ENEM29002 *Fluid Power Engineering and Control*
Term 2 - 2024

Profile information current as at 29/07/2024 05:54 pm

General Information

Overview

This project-based unit is about designing fluid power systems for automated and semiautomated industrial plants. This unit deals with exploring fluid power elements and their ISO standard symbols, designing fluid power circuits using actuators, directional control, and other valves, sensors, and control systems. Control technology may include both hydraulic and pneumatic systems integrated with programmable controllers (PLCs and microcontrollers). In small teams, you will undertake project work involving solving real-life industrial problems. There are also several laboratory experiments in the areas of hydraulic and pneumatic operating system design and control circuit design integrated with PLCs for automated machines. You will use simulation software (SimScape and/or FluidSim) for confirming the functionality of designed projects prior to prototyping. You will communicate professionally using discipline-specific terminology to present designs and problem solutions. Students enrolled in online mode must attend a compulsory residential school to facilitate peer collaboration and attainment of the unit learning outcomes.

Details

Career Level: *Postgraduate*
Unit Level: *Level 9*
Credit Points: *12*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.25*

Pre-requisites or Co-requisites

There are no requisites for this unit.
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

- Melbourne
- Online
- Rockhampton

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).

Residential Schools

This unit has a Compulsory Residential School for distance mode students and the details are:
Click here to see your Residential School Timetable.

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 12-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 25 hours of study per week, making a total of 300 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. **Laboratory/Practical**
Weighting: 20%
4. **Online Quiz(zes)**
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.

Unit Learning Outcomes

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

1. Design complex fluid drive systems and analyse their performance individually and in teams
2. Evaluate advanced applications of drive systems in industrial plants
3. Design fluid control circuits integrated with programmable controllers for automated machine systems
4. Design and analyse electro-mechanical, fluid power and energy conversion systems
5. Design protection and control systems for fluid power machines
6. Create professional documentation using appropriate engineering terminology and symbols related to electric and fluid drives.

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

1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1I 2I 7I)
1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1I 2I 3I 5I 6I)
1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 3I 6I)
2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 3I 4I 5I 6I)
2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 3I 4I 5I)
3.1 Ethical conduct and professional accountability. (LO: 7I)
3.2 Effective oral and written communication in professional and lay domains. (LO: 6I 7I)
3.3 Creative, innovative and pro-active demeanour. (LO: 3I 4I 6I 7I)
3.6 Effective team membership and team leadership. (LO 1I 2I 4I 6I 7I)

Advanced

1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 2A 3I 7I))
1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 2I 3I 5I 6A)
2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1I 2I 3I 5A 6I)
2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 1A 2A 3A 4I 5I 6I)
3.4 Professional use and management of information. (LO: 1A 2A 3A 4A 6I 7A)
3.5 Orderly management of self, and professional conduct. (LO: 1I 2I 3A 4I 6I 7A)

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 Postgraduate Units 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=11382

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 - Written Assessment - 20%	•	•				
2 - Written Assessment - 20%			•	•	•	•
3 - Laboratory/Practical - 20%	•		•			•
4 - Online Quiz(zes) - 40%		•		•	•	

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Knowledge	◦	◦			◦	
2 - Communication	◦					◦
3 - Cognitive, technical and creative skills		◦	◦	◦		◦
4 - Research					◦	
5 - Self-management						
6 - Ethical and Professional Responsibility			◦			
7 - Leadership						◦
8 - Aboriginal and Torres Strait Islander Cultures						

Textbooks and Resources

Textbooks

ENEM29002

Prescribed

Fluid Power with Applications
Authors: Anthony Esposito
Pearson
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)
- MATLAB and Simulink Suite Software

Referencing Style

All submissions for this unit must use the referencing styles below:

- Harvard (author-date)
- Vancouver

For further information, see the Assessment Tasks.

Teaching Contacts

Abdul Mazid Unit Coordinator
a.mazid@cqu.edu.au
Nirmal Mandal Unit Coordinator
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Schedule

Week 1. FLUID PROPERTIES - 08 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 1: Fluid Properties (2 hrs)	2	Workshop - project 1 topic selection (2 hrs). Tutorial 1: Problem solving on fundamental fluid properties (2 hrs). (Tutorial sheet available in Week 1 section of Unit Moodle site).

