ENEX13001 *Industrial Control and Automation*
Term 2 - 2024

Profile information current as at 15/07/2025 06:28 am

General Information

Overview

This unit aims to provide you with a comprehensive understanding of the key principles and concepts of industrial control and automation. The unit will focus on the essential components of automation systems. You will also gain practical expertise in programming Programmable Logic Controllers (PLCs) using ladder logic and other programming languages. This unit will offer hands-on, project-based learning opportunities that will enable you to apply your theoretical knowledge in practical settings. In this unit, you will learn to configure sensors, actuators, and control equipment to solve industrial problems. You will assess multiple options and choose the best combination of components for your design. Additionally, you will create, evaluate, and simulate an automation solution to a given industry issue using industry-standard components, software, and PLCs. This unit aligns with the United Nations Sustainable Development Goal 9: "Industry, Innovation, and Infrastructure" by fostering innovative and sustainable industrialisation using industrial automation solutions.

Details

Career Level: *Undergraduate*
Unit Level: *Level 3*
Credit Points: *6*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites

Prerequisites: ENEX12002 Introductory Electronics OR (ENEE13018 Analogue Electronics & ENEE13020 Digital Electronics).
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 2 - 2024

- Mackay
- 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: 30%
2. **Laboratory/Practical**
Weighting: 30%
3. **Project (applied)**
Weighting: 40%

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 Student unit evaluation survey

Feedback

The available learning materials and resources are insufficient to help students to learn independently.

Recommendation

Learning resources and video lectures should be improved with interactive content for independent learning.

Feedback from Unit Coordinator's reflection

Feedback

The unit lacks adequate real-world examples of industrial automation systems.

Recommendation

Industrial automation-related technologies and real-world examples should be included in the unit content.

Feedback from Unit Coordinator's reflection

Feedback

The online test may not be an adequate method for evaluating the practical knowledge of students.

Recommendation

The online test should be replaced with a practical project that applies industrial automation technologies to solve real-world problems.

Unit Learning Outcomes

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

1. Understand the principles and concepts of industrial control and automation, including sensors, actuators, controllers, communication systems and feedback mechanisms
2. Demonstrate proficiency in programming Programmable Logic Controllers using languages such as ladder logic
3. Apply theoretical knowledge through hands-on, project-based learning experiences that simulate real-world industrial automation problems, including the design and implementation of control logic
4. Evaluate appropriate sensors and actuators for controlling physical parameters in industrial processes
5. Comply with relevant industry standards and regulations governing industrial automation to ensure system reliability and safety
6. Collaborate proficiently in teams when presenting solutions to industrial automation problems.

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

Intermediate

1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences that underpin the engineering discipline. (LO: 1I 3I)
1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 4I 5I)
1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 4I 5I)
3.1 Ethical conduct and professional accountability. (LO: 4I 5I 6I)
3.2 Effective oral and written communication in professional and lay domains. (LO: 1I 2I 5I 6I)
3.3 Creative, innovative and proactive demeanour. (LO: 3I 6I)
3.4 Professional use and management of information. (LO: 1I 4I 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 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1A 3I 4A)
1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1A 3A 4A)
1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 3A 4A)
2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 2A 3A 4I 6I)
2.2 Fluent application of engineering techniques, tools and resources. (LO: 2A 3A 6I)
2.3 Application of systematic engineering synthesis and design processes. (LO: 2A 3A 6I)
2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 2I 4I 5A 6I)
Note: LO refers to the Learning Outcome number(s) that 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) - 30%	•			•	•	
2 - Laboratory/Practical - 30%	•	•	•			•
3 - Project (applied) - 40%		•	•	•	•	

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

ENEX13001

Prescribed

Principles of Measurement Systems
Edition: 4th (2005)
Authors: John P Bentley
Pearson Education Ltd.
Harlaw , Essex , England
ISBN: 0-130-43028-5
Binding: Paperback

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Laptop/Computer
- Factory I/O License

Referencing Style

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

Teaching Contacts

Diluka Moratuwage Unit Coordinator
d.moratuwage@cqu.edu.au

Schedule

Week 1 - 08 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Industrial Control and Automation • History and evolution of industrial automation • Key concepts and terminology • Benefits and challenges • Overview of modern automation technologies	Lecture Notes/Slides	

Week 2 - 15 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Measurement Systems and Characteristics • Types of measurement systems • Key characteristics (ex: range, sensitivity, precision) • Error analysis and uncertainty • Calibration	Lecture Notes/Slides	

Week 3 - 22 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Sensors in Industrial Automation - I • Overview of sensors and their importance • Types of sensors (e.g. analogue and digital) • Selection criteria in industrial applications	Lecture Notes/Slides	

Week 4 - 29 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Programmable Logic Controllers (PLCs) • Introduction and history of PLCs • PLC hardware architecture • I/O Modules and wiring • Communication buses • Basics of PLC Programming • Ladder Logic Diagrams • Advantages of using PLCs in automation.	Lecture Notes/Slides	Assessment 1 - Online Quiz Part 1 (Open from 15th July - 2nd August)

Week 5 - 05 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Sensors in Industrial Automation - II • More advanced sensors • Integration of sensors with PLCs • PNP vs NPN Sensors	Lecture Notes/Slides	

Vacation Week - 12 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 19 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Signal Conditioning for Sensing • Importance of signal conditioning • Typical signal condition approaches	Lecture Notes/Slides	

Week 7 - 26 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Actuators - I • Importance of actuators • Different types of actuators • Working principles and applications • Selection criteria for actuators • Integration of actuators with PLCs	Lecture Notes/Slides	Assessment 1 - Online Quiz Part 2 (Open from 5th August - 30th August)

Week 8 - 02 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Actuators - II • Advanced actuators • Integration of actuators in industrial systems. • Safety of industrial control systems (e.g. interlocks etc.)	Lecture Notes/Slides	

Week 9 - 09 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic

Industrial Process Control • Basics of process control • PID Control theory and tuning	Lecture Notes/Slides	Compulsory residential school.

