



# ENAE12006 *Electrical Machines and Drives*

## Term 1 - 2024

Profile information current as at 09/05/2024 02:15 am

All details in this unit profile for ENAE12006 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

In this unit, you will be introduced to different types of electrical machines that convert electrical energy to other forms of energy. You will cover construction and operational characteristics of DC and AC electrical machines. You will also get a basic understanding of machine protection and control schemes. You will work, learn and communicate ethically and professionally, to investigate and solve problems and present solutions. You will communicate technical aspects and operation of electrical machines and clearly document solutions to problems. 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 2*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

#### Pre-requisites or Co-requisites

Pre-requisite: ENEE12015 Electrical Power Engineering OR ENAE12007 Electrical Power 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 1 - 2024

- 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).

#### 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 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: 25%

#### 2. **Written Assessment**

Weighting: 25%

#### 3. **Practical and Written Assessment**

Weighting: 30%

#### 4. **Online Quiz(zes)**

Weighting: 20%

### 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 Unit Evaluation Comments

##### **Feedback**

Students found this unit an enjoyable learning experience.

##### **Recommendation**

This good practice should be maintained.

#### Feedback from Unit Coordinator

##### **Feedback**

Students appreciated the considerable amount of learning in this unit about electrical machines, drives and their applications.

##### **Recommendation**

This good practice should be maintained.

#### Feedback from Unit Evaluation

##### **Feedback**

Students suggested that unit requirements to be clearly mentioned in the unit.

##### **Recommendation**

Requirements of the unit and its assessments should be mentioned on Moodle and be presented in a lecture or tutorial session for providing more clarity to students.

#### Feedback from Unit Evaluation

##### **Feedback**

Students suggested that some of unit contents might be less useful for their learning.

##### **Recommendation**

Contents of this unit should be reviewed in terms of relevancy to the unit learning outcomes and usefulness for students.

## Unit Learning Outcomes

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

1. Describe construction and operational characteristics of DC and AC electrical machines
2. Identify the schemes used to protect and control electric drives
3. Analyse and formulate industrial drive problems and solve them in a professional manner
4. Verify the operational characteristics of electrical machines through laboratory experiments
5. Communicate effectively using terminology, symbols and diagrams associated with electrical machines through professional documentation
6. Work, learn and communicate in an ethical, professional manner both individually and in teams, using information literacy skills to investigate problems and present solutions.

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

#### **Introductory**

**1.4 Discernment of engineering developments within the practice area. (LO: 1N 2N 3N 4N 5N)**

**2.3 Application of systematic design processes to well-defined engineering problems. (LO: 1N 2N 3N 4N 5N)**

## **Intermediate**

**1.2 Procedural-level understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the practice area. (LO: 1I 2I 3I 4I)**

**1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the area of practice. (LO: 4I 5I)**

**2.1 Application of established technical and practical methods to the solution of well-defined engineering problems. (LO: 1I 2I 3I 4I)**

**2.2 Application of technical and practical techniques, tools and resources to well-defined engineering problems. (LO: 1I 2I 3I 4I 5I)**

**2.4 Application of systematic project management processes. (LO: 4I 5I)**

**3.3 Creative, innovative and pro-active demeanour. (LO: 1I 2I 3I 4I 5I)**

**3.4 Professional use and management of information. (LO: 1I 2I 3I 4I 5I)**

**3.6 Effective team membership and team leadership. (LO: 4I 5I 6I)**

## **Advanced**

**1.1 Descriptive, formula-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the practice area. (LO: 1A 2I 3I 4I)**

**1.3 In-depth practical knowledge and skills within specialist sub-disciplines of the practice area. (LO: 1I 2I 3I 4A)**

**3.2 Effective oral and written communication in professional and lay domains. (LO: 5A 6A)**

**3.5 Orderly management of self, and professional conduct. (LO: 4A 5A 6A)**

***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
1 - Written Assessment - 25%	•				•	
2 - Written Assessment - 25%		•	•			•
3 - Practical and Written Assessment - 30%				•	•	•
4 - Online Quiz(zes) - 20%	•	•	•			