Week 2. HYDRAULIC PUMPS - 15 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 2: Hydraulic Pumps - Design Construction and Working Principles (2 hrs)	5	Workshop on projects (2 hrs). Tutorial 2: Problems on hydraulic pumps & pump sizing and selection (2 hrs).(Tutorial problems available in Unit Moodle site, Week 2 section).

Week 3. HYDRAULIC MOTORS - 22 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 3: Hydraulic Motors - Design Construction and Working Principles (2 hrs)	7	Workshops on project 1 / Lab experiments on hydraulics (2 hrs). Tutorial 3. Problem solving & sizing hydraulic motors and selection (2 hrs). (Tutorial problems available in Unit Moodle site, Week 3 section).

Week 4. ACTUATORS - 29 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 4. Hydraulic Actuators & Cushioning (2 hrs)	6	Workshops on project 1 / Lab experiments on hydraulics (2 hrs). Tutorial 4: Hydraulic actuator sizing and selection (2 hrs). (Tutorial problems available in Unit Moodle site, Week 4 section).

Week 5. CONTROL VALVES - 05 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 5: Hydraulic Valves (2 hrs)	8	Workshop: SimScape software for hydraulic circuit design and simulation. Project 1 presentation workshop, students present their Projects in Team (2 hrs).

Vacation Week - 12 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
NO CLASSES		Catch up with project works.

Week 6. CIRCUIT DESIGN - 19 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 6: Fluid Control Circuit Design (2 hrs)	14	Workshop on project 1 (2 hrs). Tutorial 6: Exercises on fluid control circuit design (2 hrs). (Tutorial problems available in Unit Moodle site). **Project 1: Semi-automated fluid power machine development** Due: Week 6 Monday (19 Aug 2024) 12:00 am AEST

Week 7. INTEGRATED CIRCUIT DESIGN - 26 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 7: Electric Circuits in Fluid Control Systems (2 hrs)	15; Lecture notes.	Workshop on project 2 selection (2 hrs). Tutorial 7: Exercises on integrated control circuits (2 hrs).

Week 8. PLCs - 02 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic

Lec 8: PLC Architecture and Programming (2 hrs)	17; Lecture handout	Workshop on project 2 / Lab experiments on pneumatic control (2 hrs). Tutorial 8: PLC programming (2 hrs). (Tutorial problems available in Unit Moodle site).

Week 9. PNEUMATIC CONTROL ELEMENTS - 09 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 9: Pneumatic Control Elements (2 hrs)	14; Lecture materials	Guest lecture on PLCs programming during Workshop. Tutorial 9. Exercise PLC programming (2 hrs). Exercise problems available in Unit Moodle site)

Week 10. PNEUMATIC CONTROL - 16 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 10: Pneumatic Logic Elements (2 hrs)	16; Lecture materials	Workshop on project 2 (2 hrs). Tutorial 10: Pneumatic control elements - 2 hrs (Tutorial problems available in Week 10 section of Unit Moodle site)

Week 11. PNEUMATIC SENSORS - 23 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Lec 11: Pneumatic Sensors Design and Applications (2 hrs)	Lecture materials	Tutorial 12: Pneumatic logic element applications - 2 hrs (Problems available in Week 12 section of Unit Moodle site). Lab experiments on PLCs integrated pneumatic control (2 hrs) **Laboratory Experiments and Report Submission** Due: Week 11 Friday (27 Sept 2024) 11:45 pm AEST

Week 12. Review - 30 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Review Lecture (2 hrs)	(All sources mentioned above)	Project 2 presentation during Workshop (2 hrs). Tutorial 12: Pneumatic control circuits - 2 hrs (Tutorial problems available in Moodle site, Week 12 section) **Project 2: Fully automated fluid power machine control integrated with PLCs** Due: Week 12 Monday (30 Sept 2024) 12:00 am 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
		End of Term Online Test Due: Exam Week Thursday (17 Oct 2024) 3:00 pm AEST

