



# ENEM20002 Fluid Power Engineering and Control

## Term 2 - 2021

Profile information current as at 01/07/2022 02:36 pm

All details in this unit profile for ENEM20002 have been officially approved by CQU University 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 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 micro-controllers). In small teams, you will undertake project work involving solving real-life industrial problems. There are also several laboratory experiments in 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 8*

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 - 2021

- Melbourne
- Mixed Mode
- Perth
- 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](#).

## 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 Students

**Feedback**

PLC programming training would be more fruitful if it was done before study break week.

**Recommendation**

Recommended to organise PLC program training earlier rather than at the end of the term. Earlier communication with OMRON Electronics can help to get a PLC expert for guest lecture delivery.

#### Feedback from Student

**Feedback**

Pneumatic control integrated with PLCs was a good experience.

**Recommendation**

It is recommended to continue with the developed structure of the unit (fluid power, pneumatics, and PLCs together). This may help students graduate with job-ready skills in industrial automation and production.

#### Feedback from Student

**Feedback**

Fluid power simulation with SimScape was very helpful.

**Recommendation**

Continue teaching simulation of fluid power circuits using SimScape and FluidSim facing the current challenges of industry automation.

#### Feedback from Unit Coordinator

**Feedback**

Exam (replacing quiz) is essential

**Recommendation**

In the post-COVID period, an exam carrying 40% value should be introduced. This will improve the quality of assessment of students' knowledge and skills.

## Unit Learning Outcomes

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

1. Design complex fluid drives and analyse their performance
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 and fluid control power and energy conversion systems
5. Design protection and control systems for fluid power machines
6. Analyse electro-mechanical power and energy conversion
7. Create professional documentation using terminology, symbols and diagrams related to electric and fluid drives.

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

- 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 3.2 Effective oral and written communication in professional and lay domains. (LO: 1I 2I 3I 4I 5I 6I 7I )
- 3.3 Creative, innovative and pro-active demeanour. (LO: 1N 2N 3I 4I 5I 6I 7I )
- 3.6 Effective team membership and team leadership. (LO: 1I 2I 3I 4I 5I 6I 7I )

#### Advanced

- 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 3I 4I 5A 6I 7I )
- 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 2A 3I 4I 5I 6I 7I )
- 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1A 2A 3A 4A 5I 6I 7I )
- 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1I 2I 3I 4I 5A 6I 7A )
- 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 1A 2A 3A 4I 5I 6I 7A )
- 3.4 Professional use and management of information. (LO: 1A 2A 3A 4A 5I 6I 7A )
- 3.5 Orderly management of self, and professional conduct. (LO: 1I 2I 3A 4I 5I 6I 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 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



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
<b>1 - Written Assessment - 20%</b>	•	•					•

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
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	7
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							

### Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes							
	1	2	3	4	5	6	7	8
1 - Written Assessment - 20%	○	○	○	○	○			
2 - Written Assessment - 20%	○		○	○				
3 - Laboratory/Practical - 20%		○				○		
4 - Online Quiz(zes) - 40%	○		○					

## Textbooks and Resources

### Textbooks

ENEM20002

#### Prescribed

##### Fluid Power with Applications

Edition: 7th Ed (2014)

Authors: Anthony Esposito

Pearson

Harlow , Essex , England

ISBN: 13:978-1-292-02387-8

Binding: Hardcover

#### Additional Textbook Information

Both paper and eBook versions can be purchased at the CQUni Bookshop here: <http://bookshop.cqu.edu.au> (search on the Unit code).

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

**You will need access to the following IT resources:**

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

## Referencing Style

No referencing style set.

## Teaching Contacts

**Nirmal Mandal** Unit Coordinator

[n.mandal@cqu.edu.au](mailto:n.mandal@cqu.edu.au)

## Schedule

### Week 1 - 12 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Introduction to Fluid Power		
Tutorial: Four tute problems will be solved & a demonstration of SimScape software.	Chapter 1~4 of Esposito	
Workshop: Project 1 scope of hydraulic power systems will be introduced. Team building activities will be finished.		

### Week 2 - 19 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Lecture: Hydraulic Pumps  
 Tutorial: Four tute problems will be solved & SimScape Library tutorial.  
 Workshop: For project 1, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.