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Communication				•	•	•
2 - Problem Solving	•	•	•	•	•	•
3 - Critical Thinking	•	•	•	•	•	•
4 - Information Literacy						•
5 - Team Work				•	•	•
6 - Information Technology Competence				•	•	
7 - Cross Cultural Competence						
8 - Ethical practice						
9 - Social Innovation						
10 - Aboriginal and Torres Strait Islander Cultures						

## Textbooks and Resources

### Textbooks

ENAE12006

#### Prescribed

#### Electrical Machines, Drives, and Power Systems

6th Edition (Pearson new international edition) (2014)

Authors: Theodore Wildi

Pearson Education Limited

Harlow , Essex , England

ISBN: 978-1-292-02458-5

Binding: Hardcover

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

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

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Access to a document scanner

## Referencing Style

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

For further information, see the Assessment Tasks.

## Teaching Contacts

**Kianoush Emami** Unit Coordinator

[k.emami@cqu.edu.au](mailto:k.emami@cqu.edu.au)

## Schedule

### Week 1 - 04 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Electrical machines and basic Electrical Engineering	<b>Chapter 1 and Chapter 2</b>	

### Week 2 - 11 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Electrical Engineering Principles	<b>Chapter 2 and Chapter 3</b>	

### Week 3 - 18 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Electrical Engineering Principles (continued)	<b>Chapter 3 and Chapter 6</b>	Online Quiz 1 opens on Monday (18 Mar 24) 9:00 AM AEST and closes Tuesday (26 Mar 24) 11:45 PM AEST. The quiz covers contents from Week 1 and Week 2.

### Week 4 - 25 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Direct-Current Machines	<b>Chapter 4 and Chapter 5</b>	
<b>Week 5 - 01 Apr 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Direct-Current Machines (continued)	<b>Chapter 4 and Chapter 5</b>	Online Quiz 2 opens on Monday (1 Apr 24) 9:00 AM AEST and closes Tuesday (16 Apr 24) 11:45 PM AEST. The quiz covers contents from Week 3 and Week 4.
<b>Vacation Week - 08 Apr 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
<b>Week 6 - 15 Apr 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Induction (AC) Machines	<b>Chapter 13, Chapter 14 and Chapter 18</b>	<b>Assignment 1</b> Due: Week 6 Friday (19 Apr 2024) 11:45 pm AEST
<b>Week 7 - 22 Apr 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Induction Machines (continued)	<b>Chapter 13, Chapter 14 and Chapter 18</b>	Residential school of this unit will be from 24th until 26th of April 2024 in Rockhampton B28/2.10. Online Quiz 3 opens on Monday (22 Apr 24) 9:00 AM AEST and closes Friday (3 May 24) 11:45 PM AEST. The quiz covers contents from Week 5 and Week 6.
<b>Week 8 - 29 Apr 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Synchronous (AC) Machines	<b>Chapter 16 and Chapter 17</b>	
<b>Week 9 - 06 May 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Synchronous Machines (continued)	<b>Chapter 16 and Chapter 17</b>	Online Quiz 4 opens on Monday (6 May 24) 9:00 AM AEST and closes Tuesday (14 May 24) 11:45 PM AEST. The quiz covers contents from Week 7 and Week 8.
<b>Week 10 - 13 May 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Fundamentals in Protection and Control of Electrical Machines	<b>Chapter 20</b>	
<b>Week 11 - 20 May 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Fundamental Elements of Power Electronics	<b>Chapter 21</b>	Online Quiz 5 Opens on Monday (20 May 24) 9:00 AM AEST and closes Tuesday (4 June 24) 11:45 PM AEST. The quiz covers contents from Week 9, Week 10 and Week 11.
		<b>Residential School and Lab Report</b> Due: Week 11 Friday (24 May 2024) 11:45 pm AEST
<b>Week 12 - 27 May 2024</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Power Electronic Control of AC and DC Electrical Machines (Introduction)	<b>Chapter 22 and Chapter 23</b>	

