ENAE12003 *Control Technology*
Term 1 - 2022

Profile information current as at 14/12/2025 04:10 pm

General Information

Overview
This unit will introduce you to control systems. You will describe control systems using appropriate terminology and concepts and use mathematical tools to model and analyse control systems and develop algorithms for discrete process control. You will interpret control system responses to standard inputs in order to develop system evaluation criteria, as well as interpreting continuous-time closed-loop system behaviour using time domain and frequency response methods. You will design compensators for closed-loop systems to meet given specifications and describe different approaches to discrete control using common system components and tools and present practical implementations of the controllers using passive and active circuits and discrete processes. You will document modeling and analysis of control systems in a professional manner, and work productively and professionally, both as an individual and as a member of a team. In this unit, you must complete compulsory practical activities. Refer to the Engineering Undergraduate Course Moodle site for proposed dates.

Details
Career Level: *Undergraduate*
Unit Level: *Level 2*
Credit Points: *6*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites
Pre-requisite: ENAE12013 Electrical Components and Circuit Analysis
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 1 - 2022
- Mixed Mode

Attendance Requirements
All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website
This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Online Quiz(zes)**
Weighting: 20%
2. **Written Assessment**
Weighting: 30%
3. **Written Assessment**
Weighting: 30%
4. **Practical and Written Assessment**
Weighting: 20%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Unit survey

Feedback
Lecturer made sure that students understood what was required and they enjoyed the learning experience.

Recommendation
Continue this good practice.

Feedback from Unit survey

Feedback
Time periods between submitting work and receiving feedback could be better.

Recommendation
Try to reduce the gap between assessment submission and releasing feedback.

Feedback from Unit Coordinator reflection

Feedback
Review the number of assessment pieces.

Recommendation
Change assessment structure if applicable.

Unit Learning Outcomes

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

1. Explain the principles of automatic control systems and associated control system building blocks
2. Model and analyse the behaviour of dynamic systems using appropriate mathematical, graphical, and computer-aided tools
3. Apply analytical techniques to determine system stability and input output response
4. Carry out closed loop controller design tasks both in continuous and discrete domains
5. Investigate and report the process of analogue and/or digital controller design for a dynamic system; solved collaboratively or autonomously
6. Communicate and document analogue and/or digital control system solutions, calculations, and approaches, using correct terminology, symbols, and diagrams.

The Learning Outcomes for this unit are linked with the Engineers Australia Stage 1 Competency Standards for Engineering Associates in the areas of 1. Knowledge and Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:

Introductory

1.5 Knowledge of engineering design practice and contextual factors impacting the practice area. (LO: 1N 2N 3N 4N 5N 6N)

3.1 Ethical conduct and professional accountability. (LO: 5N 6N)

Intermediate

1.3 In-depth practical knowledge and skills within specialist sub-disciplines of the practice area. (LO: 1I 2I 3I 4I 5I 6I)

1.4 Discernment of engineering developments within the practice area. (LO: 1I 2I 3I 4I 5I 6I)

1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the area of practice. (LO: 1I 2I 3I 4I 5I 6I)

2.2 Application of technical and practical techniques, tools and resources to well-defined engineering problems. (LO: 2I 3I 4I 5I 6I)

2.3 Application of systematic design processes to well-defined engineering problems. (LO: 2I 3I 4I 5I 6I)

2.4 Application of systematic project management processes. (LO: 5I 6I)

3.2 Effective oral and written communication in professional and lay domains. (LO: 5I 6I)

3.4 Professional use and management of information. (LO: 5I 6I)

3.5 Orderly management of self, and professional conduct. (LO: 5I 6I)

3.6 Effective team membership and team leadership. (LO: 5I 6I)

Advanced

1.1 Descriptive, formula-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the practice area. (LO: 1A 2A 3A 4I 5I 6I)

1.2 Procedural-level understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the practice area. (LO: 1I 2A 3A 4I 5I 6I)

2.1 Application of established technical and practical methods to the solution of well-defined engineering problems. (LO: 1I 2A 3A 4A 5I 6I)

Note: LO refers to the Learning Outcome number(s) which link to the competency and the levels: N – Introductory, I – Intermediate and A - Advanced.