Assessment Tasks

1 Project 1: Semi-automated fluid power machine development

Assessment Type
Written Assessment

Task Description
A team of four students will perform an engineering project work on a selected hydraulically operated and controlled industrial machine. In the project work students are supposed to design, calculate and analyse the projected machine and machine modules. For design you will prepare estimation for selection and design of different components and units of the fluid power and fluid control machine. The design of the projected machine will be presented primarily in manual sketches, then layout drawing, assembly drawing, fluid power and control circuits, and occasionally part drawings of selected items, suggested by the Tutor, using a CAD drawing software and fluid circuit software. Importance and scopes of industrial applications of the projected equipment and it's cost estimation are another factors. Control system for the designed machine students are supposed to use SimScape (MATLAB - Simulink) or FluidSim. On completion of the design project students are supposed to present their achievement in a workshop session.
Essential sections of Project 1 and the report are:
1. Title page (refer to template provided in Unit Moodle site).
2. Introduction and background (describe the problem of your selected project, demonstrate your understanding about the problem following available publications, mention the scope of application of the machine in industry, etc.).
3. Design layout/assembly drawing (2D/3D) in side view/s and top view, visualise it and get clear understanding of your projected machine, you may need to produce part drawings of the selected parts of your machine (selection can be done by your Tutor).
4. Sketch required fluid (hydraulic or pneumatic) power system, calculate and select required fluid (hydraulic or pneumatic) components for your project. You may need to start learning simulation using SimScape or FluidSim at this stage.
5. Industrial applications and value of your projected machine for engineering industries.
6. Safety factors that to be considered for operation of the projected machine.
7. List of References.

Assessment Due Date
Week 6 Monday (19 Aug 2024) 12:00 am AEST

Return Date to Students
Week 8 Monday (2 Sept 2024)
In 2 weeks after submission.

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
This team-based project will be assessed considering both technical and professional aspects. The technical aspects cover a wide range of applications and quality of the design and analysis of a hydraulic and pneumatic systems, comparison and safety checking of the of the new design using proper engineering procedures. Efficient of project layout drawings, uses appropriate hydraulic units, and productive drive and control systems development are the major portions of assessment. The professional aspects cover a higher level of teamwork, leadership, research, and communication skills. Further detail will be provided in due time via the Unit Moodle website.

Referencing Style

- Harvard (author-date)
- Vancouver

Submission
Online Group

Submission Instructions
Group submission. Submit one pdf document, include title page with details of all team members, mention individual contribution in % scale.

Learning Outcomes Assessed

- Design complex fluid drive systems and analyse their performance individually and in teams
- Evaluate advanced applications of drive systems in industrial plants

2 Project 2: Fully automated fluid power machine control integrated with PLCs

Assessment Type
Written Assessment

Task Description
The second project-based assignment is based on the content covered in Weeks 1 to 12. The scope of the Assignment 2 will be populated in Week 6 via Unit Moodle website. This is a team work and group submission. Major content of the submission may cover Introduction, Literature finding, Design drawings and calculations, control circuit produced using SimScape (MATLAB-Simulink) or FluidSi, PLC program, industrial importance and applications, and project cost estimation.
Essential sections of Project 2 and the report are:

1. Title page (refer to template provided in Unit Moodle site).
2. Introduction and background (describe the problem of your selected project, demonstrate your understanding about the problem following available publications, mention the scope of application of the machine in industry, etc.).
3. Design layout/assembly drawing (2D/3D) in side view/s and top view, visualise it and get clear understanding of your projected machine, you may need to produce part drawings of the selected parts of your machine (selection can be done by your Tutor).
4. Sketch required fluid (hydraulic or pneumatic) power system, calculate and select required fluid (hydraulic or pneumatic) components for your project. You may need to start learning simulation using SimScape or FluidSim at this stage.
5. Control strategy for the designed machine (schematics, pneumatic or hydraulic circuit, PLC program written to control the projected machine at least at a semi-automated level).
6. Industrial applications and value of your projected machine for engineering industries.
7. Safety factors that to be considered for operation of the projected machine.
8. List of references.