**Week 3 - 26 Jul 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Hydraulic motor Tutorial: Four tute problems will be solved and Simscape tutorials Workshop: For project 1, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning document	Chapter 7 of Esposito	

**Week 4 - 02 Aug 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Hydraulic Cylinders, Cushioning and shock absorbers Tutorial: Four tute problems will be solved and the SimScape tutorial Workshop: For project 1, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.	Chapter 6 of Esposito	

**Week 5 - 09 Aug 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Hydraulic valves and controls Tutorial: Four tute problems will be solved and SimScape tutorials Workshop: For project 1, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.	Chapter 8, 16 of Esposito	

**Vacation Week - 16 Aug 2021**

Module/Topic	Chapter	Events and Submissions/Topic
No activities		

**Week 6 - 23 Aug 2021**

Module/Topic	Chapter	Events and Submissions/Topic

Lecture: Hydraulic Circuit Design and Analysis  
 Tutorial: Four tute problems will be solved and SimScape tutorials  
 Workshop: For project 1, team presentation.

Chapter 9 of Esposito

**Written Assessment** Due: Week 6  
 Friday (27 Aug 2021) 11:45 pm AEST

**Week 7 - 30 Aug 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Hydraulic Accumulators and receivers Tutorial: Four tute problems will be solved Workshop: Project 2 scope of fluid power systems will be introduced. The same Team will be employed if it is ok.	Chapter 11 of Esposito	

**Week 8 - 06 Sep 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Hydraulic Conductors and fittings Tutorial: Four tute problems will be solved Workshop: For project 2, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.	Chapter 10 of Esposito	

**Week 9 - 13 Sep 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Pneumatics: components - compressors, circuits, and applications Tutorial: Four tute problems will be solved Workshop: For project 2, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.	Chapter 13, 14 of Esposito	

**Week 10 - 20 Sep 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Lecture: Electrical Machines and controls Tutorial: no tutorials Workshop: For project 2, the progress will be monitored and recorded using meeting minutes, 4-square charts, agenda items, and weekly planning documents.	Chapter 15, 17 of Esposito, lecture notes	

**Week 11 - 27 Sep 2021**

Module/Topic	Chapter	Events and Submissions/Topic
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Lecture: Maintenance of Hydraulic System

Tutorial: Four tute problems will be solved

Workshop: Online Quiz

Chapter 12 of Esposito

An online Quiz will be held during the Workshop session of Week 11

### Week 12 - 04 Oct 2021

**Module/Topic**

**Chapter**

**Events and Submissions/Topic**

Lecture: Review of the unit

Tutorial: no tutorial

Workshop: Project 2 formal progress presentation in the workshop section and getting ready to submit the team project on Friday, Week 12 in the submission link set in the Moodle site.

Chapters - covered so far.

**Written Assessment** Due: Week 12 Friday (8 Oct 2021) 11:45 pm AEST

### Review/Exam Week - 11 Oct 2021

**Module/Topic**

**Chapter**

**Events and Submissions/Topic**

**Practical and Written Assessment**

Due: Review/Exam Week Friday (15 Oct 2021) 11:45 pm AEST

### Exam Week - 18 Oct 2021

**Module/Topic**

**Chapter**

**Events and Submissions/Topic**

## Term Specific Information

For on-campus students, your labs will be on the respective campus. A detailed lab scheduling of this unit for on-campus will be available on the unit Moodle site. The updated lab sheet will be populated on the Moodle site.

## Assessment Tasks

### 1 Written Assessment

#### Assessment Type

Written Assessment

#### Task Description

Assignment 1 is a team project. It focuses on the content of the unit covered in week 1 to week 6. The scope of Assignment 1 will be populated in the unit Moodle before term starts and will be discussed in the week 1 workshop session. It is a team submission. A team project presentation of this project will be held on Week 6 in Workshop time and venue.

#### Assessment Due Date

Week 6 Friday (27 Aug 2021) 11:45 pm AEST

Compulsory team submission

#### Return Date to Students

Week 8 Friday (10 Sept 2021)

After two weeks of submission date

#### 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 of design and analysis of a hydraulic system, comparison, and safety checking of the new design using proper engineering procedures. The professional skills cover a higher level of teamwork, leadership, research, and communication skills.

Students should refer to the Unit Moodle site for team project report assessment criteria and individual marking criteria of the team-based projects. A detailed description of both marking schemes will be provided on the Moodle site on time. It is based on some factors such as Team Charter and/or peer assessments.

### **Submission**

Online Group

### **Submission Instructions**

Students can scan their handwritten calculations for online submission

### **Learning Outcomes Assessed**

- Design complex fluid drives and analyse their performance
- Evaluate advanced applications of drive systems in industrial plants
- Create professional documentation using terminology, symbols and diagrams related to electric and fluid drives.