Refer to the Engineering Undergraduate Course Moodle site for further information on the Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course level mapping information
https://moodle.cqu.edu.au/course/view.php?id=1511

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level ◦ Introductory Level • Intermediate Level • Graduate Level ◦ Professional Level ◦ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Online Quiz(zes) - 20%	•	•	•	•		
2 - Written Assessment - 30%	•	•				
3 - Written Assessment - 30%			•	•	•	•
4 - Practical and Written Assessment - 20%					•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Communication					•	•
2 - Problem Solving	•	•	•	•	•	
3 - Critical Thinking	•	•	•	•	•	
4 - Information Literacy						
5 - Team Work					•	
6 - Information Technology Competence		•			•	•
7 - Cross Cultural Competence						
8 - Ethical practice						
9 - Social Innovation						
10 - Aboriginal and Torres Strait Islander Cultures						

Textbooks and Resources

Textbooks

ENAE12003

Prescribed

Control Systems Engineering
Edition: 8 (2019)
Authors: Norman S. Nise
John Wiley & Sons
Binding: Hardcover

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Sanath Alahakoon Unit Coordinator
s.alahakoon@cqu.edu.au

Schedule

Week 1 - 07 Mar 2022

Module/Topic	Chapter	Events and Submissions/Topic
Overview of control systems	Chapter 1: Introduction Week 1 Study Guide	

Week 2 - 14 Mar 2022

Module/Topic	Chapter	Events and Submissions/Topic
Representation of control systems	Chapter 2: Modeling in the Frequency Domain Chapter 5: Reduction of Multiple Subsystems Week 2, 3 Study Guide	

Week 3 - 21 Mar 2022

Module/Topic	Chapter	Events and Submissions/Topic
Representation of control systems	Chapter 2: Modeling in the Frequency Domain Chapter 5: Reduction of Multiple Subsystems Week 2, 3 Study Guide	

Week 4 - 28 Mar 2022

Module/Topic	Chapter	Events and Submissions/Topic

Poles, zeros and the system response	Chapter 4: Time Response Chapter 7: Steady-State Errors Week 4, 5 Study Guide	Online Quiz Part 1 (Open from 26th March - 04th April 2022)

Week 5 - 04 Apr 2022

Module/Topic	Chapter	Events and Submissions/Topic
Poles, zeros and the system response	Chapter 4: Time Response Chapter 7: Steady-State Errors Week 4, 5 Study Guide	Residential school of the unit will be held in Rockhampton B28/2.10 from 05th to 07th April 2022 starting at 9.00 am.

Vacation Week - 11 Apr 2022

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 18 Apr 2022

Module/Topic	Chapter	Events and Submissions/Topic
PID Control	Week 6 Study Guide	**ASSIGNMENT 1** Due: Week 6 Friday (22 Apr 2022) 11:55 pm AEST

Week 7 - 25 Apr 2022

Module/Topic	Chapter	Events and Submissions/Topic
Overview of Digital Control	13: Digital Control Systems Week 7 Study Guide	Online Quiz Part 2 (Open from 23rd April - 2nd May 2022)

Week 8 - 02 May 2022

Module/Topic	Chapter	Events and Submissions/Topic
Programmable Logic Controllers	Week 8 Study Guide	

Week 9 - 09 May 2022

Module/Topic	Chapter	Events and Submissions/Topic
Root Locus Based Controller Design	Chapter 6: Stability Chapter 8: Root Locus Techniques Chapter 9: Design Via Root Locus Week 9, 10 Study Guide	**RESIDENTIAL SCHOOL & LAB REPORTS** Due: Week 9 Friday (13 May 2022) 11:55 pm AEST

Week 10 - 16 May 2022

Module/Topic	Chapter	Events and Submissions/Topic
Root Locus Based Controller Design	Chapter 6: Stability Chapter 8: Root Locus Techniques Chapter 9: Design Via Root Locus Week 9, 10 Study Guide	

Week 11 - 23 May 2022

Module/Topic	Chapter	Events and Submissions/Topic
Frequency Response Based Controller Design	Chapter 10: Frequency Response Techniques Chapter 11: Design Via Frequency Response Week 11, 12 Study Guide	

