ELEC8201

Power and Renewable Energy Systems Analysis

Session 1, In person-scheduled-weekday, North Ryde 2025

School of Engineering

Contents

General Information

Unit convenor and teaching staff
Convenor/Lecturer
Foad Taghizadeh
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Room #124, Level 1, 44 WTR
Wednesday 4:00 PM - 5:00 PM, by appointment only

Credit points
10

Prerequisites
50 CP at 6000 level or above including ELEC6202

Corequisites

Co-badged status
ELCT4004

Unit description
This unit equips senior electrical engineering students with essential mathematical techniques for analysing power systems, focusing on steady-state and transient operations involving large-scale distributed generation, energy storage, and renewable energy systems. The unit covers classical and modern power systems methods, enabling students to assess system performance with renewable generators, emerging loads like electric vehicles (EVs), and storage solutions. Topics include complex power, three-phase systems, network matrix techniques, power flow analysis, fault calculations (symmetrical and unsymmetrical), power system stability, control with variable sources, voltage stability in smart grids, and the broader impact of power system analysis in smart grids, renewable energy, transmission, distribution, and key components like insulators and substations.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals (UNSDGs) Affordable and Clean Energy; Industry, Innovation and Infrastructure

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

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

ULO1: Identify the operational characteristics of different transmission lines for electrical power networks.

ULO2: Calculate the steady state and dynamic stability of power systems with the application of network matrix and power flow analysis.

ULO3: Analyse the stability of power systems with symmetrical and unsymmetrical faults.

ULO4: Demonstrate knowledge and understanding of power system protection principles, transmission and distribution systems, insulators and substations.

ULO5: Synthesise and apply advanced knowledge and skills related to the integration of renewable energy resources into existing power grids, including the challenges, solutions, and regulatory aspects.

ULO6: Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communications.

Assessment Tasks

Name	Weighting	Hurdle	Due
Pre- Class Quiz	10%	No	Weeks 2-7
Class Quiz	20%	No	Week 8
Practical	20%	No	Weeks 2-7
Project	50%	No	Weeks 13 & 14

Pre- Class Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Weeks 2-7**
Weighting: **10%**

Students are expected to go through the iLearn content, understand the theory and attempt the quiz

On successful completion you will be able to:

- Identify the operational characteristics of different transmission lines for electrical power networks.
- Calculate the steady state and dynamic stability of power systems with the application of network matrix and power flow analysis.
- Analyse the stability of power systems with symmetrical and unsymmetrical faults.

Class Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 8 hours
Due: **Week 8**
Weighting: **20%**

The quiz will assess both factual knowledge and problem solving.

On successful completion you will be able to:

- Identify the operational characteristics of different transmission lines for electrical power networks.
- Calculate the steady state and dynamic stability of power systems with the application of network matrix and power flow analysis.
- Demonstrate knowledge and understanding of power system protection principles, transmission and distribution systems, insulators and substations.
- Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communications.

Practical

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 12 hours
Due: **Weeks 2-7**
Weighting: **20%**

Laboratory sessions and submission of lab report by the end of each session. Students will be assessed based on ability to perform analysis, modeling and implementation of the practical experiment as well as software tools

On successful completion you will be able to:

- Identify the operational characteristics of different transmission lines for electrical power networks.
- Calculate the steady state and dynamic stability of power systems with the application of network matrix and power flow analysis.
- Demonstrate knowledge and understanding of power system protection principles, transmission and distribution systems, insulators and substations.
- Synthesise and apply advanced knowledge and skills related to the integration of renewable energy resources into existing power grids, including the challenges, solutions, and regulatory aspects.
- Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communications.

Project

Assessment Type [1]: Project
Indicative Time on Task [2]: 20 hours
Due: **Weeks 13 & 14**
Weighting: **50%**

This is the major assessment of this Unit. It will consist of Project report, Oral presentation and demonstration of the project

On successful completion you will be able to:

- Identify the operational characteristics of different transmission lines for electrical power networks.
- Calculate the steady state and dynamic stability of power systems with the application of network matrix and power flow analysis.
- Demonstrate knowledge and understanding of power system protection principles, transmission and distribution systems, insulators and substations.
- Synthesise and apply advanced knowledge and skills related to the integration of renewable energy resources into existing power grids, including the challenges, solutions, and regulatory aspects.

- Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communications.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

UNIT WEBSITE

- The iLearn website for this unit can be found at: https://ilearn.mq.edu.au/login/.
    - *Note! All information and communications relevant to this Unit will be via the iLearn website.*

TEXTBOOK

- Power System Analysis and Design, Sixth Edition, by J. Duncan Glover, M. S. Sarma and T. J. Overbye (Digital or Print), (Digital version recommended).
- Electric Power Transmission and Distribution, 1st edition, by Sivanagaraju, S; Satyanarayana, S (Digital or Print), (Digital version recommended)
    - *Note! Links will be provided to specific sections of the Digital version in iLearn for each Lectorial.*
    - *Remark: All students are expected to have access to this textbook.*
    - Support Website: https://au.cengage.com/, https://learning.oreilly.com/

LECTORIALS

- Lectorials take place twice a week (Weeks 1-7) according to the Unit schedule.
    - *Note! Students are strongly encouraged to participate in at least one of the two weekly Lectorials.*
- Lectorials are a combination of traditional lecture and tutorial teaching modes and are designed to improve student engagement.
- The Lectorials are organised in a flipped classroom fashion.
- Prior to Lectorials
    - links to E-Text specific sections, brief videos and/or lecture notes are posted in

iLearn each week.
    - students are expected to read these E-Text sections, try to solve any given examples, and watch any videos and/or read any posted notes prior to attending the Lectorials.
    - 'pre-class' mini quizzes to assess the basic understanding of fundamental principles in power system analysis and design.
- During Lectorials
    - brief discussion sessions on fundamental principles.
    - plenty of practical examples.
    - interactive problem solving involving students.

LABORATORIES

- Practical activities start from Week 2 and take place once a week (Weeks 2-7) according to the Unit schedule.
    - *Note! Students must enrol in one of the available weekly Lab sessions.*
- Interactive Practicals use FESTO equipment, PowerWorld Simulator software platform and DigSilent Power Factory software platform to assist with the Lab experiments.

On-campus activities commence in Week 2. Students should contact the Unit convenor as soon as possible if they are unable to get back to campus in time.

PROJECTS

- Project activities take place from Week 8 to Week 13 according to the Unit schedule.
- The team Project is the core component of this Unit. The Projects cover practical aspects of power system networks.
- Students are required to form teams and work on the given project topic.
    - *All Project activities are performed in teams;*

TECHNOLOGY

- The laboratory work will rely on the use of FESTO equipment, PowerWorld Simulator software platform and DigSilent Power Factory software platform.
    - The software platform are available through Web browser and/or Faculty Lab PCs.
    - PowerWorld Simulator can be downloaded for free from PowerWorld website and/or can be used on dedicated Lab PCs.
- The Project work will rely on the use of DigSilent Power Factory software platform.
    - The software can be used on dedicated Lab PCs.

COMMUNICATIONS

- Students are reminded the University will communicate all official notices by email to official MQ student's account. Students should read their @student.mq.edu.au email regularly or forward it to an account they check regularly.
- All announcements and other communications regarding this Unit will be via iLearn platform.

WEB RESOURCES

- **PowerWorld Simulator support:**
  - https://www.powerworld.com/
- **DigSilent Power Factory support:**
  - https://www.digsilent.de/en/

Unit Schedule

For details, please refer to the Unit Schedule on the iLearn webpage.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit connect.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault

- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.4 Discernment of knowledge development and research directions	ULO1, ULO4, ULO5, ULO6
	1.5 Knowledge of engineering design practice	ULO3, ULO4, ULO5, ULO6
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO2, ULO3, ULO4, ULO5, ULO6
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, ULO3, ULO6
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO6
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	ULO6

EA Competency Standard		Unit Learning Outcomes
	3.2 Effective oral and written communication in professional and lay domains.	ULO6
	3.3 Creative, innovative and pro-active demeanour.	ULO1, ULO2, ULO3, ULO4, ULO6
	3.4 Professional use and management of information.	
	3.5 Orderly management of self, and professional conduct.	ULO6
	3.6 Effective team membership and team leadership	ULO6

Unit information based on version 2025.03 of the Handbook