. | 3 |
| 4 | Application of technical knowledge and tools (appropriate computer aided design software) from different engineering disciplines in designing machine components to suit specific requirements. | 4 |
| 5 | Application of codes and standards to machine component design. | 6 |

| | |
|---|---|
| **GENERIC SKILLS:** | Problem solving, Organisation |

**All - Assessment Task 3:** Project

| | |
|---|---|
| **GOAL:** | Design project will give you the opportunity to apply specific skills gained in this course to design and build artefacts (mechanisms and machine components) which meet the real-world inspired task. |
| **PRODUCT:** | Artefact - Technical and Scientific, and Written Piece |
| **FORMAT:** | Written report format with physical prototype and demonstration where applicable. |
| **CRITERIA:** | |

| No. | | Learning Outcome assessed |
|---|---|---|
| 1 | Demonstratration of advanced knowledge of appropriate analytical principles to describe, design and predict the behaviour of machine components and mechanical sub-systems. | 1 |
| 2 | Identification of appropriate analytical models to describe and predict the behaviour of standard machine components against desired outcomes. | 2 |
| 3 | Analysis the behaviour of complex machine components and sub-systems to evaluate the overall system. | 3 |
| 4 | Application of technical knowledge and tools (appropriate computer aided design software) from different engineering disciplines in designing machine components to suit specific requirements. | 4 |
| 5 | Demonstratration of creativity, design skills, appropriate methodology and clarity in communicating design of machine components through preparation of high-quality drawings and a design report. | 5 |
| 6 | Application of codes and standards to machine component design. | 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.

## 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 | W. Bolton | 2018 | Mechatronics | 7 | Pearson |

### 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?

Health and safety risks for this course have been assessed as low. It is your responsibility 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 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 or using the SafeZone app. For general enquires contact the SafeUniSC team by phone 07 5456 3864 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 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