



ENEE13016 Power System Protection

Term 1 - 2017

Profile information current as at 13/05/2024 12:09 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

Students analyse and design devices and schemes to protect electrical power apparatus and systems. They explain the philosophy, principles, concepts and practices, the codes, standards and manuals that guide design and operation of protection schemes. They analyse protection schemes, solve protection problems and correct faults. Students identify requirements, analyse and design protection for power system networks and for apparatus in electrical power systems. They develop fluency in the technical language of power systems protection and develop professional skills needed to communicate, learn and work alone and collaboratively to solve problems and document the solution process. Distance education (FLEX) students are required to have access to a computer and make frequent use of the Internet.

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

ENEE 12015 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 - 2017

- Bundaberg
- Distance
- Gladstone
- Mackay
- 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. **Written Assessment**

Weighting: Pass/Fail

4. **Examination**

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 Course Experience Questionnaire

Feedback

The best part was the broad range of protection functions covered in the course

Recommendation

The course is continually updated to cover the key industrial applications

Action

The unit is reviewed and refreshed at each offering every year and new materials added.

Feedback from Course Experience Questionnaire

Feedback

The design assignment needs some course content throughout the term. This project should be more structured like a PBL subject, which does workshops throughout the term, demonstrating some fundamental design practices and calculations.

Recommendation

Some assignment workshop activity will be added into the tutorial time.

Action

The formative assignment feedback opportunities have worked very well for those who took the opportunity. This term it was a little disappointing roughly half of the class participated. The tutorial resources were expanded and this included approximately 100 pages of worked solutions.

Feedback from Course Experience Questionnaire

Feedback

NPAG protection guide is really good source, but sometimes it is too complex. Learning guide is a really valuable source.

Recommendation

The Network Protection and Automation Guide is a key industry resource and it very complete. Unfortunately the document is huge. The weekly lecturers will be upgraded to give more guidance on using the NPAG.

Action

We continue to use the NPAG as a key industry resource. The tutorials were expanded this year to include several new examples from the NPAG.

Unit Learning Outcomes

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

1. Describe and explain the philosophy, principles, concepts and practices that are the foundation of electric power systems protection [2, 3, 5, 7, 8, 9]
2. Identify, explain the scope and standing of, and apply codes, standards and manuals used to guide design and operation of electric power systems protection [2, 3, 10]
3. Analyse power protection systems, modify and design such systems to solve problems and correct faults [3, 4, 5]
4. Describe devices and schemes used to provide protection in power systems, explain their operation and design protection devices and schemes to operate in given situations [1, 2, 3, 4, 5]
5. Identify apparatus that require protection in power systems, explain the nature of the protection they required and design protection schemes for these apparatus [1, 2, 3, 4, 5]
6. Describe the types of protection required in power systems networks, explain the nature of the protection required and design protection schemes for these networks [1, 2, 3, 4, 5]
7. Communicate effectively using electrical power systems protection terminology, symbols and diagrams [1, 2, 3]
8. Work and learn autonomously and collaboratively to solve problems, record and communicate clearly and professionally the approach used to solve problems and the reasons for adopting such approaches to the problem [2, 6, 9, 10]

Numbers in brackets show Graduate Attributes (abbreviated) below promoted by each Learning Outcome above.

BEng GAs BEngTech GAs

1. science and engineering
2. communicate effectively
3. technical competence
4. problem solution
5. systems
6. function in teams
7. social, cultural, global and environmental
8. sustainable design and development
9. professionalism and ethics
10. lifelong learning

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	8
1 - Written Assessment - 30%	•	•	•	•	•	•	•	•
2 - Online Quiz(zes) - 30%		•	•	•		•		
3 - Examination - 40%		•	•			•		
4 - Written Assessment - 0%	•	•	•	•	•	•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes							
	1	2	3	4	5	6	7	8
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								

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 - Examination - 40%		•	•							
4 - Written Assessment - 0%	•	•	•							

Textbooks and Resources

Textbooks

There are no required textbooks.

