

#### Profile information current as at 10/05/2024 07:55 pm

All details in this unit profile for ENEE14005 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 work in a team to analyse and design electrical power and control systems by applying PSSE or equivalent industry software. You will also focus on renewables, promoting the United Nations Sustainable Development Goal 7: Affordable and Clean Energy. On satisfactory completion, you will be able to investigate solutions for contemporary engineering problems, plan and control project work in a team environment, research current practice in this discipline, execute evidence-based decision-making, check and evaluate the validity of information, and prepare professional documentation for a project.

# Details

Career Level: Undergraduate Unit Level: Level 4 Credit Points: 12 Student Contribution Band: 8 Fraction of Full-Time Student Load: 0.25

# Pre-requisites or Co-requisites

Prerequisites: ENEE13021 Power System Analysis and Design AND ENEE13019 Control Systems Analysis and Design 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 <u>Assessment Policy and Procedure (Higher Education Coursework)</u>.

# Offerings For Term 1 - 2024

- 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).

# 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 12-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 25 hours of study per week, making a total of 300 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. Online Test Weighting: 20% 2. Online Test Weighting: 20% 3. Portfolio Weighting: 60%

# 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 <u>University's Grades and Results Policy</u> 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 <u>CQUniversity Policy site</u>.

# **Previous Student Feedback**

# Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

# Feedback from Unit Evaluation

#### Feedback

Students appreciated how technically informative this unit is for future job requirements.

# Recommendation

This good practice should be maintained.

# Feedback from In Class Feedback

#### Feedback

Students appreciated the use of commercial power system software in this unit.

#### Recommendation

This good practice should be maintained.

# Feedback from Unit Evaluation

#### Feedback

Students requested introducing a summary for adding each sub-model of synchronous generator in lecture notes.

#### Recommendation

Effects of each model, e.g., exciter, and governor on power systems should be summarised in future lectures.

# Feedback from Unit Coordinator

### Feedback

Questions of two online quizzes can be further revised to assess students' knowledge about sub-models of synchronous generators.

#### Recommendation

Quiz questions should be added or some existing questions should be modified to assess students knowledge about submodels of synchronous generators.

# **Unit Learning Outcomes**

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

- 1. Perform advanced load flow, stability, and power quality calculations using commercial software
- 2. Tune power system controllers to obtain the desired performance
- 3. Design power transmission infrastructure and renewable generation and storage systems for a reliable power supply
- 4. Apply the Australian Standards, National Electricity rules and general principles of sustainable development
- 5. Present design outcomes professionally as a report, short conference paper and presentation
- 6. Communicate, work and learn, both individually and in teams, in a professional manner.

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

1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 11 2I 3I 4I)

1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 11 21 31 41)

2.2 Fluent application of engineering techniques, tools, and resources. (LO: 11 2I 3I 4I)

3.3 Creative, innovative, and proactive demeanor. (LO: 5I 6I)

#### Advanced

1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1A 2A 3A 4I)

1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1A 2A 3A 4A)

1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 11 2I 3I 4A)

1.6 Understanding of the scope, principles, norms, accountabilities, and bounds of sustainable engineering practice in the specific discipline. (LO: 4A)

2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 11 2I 3I 4A)

2.3 Application of systematic engineering synthesis and design processes. (LO: 3A 4A)

2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 4A)

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

3.4 Professional use and management of information. (LO: 3A 4A)

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

3.6 Effective team membership and team leadership. (LO: 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 Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course-level mapping information <a href="https://moodle.cqu.edu.au/course/view.php?id=1511">https://moodle.cqu.edu.au/course/view.php?id=1511</a>

# Alignment of Learning Outcomes, Assessment and Graduate Attributes

N/A<br/>LevelIntroductoryIntermediateGraduateProfessionalAdvancedLevelLevelLevelLevelLevelLevelLevel

# Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Online Test - 20%	•					
2 - Online Test - 20%		•				
3 - Portfolio - 60%	٠	٠	٠	٠	•	•

# 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

ENEE14005

#### Supplementary

#### **Control Systems Engineering**

Edition: 8th edn (2019) Authors: Norman S. Nise Wiley Hoboken , NJ , USA ISBN: 9781119561880 Binding: Paperback ENEE14005

# Supplementary

#### **Power System Analysis and Design**

7th SI Edition (2022) Authors: J. Duncan Glover, Mulukutla Sarma, Thomas Overbye, Adam B. Birchfield Cengage Learning Boston , MA , USA ISBN: 9780357676196 Binding: Paperback

# **IT Resources**

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

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- MATLAB and Simulink Suite Software (For students without access to a CQUni campus), see the Textbook and Resources section for more information
- PSS/E Xplore Link for download supplied on Moodle and in project specification

# **Referencing Style**

All submissions for this unit must use the referencing style: <u>Harvard (author-date)</u> For further information, see the Assessment Tasks.