Week 12 - 30 May 2022

Module/Topic	Chapter	Events and Submissions/Topic
Frequency Response Based Controller Design	Chapter 10: Frequency Response Techniques Chapter 11: Design Via Frequency Response Week 11, 12 Study Guide	Online Quiz Part 3 (Open from 28th May - 6th June 2022)

Review/Exam Week - 06 Jun 2022

Module/Topic	Chapter	Events and Submissions/Topic

Final Submission Week	**ASSIGNMENT 2** Due: Review/Exam Week Friday (10 June 2022) 11:55 pm AEST

Exam Week - 13 Jun 2022

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 ONLINE QUIZZES

Assessment Type
Online Quiz(zes)

Task Description
There are 3 online quizzes which gives 20% of the unit total. Marks for the three quizzes will be averaged and scaled to a mark out of 20%. This collection of online quizzes will be published in the unit Moodle site. Online quizzes are designed to check the essential student understanding of each of the topics covered in the unit. The quizzes will be available in Week 4, 7 and 12. Each quiz will test the knowledge gained by the students during the weeks immediately before the particular quiz.

Number of Quizzes
3

Frequency of Quizzes

Assessment Due Date

Completed online through unit Moodle site

Return Date to Students

Students will have access to the results immediately after the quizzes

Weighting
20%

Minimum mark or grade
Students must score 50% of the allocated marks.

Assessment Criteria
Students can have up to three attempts. Highest mark/s will be counted. Each correct response will receive one mark. Marks for the three quizzes will be averaged and scaled to a mark out of 20%.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Complete online through unit Moodle site.

Learning Outcomes Assessed

- Explain the principles of automatic control systems and associated control system building blocks
- Model and analyse the behaviour of dynamic systems using appropriate mathematical, graphical, and computer-aided tools
- Apply analytical techniques to determine system stability and input output response
- Carry out closed loop controller design tasks both in continuous and discrete domains

2 ASSIGNMENT 1

Assessment Type
Written Assessment

Task Description
In this compulsory assessment item, students are expected to successfully complete the exercises specified in the unit

Moodle site. This assignment contains 6-8 problems which will require the theoretical knowledge gained through your learning during the first six weeks. Marking scheme for each
question will be published with the assignment and the marks for this assignment will contribute to 30% of the overall marks of this course. Assignment questions will be published in the unit Moodle site within the first week of the term. Please also refer to assessment criteria for more details.

Assessment Due Date
Week 6 Friday (22 Apr 2022) 11:55 pm AEST

Please upload to the link provided in unit website in Moodle as a WORD of PDF file

Return Date to Students
Week 8 Friday (6 May 2022)

Feedback given through unit website in Moodle

Weighting
30%

Minimum mark or grade
Students must score 50% of the allocated marks.

Assessment Criteria
Each question in this assignment will be assessed separately for the criterion accuracy and correct results and given a mark from zero to 10 marks. 20% of the total marks for this assignment are based on accuracy and correct results, including:

- Correct application of maths and arithmetic
- Answers clearly identified
- Correct results

In addition, the assignment as a whole will be assessed against the following criteria:
Evidence of correct procedures (40% of the total marks for the assignment)

- All necessary steps in analysis are present on correct order
- Clear presentation of mathematical and arithmetical working linking given details of the problem to the results obtained.
- Evidence of checking results (mathematical, graphical, logic-common sense)

Evidence of understanding of the topic (30% of the total marks for the assignment)

- Explanation of choices made in the analysis (why is procedure required, why this particular procedure)
- Interpretation of results, eg limitations, direction of vectors

Professional presentation (10% of the total marks for the assignment)

- The work (job) is clearly identified (problem, date, analyst)
- Clear statement of each problem and its details and requirements
- Logical layout of analysis
- Appropriate use of diagrams, clear diagrams
- Correct use of terminology, conventions
- Clear English in the explanation of procedure and interpretation of results.
- Referencing of authoritative sources of equations and data

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Please upload to the link provided in course website in Moodle as a WORD of PDF file