Additional Textbook Information

This course will utilise freely available materials including the Network Protection and Automation Guide which may be obtained at

<http://www.alstom.com/grid/products-and-services/Substation-automation-system/protection-relays/Network-Protection-Automation-Guide-NEW-2011-Edition/>

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

Peter Wolfs Unit Coordinator

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Schedule

Week 1 - 06 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Protection System fundamentals		

Week 2 - 13 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Current transformers		

Week 3 - 20 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Over current protection		

Week 4 - 27 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Over current protection		

Week 5 - 03 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic
Transformer protection		On-line class test 1 due

Vacation Week - 10 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 17 Apr 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Transformer protection		
Week 7 - 24 Apr 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Distance (impedance) protection		On-line class test 2 due
Week 8 - 01 May 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Distance (impedance) protection		
Week 9 - 08 May 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Motor/Generator protection		
Week 10 - 15 May 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Feeder protection		On-line class test 3 due
Week 11 - 22 May 2017		
Module/Topic	Chapter	Events and Submissions/Topic
Coordinating protection schemes in a substation		
Week 12 - 29 May 2017		
Module/Topic	Chapter	Events and Submissions/Topic
		Assignment Due
Review		Substation Protection Assignment Due: Week 12 Friday (2 June 2017) 11:45 pm AEST
Review/Exam Week - 05 Jun 2017		
Module/Topic	Chapter	Events and Submissions/Topic
		Workbook Due: Review/Exam Week Friday (9 June 2017) 11:45 pm AEST
Exam Week - 12 Jun 2017		
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 zone 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. The full assignment document is available through Moodle before the start of the term.

Assessment Due Date

Week 12 Friday (2 June 2017) 11:45 pm AEST

Submit on line

Return Date to Students

Review/Exam Week Friday (9 June 2017)

Returned on line.

Weighting

30%

Minimum mark or grade

15/30

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.
1. 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;
2. 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 an individual assignment.

Referencing Style

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

Submission

Online

Submission Instructions

Please submit electronic version of your assignment through Moodle.

Learning Outcomes Assessed

- Describe and explain the philosophy, principles, concepts and practices that are the foundation of electric power systems protection [2, 3, 5, 7, 8, 9]

- Identify, explain the scope and standing of, and apply codes, standards and manuals used to guide design and operation of electric power systems protection [2, 3, 10]
- Analyse power protection systems, modify and design such systems to solve problems and correct faults [3, 4, 5]
- Describe devices and schemes used to provide protection in power systems, explain their operation and design protection devices and schemes to operate in given situations [1, 2, 3, 4, 5]
- Identify apparatus that require protection in power systems, explain the nature of the protection they required and design protection schemes for these apparatus [1, 2, 3, 4, 5]
- Describe the types of protection required in power systems networks, explain the nature of the protection required and design protection schemes for these networks [1, 2, 3, 4, 5]
- Communicate effectively using electrical power systems protection terminology, symbols and diagrams [1, 2, 3]
- Work and learn autonomously and collaboratively to solve problems, record and communicate clearly and professionally the approach used to solve problems and the reasons for adopting such approaches to the problem [2, 6, 9, 10]

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Team Work
- Ethical practice

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

Learning Outcomes Assessed

- Identify, explain the scope and standing of, and apply codes, standards and manuals used to guide design and operation of electric power systems protection [2, 3, 10]
- Analyse power protection systems, modify and design such systems to solve problems and correct faults [3, 4, 5]
- Describe devices and schemes used to provide protection in power systems, explain their operation and design protection devices and schemes to operate in given situations [1, 2, 3, 4, 5]
- Describe the types of protection required in power systems networks, explain the nature of the protection required and design protection schemes for these networks [1, 2, 3, 4, 5]

Graduate Attributes

- Problem Solving

3 Workbook

Assessment Type

Written Assessment

Task Description

Your work book should contain the worked solutions to tutorials and materials supporting your assignment such as diagrams and any calculations.

Assessment Due Date

Review/Exam Week Friday (9 June 2017) 11:45 pm AEST

Return Date to Students

Feedback will be given online

Weighting

Pass/Fail

Assessment Criteria

Content - reasonable attempts should be present for 75% tutorial activities and in support of the protection assignment. The work book should illustrate a capacity to perform calculations accurately, with an understanding of significant figures and with the correct use of the SI engineering units. Scan the workbook to produce a single PDF for submission.

Referencing Style

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

Submission

Online

Learning Outcomes Assessed

- Describe and explain the philosophy, principles, concepts and practices that are the foundation of electric power systems protection [2, 3, 5, 7, 8, 9]
- Identify, explain the scope and standing of, and apply codes, standards and manuals used to guide design and operation of electric power systems protection [2, 3, 10]
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Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking

Examination

Outline

Complete an invigilated examination.

Date

During the examination period at a CQUniversity examination centre.

Weighting

40%

Length

180 minutes

Minimum mark or grade

50

Exam Conditions

Restricted.

Materials

Calculator - all non-communicable calculators, including scientific, programmable and graphics calculators are authorised

Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

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