ENEX13001 *Instrumentation and Industrial Automation*
Term 2 - 2022

Profile information current as at 07/05/2024 11:54 am

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 Elecctronics & 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 - 2022

- 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 feedback survey

Feedback
The tutorials were highly relevant to the assignment questions and the exam.

Recommendation
This practice will be continued.

Feedback from Student feedback survey

Feedback
Students say they were extremely comfortable with the exam after reviewing the given material.

Recommendation
This practice will be continued.

Feedback from Student feedback survey

Feedback
The Lab was really engaging and interesting. The Festo machine was fun to program and apply troubleshooting skills to determine what sequence of ladder logic will perform certain tasks.

Recommendation
This practice will be continued.

Feedback from Student feedback survey

Feedback
The written tutorial solution is difficult to understand and a video recording of the tutorial solution will help students to learn.

Recommendation
Video recording of the tutorial will be provided.

Feedback from Student feedback survey

Feedback
More modern network protocols need to be taught instead of old protocols.

Recommendation
The older network protocols are taught to make the students understand the underlying theories. Newer industrial protocols will be added.

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 informationhttps://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	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.
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)
- 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

Lam Bui Unit Coordinator
l.bui@cqu.edu.au

Schedule

Week 1 - 11 Jul 2022

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 - 18 Jul 2022

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

Week 3 - 25 Jul 2022

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

Week 4 - 01 Aug 2022

Module/Topic	Chapter	Events and Submissions/Topic

• PLC Programming Fundamentals	• Lecture notes/ Slides	

Week 5 - 08 Aug 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Signal Conditioning Elements	• CH 9 • Lecture notes/Slides	

Vacation Week - 15 Aug 2022

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 22 Aug 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Loading Effects in Two-port Networks	• CH 5	

Week 7 - 29 Aug 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Signals and Noise in Measurement Systems • Four Terminal Measurements and Source-Measure Units in Instrumentation Systems	• Ch 6 • Lecture notes/ Slides	**Assignment 1** Due: Week 7 Monday (29 Aug 2022) 11:59 pm AEST

Week 8 - 05 Sep 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Two-Port network parameters • Data Acquisition and Communications Systems • Industrial Data Communications Protocols	• Lecture notes/ Slides • CH18	

Week 9 - 12 Sep 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Industrial Instrumentation Busses and their Applications	• Lecture notes/ Slides	Residential School 14-16 September

Week 10 - 19 Sep 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Industrial Process Control Systems • Introduction to Industry 4.0	• Lecture notes/ Slides	**Assignment 2** Due: Week 10 Monday (19 Sept 2022) 11:59 pm AEST

Week 11 - 26 Sep 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Sensing Elements • Ultrasonic Measurement Systems • Flow Measurement Systems	• Ch 8 • CH 16 • CH 12	**Laboratory Exercises - Practical and Written Assessment** Due: Week 11 Monday (26 Sept 2022) 11:59 pm AEST

Week 12 - 03 Oct 2022

Module/Topic	Chapter	Events and Submissions/Topic
• Parasitic Elements in Measurement Sysems • Optical Measurement Systems	• CH 14 • CH 15	

Review/Exam Week - 10 Oct 2022

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 17 Oct 2022

Module/Topic	Chapter	Events and Submissions/Topic

Term Specific Information

You will conduct practical experiments during the compulsory residential school which will be held in Mackay Campus from Wednesday 14th to Friday 16th of September 2022. Further information about the residential school for this unit can be found on the handbook and the unit Moodle.

Assessment Tasks

1 Assignment 1

Assessment Type
Written Assessment

Task Description
This assignment is based on instrumentation principles and application of them in actual measurement systems. Further details will be available on the unit moodle site.

Assessment Due Date
Week 7 Monday (29 Aug 2022) 11:59 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 is based on advanced measurement techniques and fundamentals of industrial automation systems.

Assessment Due Date
Week 10 Monday (19 Sept 2022) 11:59 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 (26 Sept 2022) 11:59 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