



ENEX13001 *Instrumentation and Industrial Automation*

Term 2 - 2023

Profile information current as at 29/04/2024 11:30 am

All details in this unit profile for ENEX13001 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

This unit will introduce you to the fundamentals of industrial instrumentation and automation systems. You will learn the principles of operation of different sensors, actuators, instrumentation amplifiers, and industrial data communication buses. You will also learn noise cancellation and signal conditioning, sensor and actuator interfacing, programmable logic controller (PLC) programming, and process control. You will learn how to specify the requirements for sensors, actuators, and control equipment for a given task, evaluate multiple options available and select the best combination of them for your design. You will also design, fabricate, and program production lines for a given product using industry-standard components and PLCs. You will carry out product line programming using industry-standard PLC programming software and hardware. 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 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) AND ENEE12016 Signals and Systems

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 - 2023

- 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. **Written Assessment**

Weighting: 20%

2. **Written Assessment**

Weighting: 20%

3. **Practical Assessment**

Weighting: 20%

4. **Online Test**

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 survey feedback

Feedback

Tutorial questions were worked through in a clear fashion and explained thoroughly while not taking a large amount of time

Recommendation

This practice will be continued and improved.

Feedback from Unit Coordinator's reflection

Feedback

The end of term test was highly relevant to the materials taught in this unit.

Recommendation

This practice will improve student morale and performance and thus it will be continued.

Feedback from Unit Coordinator's reflection

Feedback

Laboratory exercises were engaging and very relevant to the materials covered in the lectures and tutorials which enhance student understanding.

Recommendation

This practice will be continued with further improvement of the laboratory.

Feedback from Unit evaluation survey

Feedback

Assessment return could be further improved

Recommendation

Markers will aim to return assessments to students within two weeks of their respective due dates.

Unit Learning Outcomes

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

1. Describe the need for instrumentation amplifiers in an instrumentation system and their operation
2. Apply common industrial data bus protocols and use them in data acquisition and control programs
3. Specify requirements for sensors, actuators, and accessories for a given process automation module, and select suitable components from a range of available options
4. Program industrial PLCs to provide real-time solutions for industrial automation problems
5. Implement complete solutions for industrial process automation problems
6. Solve real-life problems and communicate professionally using instrumentation engineering terminology, symbols and diagrams that conform to Australian and international standards
7. Work individually and collaboratively in teams, communicate professionally in presenting your solutions.

The 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 Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:

Intermediate 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 4I 5I 6I) 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 4I 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 2I 3A 4A 5A 6A) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 3A) 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1A 2I 3A 4A 5A 6A) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 2I 3A 4A 5A 6A) 2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 1I 3A 4A 5A 6A) 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 3A 4A 5A 6A) 2.3 Application of systematic engineering synthesis and design processes. (LO: 2I 4A 5A 6A) 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 2I 4A 5A 6A) 3.1 Ethical conduct and professional accountability. (LO: 4I 5I 6I 7A) 3.2 Effective oral and written communication in professional and lay domains. (LO: 1I 2I 5I 6I 7A) 3.3 Creative, innovative and pro-active demeanour. (LO: 4I 5I 6I 7A) 3.4 Professional use and management of information. (LO: 1I 4I 5I 6I 7A) 3.5 Orderly management of self, and professional conduct. (LO: 5I 6I 7A) 3.6 Effective team membership and team leadership. (LO: 5I 6A 7A)

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
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Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 20%	•				•		•
2 - Written Assessment - 20%		•	•	•	•	•	•
3 - Practical Assessment - 20%		•	•	•	•	•	•
4 - Online Test - 40%	•		•		•		

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
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.

Harlow , 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)
- A portable computer with Windows 7 or later with Admin authority to install CoDeSys and other required software
- Access to a document scanner and a software that can create pdf documents

Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

Lasi Piyathilaka Unit Coordinator

l.piyathilaka@cqu.edu.au

Schedule

Week 1 - 10 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to measurement systems, static characteristics, and accuracy of measurements	• CH 1 • CH 2 • CH 3	

Week 2 - 17 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
• Operational amplifiers in instrumentation systems	• Lecture notes / slides	

Week 3 - 24 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to Industrial Automation • Fundamentals of Pneumatic System Elements	• Lecture notes/ Slides	

Week 4 - 31 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
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- PLC Programming Fundamentals
- Lecture notes/ Slides

Week 5 - 07 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Signal Conditioning Elements 	<ul style="list-style-type: none"> • CH 9 • Lecture notes/Slides 	

Vacation Week - 14 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Week 6 - 21 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Loading Effects in Two-port Networks 	<ul style="list-style-type: none"> • CH 5 	

Week 7 - 28 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Signals and Noise in Measurement Systems • Four Terminal Measurements and Source-Measure Units in Instrumentation Systems 	<ul style="list-style-type: none"> • Ch 6 • Lecture notes/ Slides 	Assignment 1 Due: Week 7 Monday (28 Aug 2023) 11:45 pm AEST

Week 8 - 04 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Two-Port network parameters • Data Acquisition and Communications Systems • Industrial Data Communications Protocols 	<ul style="list-style-type: none"> • Lecture notes/ Slides • CH18 	

Week 9 - 11 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Industrial Instrumentation Busses and their Applications 	<ul style="list-style-type: none"> • Lecture notes/ Slides 	Residential School 13-15 September

Week 10 - 18 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Industrial Process Control Systems • Introduction to Industry 4.0 	<ul style="list-style-type: none"> • Lecture notes/ Slides 	Assignment 2 Due: Week 10 Monday (18 Sept 2023) 11:45 pm AEST

Week 11 - 25 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Sensing Elements • Ultrasonic Measurement Systems • Flow Measurement Systems 	<ul style="list-style-type: none"> • Ch 8 • CH 16 • CH 12 	Laboratory Exercises - Practical and Written Assessment Due: Week 11 Monday (25 Sept 2023) 11:45 pm AEST

Week 12 - 02 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Parasitic Elements in Measurement Systems • Optical Measurement Systems 	<ul style="list-style-type: none"> • CH 14 • CH 15 	

Review/Exam Week - 09 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Exam Week - 16 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Term Specific Information

You will conduct practical experiments during the compulsory residential school which will be held in Mackay Campus. Further information about the residential school for this unit can be found on the unit Moodle site under the Residential school tile.