# **Teaching Contacts**

Kianoush Emami Unit Coordinator k.emami@cqu.edu.au

# Schedule

Week 1 - 04 Mar 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Review of Load Flow and fault calculations, models of power system components review of PSS/E	Chapters 6-9, of Glover, Sarma, and Overbye	
Week 2 - 11 Mar 2024		
Module/Topic	Chapter	Events and Submissions/Topic

Power system dynamics, classical machine model, swing equation, critical clearing time, detailed machine models,, simulation using PSSE	Chapter 11 of Glover, Sarma and Overbye	
Week 3 - 18 Mar 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Review of Control Theory, transfer functions, Linear State space models, exciters and governors, modelling of exciters and governors, in PSSE, AEMO Specifications for damping	Refer to ENEE13019 notes on transfer functions and linear modelling, Nise chapters 2,3 , Glover et al chapters 11 and 12 and PSSE Models document	<b>Online test 1</b> Due: Week 3 Friday (22 Mar 2024) 11:45 pm AEST
Week 4 - 25 Mar 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Review of Compensator design, modelling of voltage response of synchronous machine, exciter tuning, effect of fast exciters on dynamic stability	Refer to ENEE13019 notes on root locus design.and time domain response. See Nise chapters 4,8 and 9	
Week 5 - 01 Apr 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Modelling of Solar PV and Wind, effect on system performance, AS4777 Effects of low system inertia, storage options, low voltage ride through issues	PSS/E models document and AS4777	
Vacation Week - 08 Apr 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Week 6 - 15 Apr 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Power System Quality, harmonics, sources effects and modelling	AS/NZS 61000.3.2:2003	
Week 7 - 22 Apr 2024		
Module/Topic	Chapter	Events and Submissions/Topic Project Progress Report (15%)
Other aspects of power quality - flicker and negative sequence, estimation, effect of and on renewable generation	National Electricity Rules (NER) chapter 5 AS/NZS61000.3.7:2001	of Portfolio) Due: Week 7 Friday (26 April 2024) 11:55 pm AEST
Week 8 - 29 Apr 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>
Introduction to the NER clauses for connection, NER clauses S5.2.5.1 - S5.2.5.6	NER chapter 5	
Week 9 - 06 May 2024		
Module/Topic	Chapter	Events and Submissions/Topic
Introduction to the NER clauses for connection, NER clauses S5.2.5.7 - S5.2.5.14 and S5.2.6.1, S5.2.6.2		
Week 10 - 13 May 2024		
Module/Topic	Chapter	<b>Events and Submissions/Topic</b>

Introduction to the Australian electricity market, market impact of Online Test 2 Due: Week 10 Friday renewables, Sustainability triple (17 May 2024) 11:45 pm AEST bottom line Week 11 - 20 May 2024 Module/Topic Chapter **Events and Submissions/Topic** Review of unit and portfolio requeirements Week 12 - 27 May 2024 Module/Topic Chapter **Events and Submissions/Topic** Question and Answer session regarding project Review/Exam Week - 03 Jun 2024 Module/Topic Chapter **Events and Submissions/Topic Portfolio-Updated Progress** Report(15%), Presentation(15%) and Final Report(30%) Due: Review/Exam Week Friday (7 June 2024) 11:55 pm AEST Exam Week - 10 Jun 2024 Chapter **Events and Submissions/Topic** Module/Topic

# Assessment Tasks

# 1 Online test 1

Assessment Type Online Test

# **Task Description**

Questions covering load flow analysis, reactive compensation, transmission line modelling, basic power system stability including the swing equation and critical clearing times, operation of PSS/E

# Assessment Due Date

Week 3 Friday (22 Mar 2024) 11:45 pm AEST

# **Return Date to Students**

Feedback will be accessible immediately after the quiz is completed.

# Weighting

20%

# Minimum mark or grade

To pass this assessment, students must achieve a minimum score of 50% of the maximum grade.

