



# ELEC6203

## Control Systems and Industrial Automation

Session 1, In person-scheduled-weekday, North Ryde 2025

*School of Engineering*

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## General Information

Unit convenor and teaching staff

Unit convenor

Leonardo Callegaro

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Contact via email

44 Waterloo Road Room 123

Wed 2-4:00pm

Credit points

10

Prerequisites

Corequisites

Co-badged status

ELEC3024 Control Systems

Unit description

This unit develops fundamental knowledge and skills in the area of control systems analysis and design, and application in modern industrial automation contexts. Topics covered include: an introduction to control system design process and applications; mathematical modelling of electrical and mechanical systems in the frequency domain; performance and stability analysis of single-input single-output linear control systems; design of feedback control systems using root locus and frequency response techniques; an introduction to digital control systems; and controllers for industrial automation. This unit uses problem/team based learning approach, where students choose their team members and work together on a project topic. The project topic is based on a practical control system or research problem. Each team performs the modelling, analysis, identification, control design, and simulation of the control system related to the project. Simulink/MATLAB is used to implement a real-time digital control system, and a control board is adopted when hardware interfacing is required.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals ([UNSDGs](#)) Industry, Innovation and Infrastructure

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Describe a control system's design process and control systems analysis

**ULO2:** Develop appropriate mathematical models of electrical and mechanical systems to be controlled in the frequency domain

**ULO3:** Analyse the performance and stability of single-input single-output linear control systems

**ULO4:** Design feedback control systems using tools such as MATLAB & Simulink to achieve specific performance requirements

**ULO5:** Characterise the behaviour of elementary feedback control systems in simulation, and using microcontroller based experiments when hardware is required

**ULO6:** Evaluate operation and performance of controllers used in industrial automation applications

## General Assessment Information

### Grading and Passing Requirement for Unit

- In order to pass this Unit a student must obtain a mark of 50 or more for the Unit (i.e. obtain a passing grade P, CR, D, or HD)
- If you receive Special Consideration for the oral presentation and demonstration of the Project, a supplementary conventional exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a Special Consideration application for the oral presentation and demonstration of the Project you are declaring yourself available for a conventional exam during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to applying. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.
- For further details about grading, please refer below in the policies and procedures section.

### Attendance and Participation

We strongly encourage all students to actively participate in all scheduled learning activities. Regular engagement is crucial for your success in this unit, as these activities provide opportunities to deepen your understanding of the material, collaborate with peers, and receive valuable feedback from instructors, to assist in completing the unit assessments. Your active

participation not only enhances your own learning experience but also contributes to a vibrant and dynamic learning environment for everyone.

### Late Assessment Submission Penalty

- Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern.
- For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for [Special Consideration](#).

### Assessments where Late Submission will (and will not) be accepted

- Pre-Class Quiz (Lectorials) - NO, unless Special Consideration is granted.
- Assignments (PC Labs) - NO, unless Special Consideration is granted.
- Class Quiz (Lectorials) - NO, unless Special Consideration is granted.
- Assessment (Project) - YES, Standard Late Penalties applies to the iLearn submission.

### Re-Submission of work

Re-submission of work is not accepted.

### Special Consideration

The [Special Consideration Policy](#) aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through <https://connect.mq.edu.au>.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Pre-Class Quiz</a>	10%	No	Week 2, 3, 4, 5, 6, 7
<a href="#">Assignments (PC Labs)</a>	20%	No	Week 2, 3, 4, 5, 6, 7
<a href="#">Class Quiz</a>	20%	No	Week 9
<a href="#">Assessment (Project)</a>	50%	No	Week 13, 14

## Pre-Class Quiz

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Week 2, 3, 4, 5, 6, 7**

Weighting: **10%**

Students are expected to go through the iLearn content, understand the theory and attempt the quiz

On successful completion you will be able to:

- Describe a control system's design process and control systems analysis
- Develop appropriate mathematical models of electrical and mechanical systems to be controlled in the frequency domain
- Analyse the performance and stability of single-input single-output linear control systems
- Design feedback control systems using tools such as MATLAB & Simulink to achieve specific performance requirements
- Characterise the behaviour of elementary feedback control systems in simulation, and using microcontroller based experiments when hardware is required
- Evaluate operation and performance of controllers used in industrial automation applications

## Assignments (PC Labs)

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 12 hours

Due: **Week 2, 3, 4, 5, 6, 7**

Weighting: **20%**

This evaluation focuses on students ability to solve problems and perform modelling, design and implementation of control systems using MATLAB/Simulink.

On successful completion you will be able to:

- Develop appropriate mathematical models of electrical and mechanical systems to be controlled in the frequency domain
- Analyse the performance and stability of single-input single-output linear control systems

- Design feedback control systems using tools such as MATLAB & Simulink to achieve specific performance requirements
- Evaluate operation and performance of controllers used in industrial automation applications

## Class Quiz

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Week 9**

Weighting: **20%**

The quiz will assess both factual knowledge and problem solving.