Learning Outcomes Assessed

- Explain the principles of automatic control systems and associated control system building blocks
- Model and analyse the behaviour of dynamic systems using appropriate mathematical, graphical, and computer-aided tools

3 ASSIGNMENT 2

Assessment Type
Written Assessment

Task Description
In this compulsory assessment item, students are expected to successfully complete the exercises specified in the unit Moodle site. This assignment contains 6-8 problems which will require the theoretical knowledge gained through your learning during week 6 to week 12. Marking scheme for each
question will be published with the assignment and the marks for this assignment will contribute to 30% of the overall marks of this course. Assignment questions will be published in the unit Moodle site within the first week of the term. Please also refer to assessment criteria for more details.

Assessment Due Date
Review/Exam Week Friday (10 June 2022) 11:55 pm AEST

Please upload to the link provided in unit website in Moodle as a WORD of PDF file

Return Date to Students
Exam Week Friday (17 June 2022)

Feedback given through unit website in Moodle

Weighting
30%

Minimum mark or grade
Students must score 50% of the allocated marks.

Assessment Criteria
Each question in this assignment will be assessed separately for the criterion accuracy and correct results and given a mark from zero to 10 marks. 20% of the total marks for this assignment are based on accuracy and correct results, including:

- Correct application of maths and arithmetic
- Answers clearly identified
- Correct results

In addition, the assignment as a whole will be assessed against the following criteria:
Evidence of correct procedures (40% of the total marks for the assignment)

- All necessary steps in analysis are present on correct order
- Clear presentation of mathematical and arithmetical working linking given details of the problem to the results obtained.
- Evidence of checking results (mathematical, graphical, logic-common sense)

Evidence of understanding of the topic (30% of the total marks for the assignment)

- Explanation of choices made in the analysis (why is procedure required, why this particular procedure)
- Interpretation of results, eg limitations, direction of vectors

Professional presentation (10% of the total marks for the assignment)

- The work (job) is clearly identified (problem, date, analyst)
- Clear statement of each problem and its details and requirements
- Logical layout of analysis
- Appropriate use of diagrams, clear diagrams
- Correct use of terminology, conventions
- Clear English in the explanation of procedure and interpretation of results.
- Referencing of authoritative sources of equations and data

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Please upload to the link provided in unit website in Moodle as a WORD of PDF file

Learning Outcomes Assessed

- Apply analytical techniques to determine system stability and input output response
- Carry out closed loop controller design tasks both in continuous and discrete domains
- Investigate and report the process of analogue and/or digital controller design for a dynamic system; solved collaboratively or autonomously
- Communicate and document analogue and/or digital control system solutions, calculations, and approaches, using correct terminology, symbols, and diagrams.

4 RESIDENTIAL SCHOOL & LAB REPORTS

Assessment Type
Practical and Written Assessment

Task Description
Dates for the compulsory residential school will be notified to students through residential school calendar and the course Website. Students will be formed into teams for all residential school activities and each team must submit professional technical laboratory reports compiled into one Zipped file covering each laboratory experiment they will carry out during the residential school. The details of the experiments will be notified to students through the course Website. Please also refer to assessment criteria for more details.

Assessment Due Date
Week 9 Friday (13 May 2022) 11:55 pm AEST

Submit to the link in the unit website in Moodle as a WORD or PDF file.

Return Date to Students
Week 11 Friday (27 May 2022)

Feedback given through unit website in Moodle

Weighting
20%

Minimum mark or grade
Students must score 50% of the allocated marks.

Assessment Criteria
Marking of the team reports will be done according to the following criteria.
The accuracy and relevance of information
Application of knowledge
Language and grammar used in answering questions
Proper referencing of sources of information
Inclusion of all relevant Equations, images, data and tables, and the quality of presentation and layout.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Please upload to the link provided in unit website in Moodle as a WORD of PDF file

Learning Outcomes Assessed

- Investigate and report the process of analogue and/or digital controller design for a dynamic system; solved collaboratively or autonomously
- Communicate and document analogue and/or digital control system solutions, calculations, and approaches, using correct terminology, symbols, and diagrams.

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem