



# ENEE13016 Power System Protection

## Term 1 - 2021

Profile information current as at 05/05/2024 07:40 am

All details in this unit profile for ENEE13016 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 analyse and design devices and schemes to protect electrical power apparatus and systems. You will explain the philosophy, principles, concepts and practices, the codes, standards and refer to manuals that guide the design and operation of protection schemes. You will also analyse protection schemes, solve protection problems and correct faults. You will identify requirements, analyse and design protection for power system networks and for apparatus in electrical power systems. You will develop fluency in the technical language of power systems protection and develop the professional skills needed to communicate, learn and work alone and collaboratively to solve problems and document the solution process.

#### 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

ENEE12015 Electrical Power Engineering or ENEE12004 Introduction to Power Systems or ENTE12005 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 - 2021

- Bundaberg
- Cairns
- Gladstone
- Mackay
- 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).

#### 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: 30%

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

Weighting: 30%

#### 3. **Take Home Exam**

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 Have Your Say

##### Feedback

Only the lack of face to face interaction and missing substation visit but that was out of our control this year.

##### Recommendation

The substation visit will be introduced, health directives permitting.

## Unit Learning Outcomes

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

1. Analyse and design power system protection schemes to solve operational problems and correct faults
2. Apply codes, standards, guidelines in manuals to design power system protection schemes for given operational scenarios
3. Design protection schemes for power networks, including determining the type and nature of suitable protection for apparatus that needs protection
4. Document solutions effectively using electrical power systems protection terminology, symbols and diagrams to present the information in a professional manner
5. Communicate, work and learn both individually and in teams, in a professional manner.

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Written Assessment - 30%	•	•	•	•	•
2 - Online Quiz(zes) - 30%	•	•			
3 - Take Home Exam - 40%			•	•	•

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
1 - Communication	•	•	•	•	•
2 - Problem Solving	•	•	•		

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
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					

## Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 30%	•	•	•							
2 - Online Quiz(zes) - 30%	•	•								
3 - Take Home Exam - 40%	•	•	•							

## Textbooks and Resources

### Textbooks

**There are no required textbooks.**

### IT Resources

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

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

## Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)  
For further information, see the Assessment Tasks.

## Teaching Contacts

**Sanath Alahakoon** Unit Coordinator  
[s.alahakoon@cqu.edu.au](mailto:s.alahakoon@cqu.edu.au)

## Schedule

### Week 1 - 08 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Protection system fundamentals	NPAG Chapter 2; Reading Topic 1	

### Week 2 - 15 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Current transformers	NPAG Chapter 6 sections 6.4.1 to 6.4.9; Reading Topic 2	

### Week 3 - 22 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Over current protection	NPAG Chapter 9 sections 9.1 to 9.9; Reading Topic 3 pages 3-1 to 3-9.	

### Week 4 - 29 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Over current protection	NPAG Chapter 9 sections 9.10 to 9.18; Reading Topic 3 pages 3-10 to 3-19.	

### Week 5 - 05 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Transformer protection	NPAG Chapter 16 sections 16.1 to 16.8	On-line class test 1 due Assignment feedback opportunity 1

### Vacation Week - 12 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

### Week 6 - 19 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Transformer protection	NPAG Chapter 16 sections 16.9 to 16.16; Reading Topic 6.	

### Week 7 - 26 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Distance (impedance ) protection	NPAG Chapter 11 sections 11.1 to 11.8; Reading Topic 5 pages 5-1 to 5-9.	On-line class test 2 due Assignment feedback opportunity 2

### Week 8 - 03 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Distance (impedance ) protection	NPAG Chapter 11 sections 11.9 to 11.13; Chapter 12. Reading Topic 5 pages 5-20 to 5-33.	

### Week 9 - 10 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Motor/Generator protection	NPAG Chapters 17 and 19; Reading Topic 6.	Assignment feedback opportunity 3

**Week 10 - 17 May 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Feeder protection	NPAG Chapter 9 sections 9.19 to 9.21; Chapter 10.	On-line class test 3 due

**Week 11 - 24 May 2021**

Module/Topic	Chapter	Events and Submissions/Topic
The digital substation	NPAG Chapters 24 and 25.	<b>Substation Protection Assignment</b> Due: Week 11 Friday (28 May 2021) 11:59 pm AEST

**Week 12 - 31 May 2021**

Module/Topic	Chapter	Events and Submissions/Topic
Review		

**Review/Exam Week - 07 Jun 2021**

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

**Exam Week - 14 Jun 2021**

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

## Assessment Tasks

### 1 Substation Protection Assignment

**Assessment Type**

Written Assessment

**Task Description**

Review and analyse selected features of an integrated substation protection system. The major technical deliverables are: A simplified protection diagram; The identification of suitable protection zones; Determining suitable protection schemes within each zone; Identifying suitable commercial equipment; Demonstrating that the actions of the protection schemes are co-ordinated; Determining specified key parameters for protection equipment. Students will present an engineering report that includes a Simplified Protection Diagram; A Design Summary and a Main Body. Page limits apply. Three optional formative feedback opportunities on specific assignment tasks are available in weeks six, eight and ten. This is a team based assessment. The preferred team size is two. Where circumstances exist, the team size can vary. Teams can self-select their members and must advise the lecturer of the team membership via email before the end of week two. For team based assignments will be submitted with a written statement outlining the contribution of each team member.

The full assignment document is available through Moodle before the start of the term.

**Assessment Due Date**

Week 11 Friday (28 May 2021) 11:59 pm AEST

Submitted through unit Moodle site as a PDF file.

**Return Date to Students**

Review/Exam Week Friday (11 June 2021)

Returned through unit Moodle site

**Weighting**

30%

**Minimum mark or grade**

Students must achieve 50% out of the allocated marks for this assignment to pass.

**Assessment Criteria**

The Simplified Protection Diagram

It is acceptable to hand draw the diagram (CAD can take time). The diagram should show clearly:

The primary plant – transformers, breakers and busbars

- The CT and VT locations

- The protection relays with a single line connection to their inputs (generally CTs and VTs) and outputs (circuit breaker operating coils). Show the IEEE device numbers on the relays.

To achieve clarity of presentation the simplified drawing can omit:  
Interconnections between the relays;

- The relay tables;
- Details of the housekeeping power supplies.

#### Design Summary

The design summary would be expected to refer to the protection diagram. It should:

1. Identify the protection zones;
2. For each protection zone specify:
  - a. The protection schemes to be applied;
  - b. How backup protection is achieved;
  - c. The placement of CTs and VTs;
  - d. Provide the basic ratings for CTs and VTs;
  - e. For overcurrent protection schemes only, give suitable relay settings.

#### Main Body

Provide an overview of the protection zones and protection schemes;

1. For each protection zone your plan will specify:
  - a. Provide a brief rationale for the selection of the scheme(s);
  - b. Provide a brief rationale the placement of CTs and VTs;
  - c. Outline the calculations for the ratings of CTs and VTs;
  - d. Outline the calculations for overcurrent relay settings;
  - e. Provide recommendations for suitable commercial relays.
2. For each protection zone, give at least two examples of how the protection system will safely and reliably detect and isolate faults within the protection zone. One fault will be a earth fault, one fault will be a line to line fault;
3. For each protection zone, give at least one example of how the protection system will discriminate against a fault outside of the protection zone.

This is a team based assignment.

#### Referencing Style

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

#### Submission

Online

#### Submission Instructions

Submitted through unit Moodle site as a PDF file.

#### Learning Outcomes Assessed

- Analyse and design power system protection schemes to solve operational problems and correct faults
- Apply codes, standards, guidelines in manuals to design power system protection schemes for given operational scenarios
- Design protection schemes for power networks, including determining the type and nature of suitable protection for apparatus that needs protection
- Document solutions effectively using electrical power systems protection terminology, symbols and diagrams to present the information in a professional manner
- Communicate, work and learn both individually and in teams, in a professional manner.

#### Graduate Attributes

- Problem Solving
- Critical Thinking
- Information Literacy

## 2 Online Quizzes

#### Assessment Type

Online Quiz(zes)

#### Task Description

Three on line quizzes covering weeks 1-4; 5-6 and 7-9. Most questions are multiple choice and most questions require some calculations to select a correct answer. Several attempts at each quiz are allowed but at each attempt new (but similar) questions are presented. Quizzes contain between ten and twenty questions. Most students will require less than

one hour to complete a quiz attempt.

**Number of Quizzes**

3

**Frequency of Quizzes**

Other

**Assessment Due Date**

As stated in the weekly schedule.

**Return Date to Students**

Marks will be available in the Moodle on completion of the quiz.

**Weighting**

30%

**Assessment Criteria**

The three quizzes total 30 marks. Ten marks per quiz.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Online

**Learning Outcomes Assessed**

- Analyse and design power system protection schemes to solve operational problems and correct faults
- Apply codes, standards, guidelines in manuals to design power system protection schemes for given operational scenarios

**Graduate Attributes**

- Problem Solving
- Critical Thinking

## 3 TAKE HOME EXAM

**Assessment Type**

Take Home Exam

**Task Description**

This take home examination will be monitored through a ZOOM session and students will have to provide written answers to some questions.

1. Examination will be time scheduled and will take place for everyone at the same time.
2. Each student stays home with a device (preferably a laptop) essentially having a camera through which we can watch the student in a ZOOM session during the examination (please make sure you have a device with these requirements functioning).
3. That ZOOM link needs to be open throughout the exam.
4. The examination paper will be loaded to the Moodle so that students only can access it during examination period.
5. The student uses blank A4 papers (single side) to write answers.
6. At the end of the examination, he/she first takes photos of all written pages and email invigilator.
7. Later he/she scan the pages and upload to Moodle within a specified time at the end of examination.
8. Examination date and time will be within the standard examination period for Term 2-2020.

**Assessment Due Date**

Date and time of the examination which will be held within the Exam Week will be notified later.

**Return Date to Students**

Outcomes will be published with the grade certification.

**Weighting**

40%



**Minimum mark or grade**

In order to pass, students must score more than 50% out of the allocated marks for this assignment.

**Assessment Criteria**

The distribution of marks across the examination questions will be presented in the examination paper.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

At the end of the examination, student must first take photos of all written pages and email invigilator. Later he/she must scan the pages and upload to Moodle within a specified time from the end of examination.

**Learning Outcomes Assessed**

- Design protection schemes for power networks, including determining the type and nature of suitable protection for apparatus that needs protection
- Document solutions effectively using electrical power systems protection terminology, symbols and diagrams to present the information in a professional manner
- Communicate, work and learn both individually and in teams, in a professional manner.

**Graduate Attributes**

- Problem Solving
- Critical Thinking
- Information Literacy

## 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