Assessment Criteria Accuracy and correctness of answers

# **Referencing Style**

• Harvard (author-date)

# Submission

Online

# Learning Outcomes Assessed

• Perform advanced load flow, stability, and power quality calculations using commercial software

# 2 Online Test 2

# Assessment Type

Online Test

# **Task Description**

Questions on modelling of detailed synchronous machines, exciters, power system stabilisers, and renewable generation, use of PSS/E in modelling the aforementioned, power system quality

#### Assessment Due Date

Week 10 Friday (17 May 2024) 11:45 pm AEST

#### **Return Date to Students**

Feedback will be accessible immediately after the quiz is completed.

# Weighting 20%

20%

#### Minimum mark or grade

To pass this assessment, students must achieve a minimum score of 50% of the maximum grade.

#### Assessment Criteria

Accuracy and correctness of answers

#### **Referencing Style**

• Harvard (author-date)

#### Submission Online

Unine

### Learning Outcomes Assessed

• Tune power system controllers to obtain the desired performance

# 3 Portfolio-Updated Progress Report(15%), Presentation(15%) and Final Report(30%)

# Assessment Type

Portfolio

#### **Task Description**

Portfolio consists of a progress report due at 11:55 pm AEST on the Friday of week 7, and a final report and recorded group presentation all due at 11:55 pm AEST on the Friday of week 13. Grading criteria for these tasks will be provided on Moodle. These are group submissions however the marks will be individualised based on self and peer assessment of your contribution in the case of the reports and individual performance in the case of the presentation. The self and peer assessment is done through the university Self and Peer assessment (SPA) system. Details of this will be given on Moodle.

Weightings of these component in respect of the term totals are as follows Progress report : 15% Presentation : 15%

Final Report: 30% including 5% from self and peer assessment making a total of 60% for the entire portfolio.

# Assessment Due Date

Review/Exam Week Friday (7 June 2024) 11:55 pm AEST Progress Report due 11:55 PM 26 April 2024 (week 7), Final Report and recorded presentation due 11:55 pm 7 June 2024 (week 13)

# **Return Date to Students**

Within two weeks of due date

Weighting

60%

**Minimum mark or grade** To pass this assessment, students must achieve a minimum score of 50% of the maximum grade.

Assessment Criteria Progress Report

- 1. Technical accuracy in
  - (a) load flow based analysis and design
  - (b) detailed machine modelling
  - (c) modelling of exciters and PSS's and Critical clearing time calculations
  - (d) tuning of exciters
- 2. statement of issues and evidence of intra and inter team communication, team charter and self and peer assessments
- 3. plan for future work including Gantt chart
- 4. succinctness, correct grammar, spelling formatting etc

# **Final Report**

1. Technical accuracy in the topics mentioned under progress report plus

- (a) Estimation of harmonic issues that may arise from installation of solar plant
- (b) Estimation of other power quality issues such as flicker and phase unbalance
- (c) Sizing of storage.
- (d) modelling of renewables in PSS/E
- (e) assessment of impact of solar on system stability and discussion of mitigation measures
- (f) sustainability report across triple bottom line
- (g) assessment of NER clauses
- (h) impact on the electricity market
- (i) addressing Progress Report feedback in a separate section

2. statement of issues and evidence of intra and inter team communication, team charter and modification thereof where necessary as well as self and peer assessments

- 3. Risk assessment
- 4. succinctness, correct grammar, spelling formatting etc
- 5. recommendations

#### Presentation

1. Technical aspects with respect to those mentioned under final report including sustainability and risk assessment and recommendations

- 2. Clarity and succinctness of slides
- 3. Presentation being ten minutes or less
- 4. Participation of all members of team and individual performance

# **Referencing Style**

• <u>Harvard (author-date)</u>

# Submission

**Online Group** 

#### **Submission Instructions**

Submit via links provided on Moodle

#### Learning Outcomes Assessed

- Perform advanced load flow, stability, and power quality calculations using commercial software
- Tune power system controllers to obtain the desired performance
- Design power transmission infrastructure and renewable generation and storage systems for a reliable power supply
- Apply the Australian Standards, National Electricity rules and general principles of sustainable development
- Present design outcomes professionally as a report, short conference paper and presentation
- Communicate, work and learn, both individually and in teams, in a professional manner.

# Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

#### What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

#### Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

#### Where can I get assistance?

For academic advice and guidance, the <u>Academic Learning Centre (ALC)</u> can support you in becoming confident in completing assessments with integrity and of high standard.

#### What can you do to act with integrity?





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