On successful completion you will be able to:

- Describe a control system's design process and control systems analysis
- Develop appropriate mathematical models of electrical and mechanical systems to be controlled in the frequency domain
- Analyse the performance and stability of single-input single-output linear control systems
- Design feedback control systems using tools such as MATLAB & Simulink to achieve specific performance requirements
- Characterise the behaviour of elementary feedback control systems in simulation, and using microcontroller based experiments when hardware is required
- Evaluate operation and performance of controllers used in industrial automation applications

## Assessment (Project)

Assessment Type <sup>1</sup>: Project

Indicative Time on Task <sup>2</sup>: 20 hours

Due: **Week 13, 14**

Weighting: **50%**

This is the major assessment of this Unit. It will consist of project report, oral presentation and demonstration of the project

On successful completion you will be able to:

- Describe a control system's design process and control systems analysis
- Develop appropriate mathematical models of electrical and mechanical systems to be controlled in the frequency domain
- Analyse the performance and stability of single-input single-output linear control systems
- Design feedback control systems using tools such as MATLAB & Simulink to achieve specific performance requirements
- Characterise the behaviour of elementary feedback control systems in simulation, and using microcontroller based experiments when hardware is required
- Evaluate operation and performance of controllers used in industrial automation applications

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Methods of Communication

- Students are reminded the university will communicate all official notices by email to official MQ student's account. Students should read their @student.mq.edu.au email regularly (or forward it to an account they check regularly).
- All announcements and other communication regarding this Unit will be delivered via the iLearn platform.
- Queries to convenors can either be placed on the iLearn discussion board or sent to the unit convenor via the contact email on iLearn.

### Unit Website

- The iLearn website for this unit can be found at: <https://ilearn.mq.edu.au/login/>.
  - *Note: All information and communications relevant to this Unit will be via the iLearn website.*

### Textbook

- [Control Systems Engineering \(Digital or Print\)](#), 8th edn, Australia & New Zealand Edition 2019, Norman S. Nise, Wiley, ISBN: 9781119594352 (Digital version recommended).

- *Note: Links will be provided to specific sections of the Digital version in iLearn for each Lectorial.*
- *Remark: this textbook is used extensively as a reference in all activities of this Unit. All students are expected to have access to this textbook.*
- or, **Control Systems Engineering (Print)**, 7th Edition 2014, Norman S. Nise, John Wiley & Sons, ISBN: 9781118170519.
  - *Note: Older editions of this textbook suffice for individual study, although links to weekly readings posted on iLearn refer uniquely to the 8th edn (Digital) version only.*
- **Student Companion Site:** <http://bcs.wiley.com/he-bcs/Books?action=index&itemId=1119474221&bcsId=11568> is a complimentary resource to the textbook, including a wealth of MATLAB examples classified according to each chapter.
- **Support Website:** <http://www.wileydigitalsolutions.com.au/support/article/student/> – link to the Wiley's digital solutions support page and live chat for students.

## Workshops

- There will be a Workshop (3 hours, online) for every week in the first part of the semester (Weeks 1-7). The workshop will comprise of: - discussion session on fundamental knowledge. - practical examples. - interactive problem solving involving students.
- These workshops are a combination of traditional lecture and tutorial teaching modes and are designed to improve student engagement inside/outside classes.
- The workshops are organised in a **flipped classroom fashion**, students are expected to go through the recommended weekly study contents before each Lectorial takes place.
- Outside class
  - links to E-Text specific sections, brief videos and/or lecture notes are posted in iLearn each week.
  - students are expected to read these E-Text sections, try to solve any given examples, and watch any videos and/or read any posted notes prior to attending the Lectorials.
- Inside class
  - brief discussion sessions on fundamental principles.
  - practical examples.
  - interactive problem solving involving students.

## Laboratories

- PC Lab activities start from Week 2 and take place once a week (Weeks 2-7) according



to the Unit schedule.

- *Note: Students must register in one of the available weekly Lab sessions.*
- Interactive PC Labs use MATLAB/Simulink software platform to assist with the modelling and design of control systems.

*On-campus activities commence in Week 2. Students should contact the Unit convenor as soon as possible if they are unable to get back to campus in time.*

## Project

- Project activities take place during Weeks 8-13.
- The Project covers practical aspects of control theory and its applications.
- Students are required to form teams to work on the Project.
  - *All Project activities are performed in teams.*

## Technology

- The laboratory work will rely on the use of MATLAB/Simulink software platform.
- The software is available through [AppStream](#) and/or on Faculty PCs.
- Each team will be given an Arduino kit for the second half of the semester to perform experimental activities.

## Web Resources

- **Control Tutorials for MATLAB and Simulink (CTMS):**
  - <http://ctms.engin.umich.edu/CTMS/index.php?aux=Home>
  - These tutorials are designed to help students learn how to use MATLAB/Simulink for the analysis and design of automatic control systems.
  - They cover the basics of MATLAB/Simulink and introduce the most common classical and modern control design techniques.
- **MathWorks Website (MATLAB, Simulink, user-guides, tutorials, etc):**
  - MATLAB Courseware
    - <https://au.mathworks.com/academia/courseware.html>
  - MATLAB Onramp
    - <https://au.mathworks.com/learn/tutorials/matlab-onramp.html>

## Unit Schedule

An up to date weekly unit schedule is posted on the iLearn website.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to

Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies) (<https://students.mq.edu.au/support/study/policies>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [connect.mq.edu.au](https://connect.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Academic Success

[Academic Success](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via the [Service Connect Portal](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Engineers Australia (EA) Competency Mapping

Engineers Australia Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1, ULO2, ULO3, ULO4, ULO5
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1, ULO2, ULO3, ULO4, ULO5

	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, ULO3, ULO4, ULO5
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	ULO1, ULO2, ULO3, ULO5, ULO6
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO1, ULO2, ULO3, ULO4, ULO5
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2, ULO3, ULO4, ULO5
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO1, ULO2, ULO3, ULO4, ULO5
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	
	3.2 Effective oral and written communication in professional and lay domains.	
	3.3 Creative, innovative and pro-active demeanour.	
	3.4 Professional use and management of information.	ULO1, ULO3, ULO4, ULO5
	3.5 Orderly management of self, and professional conduct.	ULO4
	3.6 Effective team membership and team leadership	ULO5

Unit information based on version 2025.02 of the [Handbook](#)