

# MCH402 Advanced Control Systems Engineering

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

2024 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

This course has been designed to enhance your knowledge of advanced control system design. You will analyse automated, digital, and predictive control systems, and use control system software for real-time implementation. You will distinguish principles of control systems and apply them to engineering processes. Theoretical knowledge is complemented with projects simulating real-world scenarios, demonstrated through software like Matlab or Octave.

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

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

### 1.3. Course Topics

Topics may include:

- Review of control system engineering including stability and steady state errors.
- Overview of transforms.
- Digital and discrete control system design and analysis.
- Predictive and adaptive control systems.
- Multivariable control.
- Design, modelling and real time realisation of different control systems using control software.

## 2. What level is this course?

400 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...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Demonstrate advanced knowledge of the theory and applications of control systems and controllers.	Knowledgeable	1, 1.3.a, 1.3
2 Demonstrate knowledge of different predictive and adaptive control systems designs	Knowledgeable	1, 1.3.a, 1.3
3 Transform and evaluate different control systems to synthesize and justify solutions for specific applications.	Creative and critical thinker	2, 2.1.a, 2.1
4 Design and evaluate various digital and discrete control systems for stability and performance to ensure relevant criteria are met.	Creative and critical thinker	2, 2.1.a, 2.1
5 Apply mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process and perform real time realisation of the control system using control software	Empowered	2, 2.3.a, 2.3
6 Design and apply suitable automatic and multivariable control systems in order to automate an industrial engineering process.	Engaged	2, 2.3.a, 2.3

### \* Competencies by Professional Body

CODE	COMPETENCY
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.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2	Elements of competency: Engineering Application Ability

CODE	COMPETENCY
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.
2.3.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.

## 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

Enrolled in GC003, GD003, MC003, GC004, GD004, MC004, GC005, GD005, MC005, GC006, GD006, MC006, SC404, SC405 or SC411.

### 5.2. Co-requisites

Not applicable

### 5.3. Anti-requisites

Not applicable

### 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

Early feedback will be provided through completion of weekly activities in workshops. Furthermore, feedback on each assessment will be provided which will be used to help with the following assessment.

### 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%	2000 words	Week 8	Online Assignment Submission with plagiarism check
All	2	Quiz/zes	Individual	10%	5 x Quizzes	Throughout teaching period (refer to Format)	Online Test (Quiz)
All	3	Examination - Centrally Scheduled	Individual	50%	2 hours	Exam Period	Online Assignment Submission with plagiarism check

**All - Assessment Task 1: Laboratory Analysis**

<b>GOAL:</b>	Laboratory analysis of a control system.	
<b>PRODUCT:</b>	Practical / Laboratory Skills, and Written Piece	
<b>FORMAT:</b>	Laboratory analysis of a control system.	
<b>CRITERIA:</b>	<b>No.</b>	<b>Learning Outcome assessed</b>
	1	Design, evaluation and critically analysis of various digital and discrete control systems for stability and performance to ensure relevant criteria are met. 4
	2	Application of mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process and perform real time realisation of the control system using control software 5
	3	Design and application of suitable automatic and multivariable control systems in order to automate an industrial engineering process. 6
	4	Demonstration of advanced knowledge of the theory and applications of control systems and controllers. 1
	5	Demonstration of knowledge of different predictive and adaptive control systems designs 2
<b>GENERIC SKILLS:</b>	Communication, Problem solving, Organisation, Applying technologies, Information literacy	

**All - Assessment Task 2: Quizzes**

<b>GOAL:</b>	Apply knowledge through practical tasks and problem solving.	
<b>PRODUCT:</b>	Quiz/zes	
<b>FORMAT:</b>	Application of knowledge through practical tasks and problem solving. Weeks 2, 4, 6, 8, 10.	
<b>CRITERIA:</b>	<b>No.</b>	<b>Learning Outcome assessed</b>
	1	Demonstration of advanced knowledge of the theory and applications of control systems and controllers. 1
	2	Demonstration of knowledge of different predictive and adaptive control systems designs 2
<b>GENERIC SKILLS:</b>	Problem solving, Organisation, Applying technologies, Information literacy	

### All - Assessment Task 3: Final Exam

<b>GOAL:</b>	Answer questions and problems related to the course contents.																		
<b>PRODUCT:</b>	Examination - Centrally Scheduled																		
<b>FORMAT:</b>	Questions and problems related to the course contents.																		
<b>CRITERIA:</b>	<table border="1"><thead><tr><th>No.</th><th></th><th>Learning Outcome assessed</th></tr></thead><tbody><tr><td>1</td><td>Design, evaluation and critically analysis of various digital and discrete control systems for stability and performance to ensure relevant criteria are met.</td><td>4</td></tr><tr><td>2</td><td>Transformation and evaluation of different control systems to synthesize and justify solutions for specific applications.</td><td>3</td></tr><tr><td>3</td><td>Application of mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process and perform real time realisation of the control system using control software</td><td>5</td></tr><tr><td>4</td><td>Demonstration of advanced knowledge of the theory and applications of control systems and controllers.</td><td>1</td></tr><tr><td>5</td><td>Demonstration of knowledge of different predictive and adaptive control systems designs</td><td>2</td></tr></tbody></table>	No.		Learning Outcome assessed	1	Design, evaluation and critically analysis of various digital and discrete control systems for stability and performance to ensure relevant criteria are met.	4	2	Transformation and evaluation of different control systems to synthesize and justify solutions for specific applications.	3	3	Application of mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process and perform real time realisation of the control system using control software	5	4	Demonstration of advanced knowledge of the theory and applications of control systems and controllers.	1	5	Demonstration of knowledge of different predictive and adaptive control systems designs	2
No.		Learning Outcome assessed																	
1	Design, evaluation and critically analysis of various digital and discrete control systems for stability and performance to ensure relevant criteria are met.	4																	
2	Transformation and evaluation of different control systems to synthesize and justify solutions for specific applications.	3																	
3	Application of mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process and perform real time realisation of the control system using control software	5																	
4	Demonstration of advanced knowledge of the theory and applications of control systems and controllers.	1																	
5	Demonstration of knowledge of different predictive and adaptive control systems designs	2																	
<b>GENERIC SKILLS:</b>	Problem solving, Applying technologies, 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

There are no required/recommended resources for this course.

### 8.2. Specific requirements

Not applicable

## 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 will be penalised at the following maximum rate (the rates are cumulative):

- 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 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 and supply the required documentation to negotiate an outcome.

Refer to the Assessment: Courses and Coursework Programs – Procedures

## 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](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).

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