



# ENEE13021 *Power System Analysis and Design*

## Term 2 - 2018

Profile information current as at 30/04/2024 03:57 pm

All details in this unit profile for ENEE13021 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 should be able to work in teams to model, analyse and investigate design and operation options for electrical power networks to meet community service requirements. On satisfactory completion students should be able to analyse steady state power system performance, and articulate the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs. Distance Education (Flex) students will be required to attend a residential school to promote development of unit learning outcomes.

### 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

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 - 2018

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Mixed Mode
- 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 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. **Practical and Written Assessment**

Weighting: 15%

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

Weighting: 30%

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

Weighting: 15%

#### 4. **Examination**

Weighting: 40%

#### 5. **Written Assessment**

Weighting: Pass/Fail

### 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 Student feedback

##### Feedback

Need to shorten turnaround time for assignments.

##### Recommendation

Will ensure assignments are returned within two weeks.

#### Feedback from Student feedback

##### Feedback

Unit well organised and running well.

##### Recommendation

Will continue with the current format of the unit.

## Unit Learning Outcomes

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

1. Discuss the difference between balanced and unbalanced operation of power systems
2. Analyse, using appropriate software tools, power system performance in both balanced and unbalanced modes of operation
3. Calculate fault currents and power flow in power systems and discuss the selection of appropriate protection schemes
4. Understand the power flow problem along with the methods of solutions and appreciate the relevance of power flow studies in power system planning and operation.
5. Investigate and report the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs
6. Explain the difference between dynamic stability and transient stability and investigate tools that could be used to analyse the power system for voltage and power angle stability performance
7. Communicate effectively using power systems terminology, symbols and diagrams adhering to Australian Standards; and present design documents, solutions and calculations professionally
8. Work collaboratively and autonomously to solve problems and record and communicate clearly and professionally the approach used to solve problems

The Learning Outcomes for this unit are linked with Engineers Australia's **Stage 1 Competency Standard for Professional Engineers**.

## 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
<b>1 - Practical and Written Assessment - 15%</b>	•	•	•	•	•	•	•	•
<b>2 - Written Assessment - 30%</b>	•	•	•	•	•	•	•	•

Assessment Tasks	Learning Outcomes							
	1	2	3	4	5	6	7	8
3 - Practical and Written Assessment - 15%	•	•	•	•	•	•	•	•
4 - Examination - 40%	•	•	•	•	•	•	•	•
5 - 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 - Practical and Written Assessment - 15%	•	•	•					•		
2 - Written Assessment - 30%	•	•	•		•			•		
3 - Practical and Written Assessment - 15%	•	•	•					•		
4 - Examination - 40%		•	•					•		
5 - Written Assessment - 0%	•	•	•					•		

## Textbooks and Resources

### Textbooks

ENEE13021

#### Prescribed

#### Power System Analysis and Design

Edition: 6 (2016)

Authors: J. Duncan Glover, Thomas Overbye, Mulukutla Sarma

CENGAGE LEARNING

USA

ISBN: 978-1-305-63618-7

Binding: Paperback

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

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

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Access to a document scanner and a pdf converter
- Computer with Windows OS, headphones & microphone
- University edition of PSSE - downloadable from the internet

## Referencing Style

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

For further information, see the Assessment Tasks.

## Teaching Contacts

**Edward Palmer** Unit Coordinator

[e.palmer@cqu.edu.au](mailto:e.palmer@cqu.edu.au)

## Schedule

### Week 1 - 09 Jul 2018

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to power systems analysis	Chapters 1 & 2 of Glover, Sarma and Overbye	

### Week 2 - 16 Jul 2018

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Power System Modelling	Chapters 3 & 4 of Glover, Sarma and Overbye	

### Week 3 - 23 Jul 2018

Module/Topic	Chapter	Events and Submissions/Topic
Symmetrical Components	Chapter 8 of Glover, Sarma and Overbye	

### Week 4 - 30 Jul 2018

Module/Topic	Chapter	Events and Submissions/Topic
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Fault Analysis	Chapter 8 of Glover, Sarma and Overbye	
<b>Week 5 - 06 Aug 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Modelling of Power System Networks	Chapter 5 of Glover, Sarma and Overbye	
<b>Vacation Week - 13 Aug 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
		Residential School 23-25 August - North Rockhampton Campus
<b>Week 6 - 20 Aug 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Introduction to Load Flow Analysis	Chapter 6 of Glover, Sarma and Overbye	<b>Assignment 1 (Individual Submission)</b> Due: Week 6 Friday (24 Aug 2018) 11:45 pm AEST
<b>Week 7 - 27 Aug 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Load Flow Algorithms	Chapter 6 of Glover, Sarma and Overbye	
<b>Week 8 - 03 Sep 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Load Flow Studies, Modelling and Voltage Control	Chapter 6 of Glover, Sarma and Overbye	
<b>Week 9 - 10 Sep 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Introduction to Transient Stability	Chapter 11 of Glover, Sarma and Overbye	
<b>Week 10 - 17 Sep 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Multi-machine systems, small signal stability	Chapter 11 of Glover, Sarma and Overbye	
<b>Week 11 - 24 Sep 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Stability controls, modelling of renewables	Chapters 11 and 12 of Glover, Sarma, and Overbye	
<b>Week 12 - 01 Oct 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
Revision		<b>Project ( Group Submission)</b> Due: Week 12 Friday (5 Oct 2018) 11:45 pm AEST <b>Assignment 2 Individual Submission</b> Due: Week 12 Friday (5 Oct 2018) 11:45 pm AEST
<b>Review/Exam Week - 08 Oct 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>
		<b>Workbook</b> Due: Review/Exam Week Friday (12 Oct 2018) 11:45 pm AEST
<b>Exam Week - 15 Oct 2018</b>		
<b>Module/Topic</b>	<b>Chapter</b>	<b>Events and Submissions/Topic</b>

## Term Specific Information

Please note that the residential school is compulsory.

## Assessment Tasks

### 1 Assignment 1 (Individual Submission)

#### Assessment Type

Practical and Written Assessment

#### Task Description

Students are expected to successfully complete the exercises specified in the unit website in Moodle. This assignment may contain 4 problems which will require the theoretical knowledge gained through your learning during the first five weeks. The topics covered by these questions will be symmetrical components, balanced and unbalanced fault analysis and transmission line modelling.

The marking scheme for each question will be published with the assignment and the marks for this assignment will contribute to 15% of the overall marks of this unit. Assignment questions will be published in unit Moodle site in due course. Please also refer to assessment criteria for more details.

#### Assessment Due Date

Week 6 Friday (24 Aug 2018) 11:45 pm AEST

Submit to the link in Week 6 of the unit website in Moodle as a WORD or PDF file.

#### Return Date to Students

Week 8 Friday (7 Sept 2018)

Feedback sheet provided through unit website in Moodle

#### Weighting

15%

#### Assessment Criteria

A total of 50 marks is allocated to this assignment. Students are assessed on accuracy of calculated results, correctness of the method used and presentation

#### Referencing Style

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

#### Submission

Online

#### Learning Outcomes Assessed

- Discuss the difference between balanced and unbalanced operation of power systems
- Analyse, using appropriate software tools, power system performance in both balanced and unbalanced modes of operation
- Calculate fault currents and power flow in power systems and discuss the selection of appropriate protection schemes
- Understand the power flow problem along with the methods of solutions and appreciate the relevance of power flow studies in power system planning and operation.
- Investigate and report the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs
- Explain the difference between dynamic stability and transient stability and investigate tools that could be used to analyse the power system for voltage and power angle stability performance
- Communicate effectively using power systems terminology, symbols and diagrams adhering to Australian Standards; and present design documents, solutions and calculations professionally
- Work collaboratively and autonomously to solve problems and record and communicate clearly and professionally the approach used to solve problems

#### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

## 2 Project ( Group Submission)

### Assessment Type

Written Assessment

### Task Description

This assessment item will address all learning outcomes of this unit and will contribute to 30% of the final marks of the unit.

Students will be formed into teams of no more than 3 members for this assessment item.

Each team will be assigned a power system modeling and simulation exercise related to power systems stability, fault calculations, load flow etc.

The project will be based on the university edition of PSSE software. PSSE is an industry standard package used throughout Australia and overseas in power utilities. The free university edition is a version of it specifically for the use of students in university units. In this unit you will achieve a basic competency in the use of PSSE which will be extremely valuable should you pursue a career in the power industry. Video tutorials on the use of PSSE and instructions on installation are available on Moodle.

### Assessment Due Date

Week 12 Friday (5 Oct 2018) 11:45 pm AEST

Submit to the link in Week 10 of the unit website in Moodle as a WORD or PDF file.

### Return Date to Students

Exam Week Friday (19 Oct 2018)

Feedback given through unit website in Moodle

### Weighting

30%

### Assessment Criteria

#### Objectives

This assessment item relates to ALL unit learning outcomes as stated.

#### Assessment Criteria

Correct procedure and steps towards constructing necessary models using modeling and simulation exercise: 60%

Correct answers and units: 30%

Professional presentation and layout of the report: 10%

### Referencing Style

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

### Submission

Online Group

### Submission Instructions

Submit as a pdf or Word document using the link provided on Moodle.

### Learning Outcomes Assessed

- Discuss the difference between balanced and unbalanced operation of power systems
- Analyse, using appropriate software tools, power system performance in both balanced and unbalanced modes of operation
- Calculate fault currents and power flow in power systems and discuss the selection of appropriate protection schemes
- Understand the power flow problem along with the methods of solutions and appreciate the relevance of power flow studies in power system planning and operation.
- Investigate and report the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs
- Explain the difference between dynamic stability and transient stability and investigate tools that could be used to analyse the power system for voltage and power angle stability performance
- Communicate effectively using power systems terminology, symbols and diagrams adhering to Australian Standards; and present design documents, solutions and calculations professionally
- Work collaboratively and autonomously to solve problems and record and communicate clearly and professionally the approach used to solve problems

### Graduate Attributes

- Communication
- Problem Solving

- Critical Thinking
- Team Work
- Ethical practice

### 3 Assignment 2 Individual Submission

#### Assessment Type

Practical and Written Assessment

#### Task Description

Students are expected to successfully complete the exercises specified in the unit website in Moodle. This assignment will contain 2 problems which will require the theoretical knowledge gained through your learning during the weeks 1-8 but will focus on load flow and stability analysis. In addition they may need the usage of the university edition of PSSE to carry out simulations on practical power systems. Marking scheme for each question will be published with the assignment and the marks for this assignment will contribute to 15% of the overall marks of this unit. Assignment questions will be published in unit Moodle site in due course. Please also refer to assessment criteria for more details.

#### Assessment Due Date

Week 12 Friday (5 Oct 2018) 11:45 pm AEST

Submit to the link in Week 11 of the unit website in Moodle as a WORD or PDF file.

#### Return Date to Students

Exam Week Monday (15 Oct 2018)

Feedback given through unit website in Moodle

#### Weighting

15%

#### Assessment Criteria

There are 60 marks assigned to this assignment which will consist of two questions, one on load flow analysis and one on transient stability. Marks will be assigned for accuracy of results, method used and the presentation of the results.

#### Referencing Style

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

#### Submission

Online

#### Submission Instructions

Submit as a pdf or Word document using the link provided on Moodle.

#### Learning Outcomes Assessed

- Discuss the difference between balanced and unbalanced operation of power systems
- Analyse, using appropriate software tools, power system performance in both balanced and unbalanced modes of operation
- Calculate fault currents and power flow in power systems and discuss the selection of appropriate protection schemes
- Understand the power flow problem along with the methods of solutions and appreciate the relevance of power flow studies in power system planning and operation.
- Investigate and report the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs
- Explain the difference between dynamic stability and transient stability and investigate tools that could be used to analyse the power system for voltage and power angle stability performance
- Communicate effectively using power systems terminology, symbols and diagrams adhering to Australian Standards; and present design documents, solutions and calculations professionally
- Work collaboratively and autonomously to solve problems and record and communicate clearly and professionally the approach used to solve problems

#### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

### 4 Workbook

#### Assessment Type

Written Assessment

**Task Description**

The **Workbook** provides a record or detailed diary of each individual student's study and learning activities throughout the unit and should include all individual work carried out. Preparation of a Workbook should be understood as good study technique. It also provides evidence that students have adequately studied the whole unit and achieved unit learning outcomes.

The Workbook can be handwritten or kept as a text file. Each entry should be dated, pages should be numbered and show your name or initials. It should be prepared week by week, not at the end of term. Show rough attempts at problems including failures and fixes, brainstorming, draft notes and developing ideas. In the Workbook students should record:

- study notes taken while studying textbooks and unit resources
- study notes taken during lectures and/or workshops
- personal study summaries of key concepts
- notes, sketches/ drawings or mind-maps
- planning and preparation for team/project tasks
- planning and preparation for online unit discussions
- workbook practice tasks you are asked to complete in the Unit Website
- initial attempts at set tutorial tasks
- initial attempts at assignment tasks
- preparation for class tests or exams.

**Assessment Due Date**

Review/Exam Week Friday (12 Oct 2018) 11:45 pm AEST

Submit to the link provided in unit website in Moodle as a WORD or PDF file.

**Return Date to Students**

Exam Week Friday (19 Oct 2018)

Feedback given through unit website in Moodle

**Weighting**

Pass/Fail

**Minimum mark or grade**

Pass

**Assessment Criteria**

The students are expected to compile their workbooks according to the guidelines given in the above description. Lecturer will go through the submitted workbooks and decide the amount of work that has been compiled by each student reflects sufficient time involvement of each student into the activities of this unit and also if each student has gained sufficient understanding of the content of this unit. At the same time he will focus on assessing whether the compiled activities in workbook reflects achieving all the learning outcomes of this unit. Those students who seem to have achieved these objectives will be given a pass grade for this assessment item while the others may have to complete some supplementary assessment items specified by the lecturer.

**Referencing Style**

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

**Submission**

Online

**Learning Outcomes Assessed**

- Discuss the difference between balanced and unbalanced operation of power systems
- Analyse, using appropriate software tools, power system performance in both balanced and unbalanced modes of operation
- Calculate fault currents and power flow in power systems and discuss the selection of appropriate protection schemes
- Understand the power flow problem along with the methods of solutions and appreciate the relevance of power flow studies in power system planning and operation.
- Investigate and report the process of updating and maintaining power network assets in order that they meet safety, reliability, availability, security, and quality requirements for both present and future society needs
- Explain the difference between dynamic stability and transient stability and investigate tools that could be used to analyse the power system for voltage and power angle stability performance
- Work collaboratively and autonomously to solve problems and record and communicate clearly and professionally the approach used to solve problems

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

## 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**

Closed Book.

**Materials**

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

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

## 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