Week 10 - 16 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to SCADA Systems • Overview of SCADA Systems and their importance • Main components of a SCADA System (e.g. RTUs, MTUs, and communication infrastructure) • Applications of SCADA Systems	Lecture Notes/Slides	**Assessment 2 - Laboratory Practical** Due: Week 10 Friday (20 Sept 2024) 11:59 pm AEST

Week 11 - 23 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Project Help	Lecture Notes/Slides	

Week 12 - 30 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Project Progress Update	Lecture Notes/Slides	**Assessment 3 - Project** Due: Week 12 Friday (4 Oct 2024) 11:59 pm AEST

Review/Exam Week - 07 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 14 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic

Term Specific Information

This unit includes a mandatory residential school. Please refer to the timetable for specific dates and location information. Additionally, students are required to purchase a license for Factory I/O software. Further details can be found on the Moodle site.

Assessment Tasks

1 Assessment 1 - Online Quizzes

Assessment Type
Online Quiz(zes)

Task Description
This assessment is divided into two online quizzes (due on week 4 and week 7) and includes short answer questions, structured questions and calculations. Each quiz evaluates the knowledge about fundamental concepts in measurement systems, sensors, and actuators and the ability to assess appropriate sensors and actuators for industrial processes. More details will be available in the Moodle Tiles.

Number of Quizzes
2

Frequency of Quizzes
Other

Assessment Due Date

Return Date to Students

Marked assignment with feedback will be returned to students usually within 2 weeks after submission. However, please

note that no model answers will be provided.

Weighting
30%

Minimum mark or grade
50%

Assessment Criteria
Marks will be allocated for the following:

- Understanding fundamental concepts
- Application of fundamental concepts and logical reasoning
- Problem-solving and correct calculations

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Answer structured and short answer questions in the provided space, and upload pdf files (s) when required.

Learning Outcomes Assessed

- Understand the principles and concepts of industrial control and automation, including sensors, actuators, controllers, communication systems and feedback mechanisms
- Evaluate appropriate sensors and actuators for controlling physical parameters in industrial processes
- Comply with relevant industry standards and regulations governing industrial automation to ensure system reliability and safety

2 Assessment 2 - Laboratory Practical

Assessment Type
Laboratory/Practical

Task Description
This assessment is designed to provide a hands-on learning experience in industrial automation through a laboratory experiment focused on programming a Modular Production Station (MPS). More details will be available in the Moodle Tiles.

Assessment Due Date
Week 10 Friday (20 Sept 2024) 11:59 pm AEST

Return Date to Students

Marked assignment with feedback will be returned to students usually within two weeks after submission. However, please note that no model answers will be provided.

Weighting
30%

Minimum mark or grade
50%

Assessment Criteria
Marks will be allocated for the following:

- PLC Programming proficiency.
- The ability to evaluate and utilise available sensors/actuators for a practical application.
- Application of theoretical knowledge on design and implementation of control logic.
- A fully working system with the expected outcome, as evidenced by a video.
- An individual lab report with solutions and discussions needs to be submitted.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Report (as a pdf file), video demos, and software codes must be uploaded to Moodle.

Learning Outcomes Assessed

- Understand the principles and concepts of industrial control and automation, including sensors, actuators, controllers, communication systems and feedback mechanisms
- Demonstrate proficiency in programming Programmable Logic Controllers using languages such as ladder logic
- Apply theoretical knowledge through hands-on, project-based learning experiences that simulate real-world industrial automation problems, including the design and implementation of control logic
- Collaborate proficiently in teams when presenting solutions to industrial automation problems.

3 Assessment 3 - Project

Assessment Type
Project (applied)

Task Description
This assessment is designed to provide a hands-on learning experience by automating a simulated factory environment using a control program executed in a simulated PLC. Students are expected to design a virtual factory using specified software and a suitable set of sensors and actuators. They will then write a control logic program in Ladder Logic and run it in a simulated PLC to operate the factory and achieve a set of specified tasks. More details will be available in the Moodle Tiles.

Assessment Due Date
Week 12 Friday (4 Oct 2024) 11:59 pm AEST

Return Date to Students

Marked assignment with feedback will be returned to students usually within two weeks after submission. However, please note that no model answers will be provided.

Weighting
40%

Minimum mark or grade
50%

Assessment Criteria
Marks will be allocated for the following:

- PLC Programming proficiency
- The ability to choose and utilise a set of suitable sensors and actuators for a given automation task.
- A fully working system with the expected outcome, as evidenced by a video.
- Codes for the Ladder Logic Diagram program and the simulated virtual environment project files.
- A report including implementation details and an explanation of the overall operation.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Report (as a pdf file), video demos, and software codes must be uploaded to Moodle.

Learning Outcomes Assessed

- Demonstrate proficiency in programming Programmable Logic Controllers using languages such as ladder logic
- Apply theoretical knowledge through hands-on, project-based learning experiences that simulate real-world industrial automation problems, including the design and implementation of control logic
- Evaluate appropriate sensors and actuators for controlling physical parameters in industrial processes
- Comply with relevant industry standards and regulations governing industrial automation to ensure system reliability and safety

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