Assessment Tasks

1 Assignment 1

Assessment Type

Written Assessment

Task Description

This assignment focuses on the fundamental principles of instrumentation and their practical application in real-world measurement systems. It encompasses both numerical problems that involve calculations and structural questions related to the design and implementation of measurement systems. By exploring these topics, you will gain a comprehensive understanding of instrumentation principles and their significance in accurate and reliable measurements.

Assessment Due Date

Week 7 Monday (28 Aug 2023) 11:45 pm AEST

Return Date to Students

Marked reports with feedback will be returned to students usually a fortnight after submission. However, there will be no model answers provided.

Weighting

20%

Assessment Criteria

Marks will be allocated for the following things:

1. Application of theoretical fundamentals.
2. Correct diagrams using standard notations.
3. Explanation of reasons to apply specific theory to solve a given problem where applicable.
4. Correct mathematical working and correct answer.
5. All working must be shown to obtain full marks
6. Neatness and format.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

single pdf file

Learning Outcomes Assessed

- Describe the need for instrumentation amplifiers in an instrumentation system and their operation
- Implement complete solutions for industrial process automation problems
- Work individually and collaboratively in teams, communicate professionally in presenting your solutions.

2 Assignment 2

Assessment Type

Written Assessment

Task Description

This assignment focuses on advanced measurement techniques and the fundamentals of industrial automation systems. It covers a wide range of topics that delve into the intricacies of measurement methods and the essential principles underlying industrial automation. By exploring these areas, you will develop a comprehensive understanding of advanced measurement techniques and their integration into industrial automation systems.

Assessment Due Date

Week 10 Monday (18 Sept 2023) 11:45 pm AEST

Return Date to Students

Marked reports with feedback will be returned to students usually a fortnight after submission. However, there will be no model answers provided.

Weighting

20%

Assessment Criteria

Marks will be allocated for the following things:

1. Application of theoretical fundamentals.
2. Correct diagrams using standard notations.
3. Explanation of reasons to apply specific theory to solve a given problem where applicable.
4. Correct mathematical working and correct answer.
5. All working must be shown to obtain full marks
6. Neatness and format.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

single pdf file

Learning Outcomes Assessed

- Apply common industrial data bus protocols and use them in data acquisition and control programs
- Specify requirements for sensors, actuators, and accessories for a given process automation module, and select suitable components from a range of available options
- Program industrial PLCs to provide real-time solutions for industrial automation problems
- Implement complete solutions for industrial process automation problems
- Solve real-life problems and communicate professionally using instrumentation engineering terminology, symbols and diagrams that conform to Australian and international standards
- Work individually and collaboratively in teams, communicate professionally in presenting your solutions.

3 Laboratory Exercises - Practical and Written Assessment

Assessment Type

Practical Assessment

Task Description

This task involves laboratory experiments on industrial automation and instrumentation. You will have to complete the pre-lab exercises to commence the laboratory practicals. Further details will be available on the unit moodle site.

Assessment Due Date

Week 11 Monday (25 Sept 2023) 11:45 pm AEST

Return Date to Students

Marked lab reports with feedback will be returned to students usually a fortnight after submission. However, there will be no model answers provided.

Weighting

20%

Minimum mark or grade

50%

Assessment Criteria

Marks will be allocated to :

1. Active contribution in group work (if applicable)
2. Following the correct procedures during the experimentation.
3. Correct results.
4. Analysis of results and discussion.
5. Conclusions.

6. Report structure.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Apply common industrial data bus protocols and use them in data acquisition and control programs
- Specify requirements for sensors, actuators, and accessories for a given process automation module, and select suitable components from a range of available options
- Program industrial PLCs to provide real-time solutions for industrial automation problems
- Implement complete solutions for industrial process automation problems
- Solve real-life problems and communicate professionally using instrumentation engineering terminology, symbols and diagrams that conform to Australian and international standards
- Work individually and collaboratively in teams, communicate professionally in presenting your solutions.

4 END OF TERM ONLINE TEST

Assessment Type

Online Test

Task Description

This is the final assessment in the unit and it will be an online written test of three (3) hours. This online test is a time-limited assessment that will be available to students only during the scheduled examination time. It will be an open-book test and students can use any printed or electronic materials as a reference. The answers should be handwritten and scanned after the examination in the question order and uploaded by the given deadline.

Assessment Due Date

Test date, time and test instructions will be provided to students at time closer to the test .

Return Date to Students

Marks will be released after the day of the certification of grades.

Weighting

40%

Minimum mark or grade

50%

Assessment Criteria

Marks will be allocated for the following things:

1. Application of theoretical fundamentals.
2. Correct diagrams using standard notations.
3. Explanation of reasons to apply specific theory to solve a given problem where applicable.
4. Correct mathematical working and correct answer.
5. All working must be shown to obtain full marks.
6. Neatness and format.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

PDF files

Learning Outcomes Assessed

- Describe the need for instrumentation amplifiers in an instrumentation system and their operation
- Specify requirements for sensors, actuators, and accessories for a given process automation module, and select suitable components from a range of available options
- Implement complete solutions for industrial process automation problems

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