ENEE13021 *Power System Analysis and Design*
Term 2 - 2023

Profile information current as at 29/04/2024 11:21 am

General Information

Overview

On the satisfactory completion of this unit, you will be able to work both individually and in-team to model, analyse and investigate design and operation options for electrical power networks to meet community service requirements. You will be able to analyse the steady-state performance of power systems, perform both symmetrical and unsymmetrical fault calculations, and conduct stability analysis of power systems. You will be using the power systems simulation software Power World Simulator or equivalent to simulate different scenarios in the power network. As such, you will articulate the process of updating and maintaining power network assets to meet most safety, reliability, and quality requirements for both present and future.

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 - 2023

- 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. **Project (applied)**
Weighting: 15%
2. **Online Quiz(zes)**
Weighting: 20%
3. **Written Assessment**
Weighting: 30%
4. **Online Test**
Weighting: 35%

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
Students appreciated the lecture content to be assisting the tutorial questions

Recommendation
Continue this good practice

Feedback from Self reflection/Student Feedback

Feedback
Poor quality of tutorial materials

Recommendation
Update the tutorial material

Feedback from Student Feedback

Feedback
The students expected project problems to be released earlier in the term

Recommendation
Release the problems for the project activity earlier in the term

Feedback from Self reflection

Feedback
Lack of good quality presentation slides for the lectures

Recommendation
Improve the slides by embedding some simulation results.

Unit Learning Outcomes

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

1. Calculate fault currents under different scenarios and discuss the selection of appropriate protection schemes
2. Solve power flow problems and appreciate the relevance of such studies in power system planning and operation
3. Analyse power system performance in both balanced and unbalanced modes of operation by using appropriate software packages
4. Investigate power angle stability for both single-machine and multimachine power systems
5. Work both collaboratively and autonomously to analyse and solve problems
6. Communicate effectively using power systems terminology, symbols and diagrams to present design documents, solutions, and calculations.

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

Intermediate 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1I 2I 3I 4I) 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1I 2I 3I 4I) 2.3 Application of systematic engineering synthesis and design processes. (LO: 3I 6I) 3.3 Creative, innovative and pro-active demeanour. (LO: 3I)

Advanced 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1A 2I 3I 4A) 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1A 2A 3A 4A 5A 6I) 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1I 2A 3A 4I 5A) 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1I 2A 3A 4I) 3.2 Effective oral and written communication in professional and lay domains. (LO: 5I 6A) 3.4 Professional use and management of information. (LO: 1I 2I 3A 4I 5I) 3.6 Effective team membership and team leadership. (LO: 3A 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 informationhttps://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

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Project (applied) - 15%	•		•		•	•
2 - Written Assessment - 30%		•	•		•	•
3 - Online Quiz(zes) - 20%				•		
4 - Online Test - 35%	•	•		•		•

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

ENEE13021

Prescribed

Power System Analysis and Design
Edition: 6th edn (2016)
Authors: J. Duncan Glover, Thomas Overbye, and Mulukutla Sarma
CENGAGE Learning
Boston , MA , USA
ISBN: 9781305636187
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
- The free version of PowerWorld Simulator - 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

Narottam Das Unit Coordinator
n.das@cqu.edu.au

Schedule

Week 1 - 10 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to power systems analysis	Chapters1 & 2 of Glover, Sarma, and Overbye	

Week 2 - 17 Jul 2023

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

Week 3 - 24 Jul 2023

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

Week 4 - 31 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic

Fault Analysis	Chapter 8&9 of Glover, Sarma, and Overbye	

Week 5 - 07 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Modelling of Power System Networks	Chapter 5 of Glover, Sarma, and Overbye	

Vacation Week - 14 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 21 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Load Flow Analysis	Chapter 6 of Glover, Sarma, and Overbye	**ASSIGNMENT** Due: Week 6 Friday (25 Aug 2023) 11:59 pm AEST

Week 7 - 28 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
Load Flow Algorithms	Chapter 6 of Glover, Sarma, and Overbye	

Week 8 - 04 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Load Flow Studies, Modelling and Voltage Control	Chapter 6 of Glover, Sarma, and Overbye	

Week 9 - 11 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Transient Stability	Chapter 11 of Glover, Sarma, and Overbye	

Week 10 - 18 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Multi-machine systems, small-signal stability	Chapter 11 of Glover, Sarma, and Overbye	

Week 11 - 25 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
Stability controls, modelling of renewables	Chapters 11 and 12 of Glover, Sarma, and Overbye	

Week 12 - 02 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
Revision		**Online Test** Due: Week 12 Monday (2 Oct 2023) 11:59 pm AEST **PROJECT** Due: Week 12 Friday (6 Oct 2023) 11:59 pm AEST

Review/Exam Week - 09 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
		End of Term Online Test may be scheduled in Week 13 (REVIEW/EXAM WEEK) or Week 14 (EXAM WEEK)

Exam Week - 16 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 ASSIGNMENT

Assessment Type
Project (applied)

Task Description

- This assignment may contain 3-4 problems that will require the theoretical knowledge gained through your learning during the first five weeks.
- The topics covered in this assignment 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.
- Assignment questions will be available in the unit Moodle site in due course. Please also refer to the assessment criteria for more details.