Assessment Due Date
Week 12 Monday (30 Sept 2024) 12:00 am AEST

Return Date to Students
Exam Week Monday (14 Oct 2024)
No later than exam week.

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
This second team-based project will be assessed considering both technical and professional aspects. The technical aspects cover a wide range of applications of design and analysis of a hydraulic and pneumatic system controlled by programmable controller's (PLCs), SimScape simulation, comparison and safety checking of the new design using proper engineering procedures. Efficient of project layout drawings, uses appropriate hydraulic units, and productive control system development are the major portions of assessment. The professional skills cover a higher level of teamwork, leadership, research and communication skills. Students should refer to the Unit Moodle site for individual marking criteria of the team-based projects and labs. Detailed information will be provided in the Moodle website in time.

Referencing Style

- Harvard (author-date)
- Vancouver

Submission
Online Group

Submission Instructions
Submit one pdf document for the group, include a title page with details of all team members. Mention contribution of individual team member in % scale.

Learning Outcomes Assessed

- Design fluid control circuits integrated with programmable controllers for automated machine systems
- Design and analyse electro-mechanical, fluid power and energy conversion systems
- Design protection and control systems for fluid power machines
- Create professional documentation using appropriate engineering terminology and symbols related to electric

and fluid drives.

3 Laboratory Experiments and Report Submission

Assessment Type
Laboratory/Practical

Task Description
Students in group will accomplish three lab experiments in hydraulic control and another three experiments in pneumatic control, and pneumatic control integrated with PLCs. Students are supposed to demonstrate their professional and skillful attitude towards every experiments. Performances may include clear understanding of the objective, procedures and setup, capability of constructing the control circuits as required and finally running the experiments and collect information and data as required for report preparation. A group report of each experiment is an essential part of assessment. Students are supposed to follow the OHS regulations in the laboratory.

Assessment Due Date
Week 11 Friday (27 Sept 2024) 11:45 pm AEST

Return Date to Students
Exam Week Friday (18 Oct 2024)
In 2 weeks after submission.

Weighting
20%

Minimum mark or grade
50%

Assessment Criteria
Assessment of lab experiments will be conducted in two phases: physically performing the experiments and submission of complete technical report on the performed experiment. Assessment criteria are based on a detailed calculations and presentations of data obtained in the hydraulic and pneumatic setup. It is based on accuracy in calculations, validation of results obtained by proper interpretation of results. It is also based on the way how students are putting symbols and hydraulic/pneumatic diagrams to present sequence of operations in the experiments. More information will be provided in due time for individual experiment.

Referencing Style

- Harvard (author-date)
- Vancouver

Submission
Online

Submission Instructions
Upload one pdf document, include title page with your detail.

Learning Outcomes Assessed

- Design complex fluid drive systems and analyse their performance individually and in teams
- Design fluid control circuits integrated with programmable controllers for automated machine systems
- Create professional documentation using appropriate engineering terminology and symbols related to electric and fluid drives.

4 End of Term Online Test

Assessment Type
Online Quiz(zes)

Task Description
End of Term Online Test (QUIZ/Test) may contain short and/or long questions, analysis and problem solving in areas of design and applications of hydraulic power and control systems, pneumatic and PLC integrated control, modern fluid power technology covering the materials studied (In lecture, tutorial, workshops, and lab sessions) over the 12 weeks of the Term.

Number of Quizzes
1

Frequency of Quizzes
Other

Assessment Due Date
Exam Week Thursday (17 Oct 2024) 3:00 pm AEST

Return Date to Students

Feedback will be provided after the grades are released.

Weighting
40%

Minimum mark or grade
50%

Assessment Criteria
No such written assessment criteria.

Referencing Style

- Harvard (author-date)
- Vancouver

Submission
Online

Learning Outcomes Assessed

- Evaluate advanced applications of drive systems in industrial plants
- Design and analyse electro-mechanical, fluid power and energy conversion systems
- Design protection and control systems for fluid power machines

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