## Review/Exam Week - 03 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic
<b>Exam Week - 10 Jun 2024</b>		
Module/Topic	Chapter	Events and Submissions/Topic
<b>Assessment 2</b> Due: Exam Week Monday (10 June 2024) 11:45 pm AEST		

## Assessment Tasks

### 1 Assignment 1

#### Assessment Type

Written Assessment

#### Task Description

Students are expected to successfully complete the exercises specified in the unit website in Moodle covering the learning outcomes 1, 5, and 6. This **compulsary** assignment contains 5-10 problems which will require the theoretical knowledge gained through your learning during the first five weeks. Marking scheme for each question will be published with the assignment and the marks for this assignment will contribute to 25% of the overall marks of this unit. Assignment questions will be available in the unit Moodle site at the beginning of the term. Please also refer to assessment criteria for more details.

#### Assessment Due Date

Week 6 Friday (19 Apr 2024) 11:45 pm AEST

To be submitted as a PDF file to unit web site, one submission per student

#### Return Date to Students

Feedback will be provided within two weeks of submission via the unit website on Moodle.

#### Weighting

25%

#### Minimum mark or grade

A minimum mark of 50% is required to pass the assessment

#### Assessment Criteria

##### Assessment Criteria

Each question in this assignment will be assessed separately for the criterion accuracy and correct results. **20% of the total marks for this assignment are based on accuracy and correct results, including:**

- Correct application of maths and arithmetic
- Answers clearly identified
- Correct results

**In addition, the assignment as a whole will be assessed against the following criteria:**

##### Evidence of correct procedures (40% of the total marks for the assignment)

- All necessary steps in analysis are present on correct order
- Clear presentation of mathematical and arithmetical working linking given details of the problem to the results obtained.
- Evidence of checking results (mathematical, graphical, logic-common sense)

##### Evidence of understanding of the topic (30% of the total marks for the assignment)

- Explanation of choices made in the analysis (why is procedure required, why this particular procedure)
- Interpretation of results, e.g. limitations, direction of vectors

##### Professional presentation (10% of the total marks for the assignment)

- Clear statement of each problem and its details and requirements
- Logical layout of analysis
- Appropriate use of diagrams, clear diagrams
- Correct use of terminology, conventions



- Referencing of authoritative sources of equations and data

## Referencing Style

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

## Submission

Online

## Submission Instructions

To be submitted as a PDF file to unit web site, one submission per student

## Learning Outcomes Assessed

- Describe construction and operational characteristics of DC and AC electrical machines
- Communicate effectively using terminology, symbols and diagrams associated with electrical machines through professional documentation

# 2 Assessment 2

## Assessment Type

Written Assessment

## Task Description

Students are expected to successfully complete the exercises specified in the unit website in Moodle covering the learning outcomes 1, 2, 3, 4, and 5. This **compulsary** assignment contains 5-10 problems which will require the theoretical knowledge gained through your learning during the term. Marking scheme for each question will be published with the assignment and the marks for this assignment will contribute to 25% of the overall marks of this unit. Assignment questions will be available in unit Moodle site at the beginning of the term. Please also refer to assessment criteria for more details.

## Assessment Due Date

Exam Week Monday (10 June 2024) 11:45 pm AEST

To be submitted as a PDF file to unit web site, one submission per student

## Return Date to Students

Feedback will be provided within two weeks of submission via the unit website on Moodle.