Assessment Due Date
Week 6 Friday (25 Aug 2023) 11:59 pm AEST
Submit to the link in the Assessment tile of the unit website in Moodle as a PDF file.

Return Date to Students
Week 8 Friday (8 Sept 2023)
Feedback sheet will be provided through unit website in Moodle.

Weighting
15%

Minimum mark or grade
Student must score 50% of the allocated marks.

Assessment Criteria
A total of 100 marks is allocated to this assignment which will be scaled down to 15% of the unit total.
Students are assessed on the accuracy of calculated results, the correctness of the method used and the presentation.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit to the link in the Assessment tile of the unit website in Moodle as a PDF file.

Learning Outcomes Assessed

- Calculate fault currents under different scenarios and discuss the selection of appropriate protection schemes
- Analyse power system performance in both balanced and unbalanced modes of operation by using appropriate software packages
- Work both collaboratively and autonomously to analyse and solve problems
- Communicate effectively using power systems terminology, symbols and diagrams to present design documents, solutions, and calculations.

2 Online Test

Assessment Type
Online Quiz(zes)

Task Description
This is an online test covering week 6 up to week 9 lectures.

Number of Quizzes

Frequency of Quizzes

Assessment Due Date
Week 12 Monday (2 Oct 2023) 11:59 pm AEST
Lecture time

Return Date to Students
Exam Week Monday (16 Oct 2023)
Feedback will be given through unit website in Moodle.

Weighting
20%

Minimum mark or grade
Students must score 50% of allocated marks.

Assessment Criteria

- A total of 100 marks is allocated to this test.
- Students are assessed on the accuracy of calculated results and the correctness of the method used.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
The test link is available in the Assessment tile of the unit website in Moodle.

Learning Outcomes Assessed

- Investigate power angle stability for both single-machine and multimachine power systems

3 PROJECT

Assessment Type
Written Assessment

Task Description

- This assessment item will address most of this unit's learning outcomes and contribute to 30% of the final mark.
- Students will form teams of no more than three members for this assessment.
- Each team will be assigned a power system modelling and simulation exercise related to power systems stability, fault calculations, load flow etc.
- The project will be based on the free edition of PowerWorld Simulator. In this unit, you will achieve a basic competency in the use of PowerWorld Simulator. Video tutorials on the use of this software and instructions on installation are available on Moodle

Assessment Due Date
Week 12 Friday (6 Oct 2023) 11:59 pm AEST
Submit the report as a PDF file to the link in the Assessment tile of the unit website in Moodle together with relevant simulation files.

Return Date to Students
Exam Week Friday (20 Oct 2023)
Feedback will be given through unit website in Moodle.

Weighting
30%

Minimum mark or grade
Students must score 50% of the allocated marks

Assessment Criteria

- Correct procedure and steps towards constructing necessary models using modelling and simulation exercise: 60%
- Correct answers and units: 30%
- Professional presentation and layout of the report: 10%
- More details on mark break down is available in Moodle.

Referencing Style

- Harvard (author-date)

Submission
Online Group

Submission Instructions
Submit the report as a PDF file to the link in the Assessment tile of the unit website in Moodle together with relevant simulation files.

Learning Outcomes Assessed

- Solve power flow problems and appreciate the relevance of such studies in power system planning and operation
- Analyse power system performance in both balanced and unbalanced modes of operation by using appropriate software packages
- Work both collaboratively and autonomously to analyse and solve problems
- Communicate effectively using power systems terminology, symbols and diagrams to present design documents, solutions, and calculations.

4 End of Term Online Test

Assessment Type
Online Test

Task Description
This online test may cover all topics from weeks 1 to 12 and may consist of a mix 4-6 numerical as well as descriptive answer questions.
This online test will be held during the University exam period (Week 13 or 14). The exact date and time will be confirmed by the end of week 9. This online test has a duration of 3 hrs. You will be provided with an additional 30 minutes to read the paper and to scan and upload the answer scripts. The Moodle submission link will become inactive 3.5 hrs after the start time. You are encouraged to sit the test from a location with a good Internet connection and where you have access to a scanner. If you are unable to find a scanner, you can use your mobile phone to scan and upload the answer scripts. Please find a list of Camera Scan apps below that is suitable for this.
1. Adobe Scan (DC) https://adobescan.app.link/d/1n1NntFHTkb
2. Microsoft Lens https://apps.apple.com/au/app/microsoft-lens-pdf-scanner/id975925059
3. SwiftScan https://swiftscan.app/en/index.html
4. CamScanner https://www.camscanner.com/
5. ClearScan https://clearscanapp.com/

Assessment Due Date

Submitted through unit Moodle site as a PDF file.

Return Date to Students

Weighting
35%

Minimum mark or grade
Students must score 50% of the allocated marks

Assessment Criteria
No Assessment Criteria

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submitted through unit Moodle site as a PDF file.

Learning Outcomes Assessed

- Calculate fault currents under different scenarios and discuss the selection of appropriate protection schemes
- Solve power flow problems and appreciate the relevance of such studies in power system planning and operation
- Investigate power angle stability for both single-machine and multimachine power systems
- Communicate effectively using power systems terminology, symbols and diagrams to present design documents, solutions, and calculations.

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