### **Graduate Attributes**

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management

## **2 Written Assessment**

### **Assessment Type**

Written Assessment

### **Task Description**

Assignment 2 is a team project. It focuses on the content of the unit covered in week 1 to week 12. The scope of Assignment 2 will be populated in the unit Moodle in Week 7 and will be discussed in the week 7 workshop session. It is a team submission. A team project presentation of this project will be held on Week 12 in Workshop time and venue.

### **Assessment Due Date**

Week 12 Friday (8 Oct 2021) 11:45 pm AEST  
Compulsory team submission

### **Return Date to Students**

Exam Week Friday (22 Oct 2021)  
After two weeks of submission date

### **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 of design and analysis of a fluid-powered system, comparison, and safety checking of the new design using proper engineering procedures. The professional skills cover a higher level of teamwork, leadership, research, and communication skills.

Students should refer to the Unit Moodle site for team project report assessment criteria and individual marking criteria of the team-based projects. A detailed description of both marking schemes will be provided on the Moodle site on time. It is based on some factors such as Team Charter and/or peer assessments.

### **Submission**

Online Group

### **Submission Instructions**

Students can scan their handwritten calculations for online submission

### **Learning Outcomes Assessed**

- Design fluid control circuits integrated with programmable controllers for automated machine systems
- Design protection and control systems for fluid power machines

- Analyse electro-mechanical power and energy conversion

#### **Graduate Attributes**

- Knowledge
- Cognitive, technical and creative skills
- Research

### 3 Practical and Written Assessment

#### **Assessment Type**

Laboratory/Practical

#### **Task Description**

It is based on the content covered in Hydraulic Test rig experiments. It is a team submission. For any change of date and time, the students will be notified before in the Moodle site. Pl. see the information on the Moodle site regularly.

#### **Assessment Due Date**

Review/Exam Week Friday (15 Oct 2021) 11:45 pm AEST

Compulsory Team submission

#### **Return Date to Students**

Exam Week Friday (22 Oct 2021)

After two weeks of submission date

#### **Weighting**

20%

#### **Minimum mark or grade**

50%

#### **Assessment Criteria**

Assessment criteria are based on detailed calculations and presentations of data obtained in the hydraulic test rig experiments. It is based on accuracy in calculations, validation of results obtained by a proper interpretation of results. It is also based on the way how students are putting symbols and hydraulic diagrams to present the sequence of operations in the experiments. No team charter approach or any other marking schemes are considered for individual student marking. All students on a team will get the same marks as that of the team lab report. A detailed description of the marking scheme for lab report marking will be provided on the Moodle site on time.

#### **Submission**

Online Group

#### **Submission Instructions**

Students can scan their handwritten calculations for online submission

#### **Learning Outcomes Assessed**

- Evaluate advanced applications of drive systems in industrial plants
- Design fluid control circuits integrated with programmable controllers for automated machine systems
- Design and analyse electro-mechanical and fluid control power and energy conversion systems
- Create professional documentation using terminology, symbols and diagrams related to electric and fluid drives.

#### **Graduate Attributes**

- Communication
- Ethical and Professional Responsibility

### 4 Online Quiz

#### **Assessment Type**

Online Quiz(zes)

#### **Task Description**

This is an invigilated individual online quiz (class test) that will be held in Week 11 of this unit during workshop time. The duration will be 2.5 hours. The detailed description and important information relating to this individual online test will be populated in the unit Moodle site.

#### **Number of Quizzes**

1

#### **Frequency of Quizzes**

Other

**Assessment Due Date**

online

**Return Date to Students**

Soon after the online quiz

**Weighting**

40%

**Minimum mark or grade**

50%

**Assessment Criteria**

You have to employ your technical knowledge and problem-solving skills to answer the questions. There are yes/no, multiple-choice questions. You have to get answers to some questions by proper calculations focussing on units of parameters. For a right answer, you will get 1 (one) and for a wrong answer, you will get a 0 (zero).

**Submission**

Online

**Submission Instructions**

automatic

**Learning Outcomes Assessed**

- Design complex fluid drives and analyse their performance
- Design and analyse electro-mechanical and fluid control power and energy conversion systems
- Design protection and control systems for fluid power machines
- Analyse electro-mechanical power and energy conversion

**Graduate Attributes**

- Knowledge
- Cognitive, technical and creative skills

## 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