COURSE OUTLINE

# ELC205 Control Systems

**Course Coordinator:** Kenneth Ang (lang@usc.edu.au) **School:** School of Science, Technology and Engineering

2021 | Semester 2

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| USC Moreton Bay | ON CAMPUS | Most of your course is on campus but you may be able to do some components of this course online. |

*Please go to the USC website 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

Not offered until Semester 2 2021
Control systems are used to attain increased productivity and better performance of a system. In this course, you gain an understanding of the expediency and application of control systems engineering. You will be introduced to the fundamental elements of control theory and its application in industrial control systems. You will use this knowledge of mathematical theories to develop advanced methods to design, model and analyze control theories and apply your modeling and analysis skills to design and solve the problem of control systems.

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

| ACTIVITY | HOURS | BEGINNING WEEK | FREQUENCY |
|---|---|---|---|
| **ON CAMPUS** | | | |
| **Tutorial/Workshop 1** | 3hrs | Not applicable | 4 times |
| **Laboratory 1** | 3hrs | Not applicable | 4 times |
| **Lecture** | 2hrs | Week 1 | 13 times |

### 1.3. Course Topics

- Control theory
- Open and closed loop control
- System modelling (Laplace transforms)
- PID control
- Root locus and Bode plots
- Design for steady state and stability
- Linear feedback systems and feedforward systems
- Advanced topics in control systems

## 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<br>On successful completion of this course, you should be able to... | GRADUATE QUALITIES MAPPING<br>Completing these tasks successfully will contribute to you becoming... | PROFESSIONAL STANDARD MAPPING<br>Engineers Australia |
|---|---|---|
| 1 Recognise and formulate system models and control system characteristics | Knowledgeable | 1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.<br>1.3 - In-depth understanding of specialist bodies of knowledge within the engineering discipline. |
| 2 Use control system theories and understanding to identify and analyse dynamic system behaviour | Creative and critical thinker | 2.1 - Application of established engineering methods to complex engineering problem solving.<br>2.3 - Application of systematic engineering synthesis and design processes. |
| 3 Apply knowledge and skills to design, implement and evaluate feedback control loops. | Empowered | 2.2 - Fluent application of engineering techniques, tools and resources. |
| 4 Professionally communicate the investigation, analysis and interpretation of experimental data in continuous and discrete-time systems. | Engaged | 3.2 - Effective oral and written communication in professional and lay domains.<br>3.3 - Creative, innovative and pro-active demeanour. |
| 5 Work collaboratively in teams to design control system to meet specified requirements. | Empowered | 3.6 - Effective team membership and team leadership. |

## 5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of “pre-requisites, co-requisites and anti-requisites”.

### 5.1. Pre-requisites

MTH201 and enrolled in Program SC404, SC405, SC410, SC411, SC425, AB101, UU301, UU302 or XU301

### 5.2. Co-requisites

Not applicable

### 5.3. Anti-requisites

Not applicable

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

A good understanding of the content of MTH201

## 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 the workshop tasks 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 | Portfolio | Group | 20% | 400 words equivalent each<br>4 x 5% each | Refer to Format | Online Assignment Submission |
| All | 2 | Oral and Written Piece | Group | 40% | The project report is to be written with a maximum page limit of 10 pages. Each group will deliver a 10 minutes oral presentation. | Week 13 | Online Assignment Submission with plagiarism check |
| All | 3 | Examination - Centrally Scheduled | Individual | 40% | 2 hours | Exam Period | Exam Venue |

### All - Assessment Task 1: Portfolio

| | |
|---|---|
| **GOAL:** | These tasks will build your skills in identifying solutions to practical experiments that use hardware and computer simulation in control systems of simple and intermediate complexity. You'll also expand your skills in using common industrial formats to document your scientific conclusions |
| **PRODUCT:** | Portfolio |
| **FORMAT:** | Control system-based laboratory works in the form of a 4 reports of 400 words equivalent each including figures, text, and diagrams. |
| **CRITERIA:** | |

| No. | | Learning Outcome assessed |
|---|---|---|
| 1 | Recognition and formulation of control system models. | 1 |
| 2 | Utilisation of theories to identify and analyse dynamic system behaviour | 2 |
| 3 | Communication of experimental results continuous and discrete-time systems using appropriate engineering terminology, symbols and diagrams. | 4 |
| 4 | Demonstration of ability to work collaboratively in teams to design control system to meet specified requirements. | 5 |
| 5 | Application of systematic control engineering and design processes within the technology domain | 3 |

### All - Assessment Task 2: Mini Project and presentation

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|---|---|
| **GOAL:** | These projects will develop your understanding of important theory and enable you to demonstrate your knowledge and skills in designing controls in electrical and electronics systems of intermediate complexity. |
| **PRODUCT:** | Oral and Written Piece |
| **FORMAT:** | Project report of 1500 words equivalent and make an oral presentation of approximately 10 minutes. |

| CRITERIA: | No. | | Learning Outcome assessed |
|---|---|---|---|
| | 1 | Utilisation of theories to identify dynamic system behaviour | 2 |
| | 2 | Application of practical skills and knowledge to design, implement and evaluate feedback control loops | 3 |
| | 3 | Communication of experimental results and understanding of control system theories in continuous and discrete-time systems using appropriate engineering terminology, symbols and diagrams in different modes of communication. | 4 |
| | 4 | Demonstration of ability to work collaboratively in teams to design control system to meet specified requirements. | 5 |

**All - Assessment Task 3:** Final Exam

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|---|---|
| GOAL: | The final exam will develop your ability to independently apply your skills and knowledge to solve familiar problem-based questions with confidence within a set time limit and without access to additional resources. |
| PRODUCT: | Examination - Centrally Scheduled |
| FORMAT: | Centrally scheduled 2 hour closed book examination. |

| CRITERIA: | No. | | Learning Outcome assessed |
|---|---|---|---|
| | 1 | Correct utilisation of control system theories to identify dynamic system behaviour | 2 |
| | 2 | Correct application of practical skills and knowledge to design, implement and evaluate feedback control loops | 3 |

## 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. Directed study hours may vary by location. 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 Blackboard 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 | PUBLISHER |
|---|---|---|---|---|
| Required | Norman S. Nise | 2017 | Control Systems Engineering | Wiley |

### 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 Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

## 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. 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.

## 10.5. 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.

## 10.6. 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.

## 10.7. 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
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website: http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

## 10.8. General Enquiries

**In person:**

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **USC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

**Tel:** +61 7 5430 2890

**Email:** studentcentral@usc.edu.au