## Weighting

25%

## Minimum mark or grade

A minimum mark of 50% is required to pass the assessment

## Assessment Criteria

### Assessment Criteria

Each question in this assignment will be assessed separately for the criterion accuracy and correct results. **20% of the total marks for this assignment are based on accuracy and correct results, including:**

- Correct application of maths and arithmetic
- Answers clearly identified
- Correct results

**In addition, the assignment as a whole will be assessed against the following criteria:**

### Evidence of correct procedures (40% of the total marks for the assignment)

- All necessary steps in analysis are present on correct order
- Clear presentation of mathematical and arithmetical working linking given details of the problem to the results obtained.
- Evidence of checking results (mathematical, graphical, logic-common sense)

### Evidence of understanding of the topic (30% of the total marks for the assignment)

- Explanation of choices made in the analysis (why is procedure required, why this particular procedure)
- Interpretation of results, e.g. limitations, direction of vectors

### Professional presentation (10% of the total marks for the assignment)

- Clear statement of each problem and its details and requirements
- Logical layout of analysis
- Appropriate use of diagrams, clear diagrams

- Correct use of terminology, conventions
- Referencing of authoritative sources of equations and data

### Referencing Style

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

### Submission

Online

### Submission Instructions

To be submitted online through unit website in Moodle

### Learning Outcomes Assessed

- Identify the schemes used to protect and control electric drives
- Analyse and formulate industrial drive problems and solve them in a professional manner
- Work, learn and communicate in an ethical, professional manner both individually and in teams, using information literacy skills to investigate problems and present solutions.

## 3 Residential School and Lab Report

### Assessment Type

Practical and Written Assessment

### Task Description

Dates for the **compulsory** residential school will be notified to students through the unit Website. Students will be formed into teams for all residential school activities. A **group** professional laboratory report is required to be submitted for each team within few weeks after completion of the residential school. The details of the experiments will be notified to students through the unit Website. Please also refer to assessment criteria for more details.

### Assessment Due Date

Week 11 Friday (24 May 2024) 11:45 pm AEST

To be submitted as a PDF file to unit web site, one submission per student

### Return Date to Students

Feedback will be provided within two weeks of submission via the unit website on Moodle.

### Weighting

30%

### Minimum mark or grade

A minimum mark of 50% is required to pass the assessment

### Assessment Criteria

#### Assessment Criteria

Marking of the individual report will be done according to the following criteria.

- The accuracy and relevance of information
- Application of knowledge
- Language and grammar used in answering questions
- Proper referencing of sources of information
- Inclusion of all relevant Equations, images, data and tables, and the quality of presentation and layout

### Referencing Style

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

### Submission

Online Group

### Submission Instructions

To be submitted online through unit website in Moodle

### Learning Outcomes Assessed

- Verify the operational characteristics of electrical machines through laboratory experiments
- Communicate effectively using terminology, symbols and diagrams associated with electrical machines through professional documentation
- Work, learn and communicate in an ethical, professional manner both individually and in teams, using information literacy skills to investigate problems and present solutions.

## 4 Online Quiz(zes)

### Assessment Type

Online Quiz(zes)

### Task Description

The assessment is a set of five online fortnightly quizzes which can be accessed via the unit Moodle site. Each online quiz weights 4% of your final mark (20% in total). The quizzes are an integrated part of the study to test on the key concepts of each topic. Each quiz will be available up to 1 week after the relevant fortnight to allow students who cannot find time each week for study. For example quiz on Week 1 and 2 will be available on Monday Week 3 and will close on Tuesday the week after. Please refer to the Schedule section of the unit profile for the opening and closing dates of each quiz.

### Important Notes:

- Each quiz has a set time to complete and once a student start a quiz, it will close after the set time.
- Once started, a quiz cannot be paused in the middle. Students are strongly advised to sufficiently cover the material related to each quiz before starting the quiz.
- You can attempt each quiz 3 times within the given time frame as specified in the schedule.
- Final mark will be the highest of all the attempts.

### Number of Quizzes

5

### Frequency of Quizzes

Fortnightly

### Assessment Due Date

Tuesday weeks 4,6,10,13 and Friday Week 8 at 11:45 PM AEST

### Return Date to Students

Results are available immediately after the completion of each quiz

### Weighting

20%

### Assessment Criteria

No Assessment Criteria

### Referencing Style

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

### Submission

Online

### Learning Outcomes Assessed

- Describe construction and operational characteristics of DC and AC electrical machines
- Identify the schemes used to protect and control electric drives
- Analyse and formulate industrial drive problems and solve them in a professional manner

## 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