ELCT4004

Power Systems Analysis

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Engineering

Contents

General Information

Unit convenor and teaching staff
Convenor/Lecturer
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Contact via Email
1st floor, Desk 23, 44 Waterloo Rd Macquarie Park
Thursday 2:00 PM - 4:00 PM

Credit points
10

Prerequisites
(ELCT2005 or ELEC295) and (ELCT3006 or ELEC396)

Corequisites

Co-badged status

Unit description
The course will provide students with essential knowledge in the mathematical techniques to analyse power systems during steady-state and transient operations of power systems with large-scale distributed generation and energy storage systems. It will provide strong foundation in classical methods and modern techniques in power systems for senior level electrical engineering students for analysing system's performance with renewable generators, new loads (EV) and storage. Topics covered comprise: review of the basic concepts used in power system analysis: phasors, complex power, three phase systems and per-unit; application of network matrices techniques and power flow analysis to study the steady-state and dynamic behaviour of power systems with distributed energy resources; power system fault calculations including: symmetrical components, symmetrical faults, and unsymmetrical faults ; power system stability and control in the presence of variable sources, loads and storage; An overview of power system protection principles; voltage stability in smart grids, the impact of power system analysis in the context of smart grid, transmission and distribution systems, insulators and substation.

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 knowlege and understanding of power system protection principles, transmission and distribution systems, insulators and substations.
ULO5: Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communications.

General Assessment Information

Grading and Passing Requirement for Unit

- In order to pass this Unit a student must obtain a mark of 50 or more for the Unit (i.e. obtain a passing grade P, CR, D, or HD).
- For further details about grading, please refer below in the policies and procedures section.
- If you receive special consideration for the oral presentation and demonstration of the Project, a supplementary conventional exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a special consideration application for the oral presentation and demonstration of the Project you are declaring yourself available for a conventional exam during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to applying. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Hurdle Requirements

- Students must attend and participate in at least **5 of the 6 weekly PC Labs** (Weeks 2-7) to pass this unit.
- Students must attend and participate in at least **5 of the 6 weekly Project Labs** (Weeks

8-13) to pass this unit.

Late Submissions and Re-submissions

- Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.
- All other assessments must be submitted by 5:00 pm (Sydney Time) on their due date.
- Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.
- Assessments not submitted by the due date will receive a mark in accordance with the late submission policy as follows:
    - A 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given. For example, an assessment worth 20% is due 5 pm on 1 January. Student A submits the assessment at 1 pm, 3 January. The assessment received a mark of 15/20. A 20% deduction is then applied to the mark of 15, resulting in the loss of three (3) marks. Student A is then awarded a final mark of 12/20.
- Re-submissions of work are not allowed.

Students are reminded of the University policies regarding assessment, academic honesty and disruption to studies.

Requests for extension on assessable work are to be made to the Unit Coordinator but will only be considered in the event of illness or misadventure.

Assessment Tasks

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

Pre- Class Quiz (Lectorial)

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 online quiz every week prior to in class activities (lectorials).

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.

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 reprot by the end of each session. Students will be assessed based on thier attendance, participation, performance, and their ability to perform analysis, modeling and implementation of the practical experiment as well as software tools . There is no laboratory session in week 1. Students need to record all the laboratory results (and printouts) and submit a report for each experiment.

Students need to attend 5 out of 6 lab sessions in order to pass the unit.

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.
- Demonstrate knowlege and understanding of power system protection principles, transmission and distribution systems, insulators and substations.

Class Quiz (Lectorials)

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

A quiz is scheduled right after the midsemester break. 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.
- Analyse the stability of power systems with symmetrical and unsymmetrical faults.
- Demonstrate knowlege and understanding of power system protection principles, transmission and distribution systems, insulators and substations.

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 3 individual assessments and 1 team assessment, as follows:

- Individual assessments:
    - Oral presentation and demonstration of the project;
    - Peer assessment regarding the actual contribution of each team member;
    - Evaluation of project logbook of each team member.
- Team assessment:
    - Project report to be submitted in iLearn by each team.

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.
- Demonstrate knowlege 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.

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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

- PC Lab 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 PC Labs use PowerWorld Simulator, LVSIM-EMS 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 once a week (Weeks 8-13) according to the Unit schedule.
  - *Note! Teams must enrol in one of the available weekly Project sessions.*
- 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 choose one project topic from a given list of

projects.

- *Note! When forming teams, students should agree in which weekly Project session they want to enrol.*
- *All Project activities are performed in teams;*

TECHNOLOGY

- The laboratory work will rely on the use of PowerWorld Simulator, LVSIM-EMS 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

- **LVSIM-EMS**
  - https://lvsim.labvolt.com/
- **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 ELCT4004 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 ask.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/

The Writing Centre

The Writing Centre 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 Enquiries

Got a question? Ask us via AskMQ, 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
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1, ULO2, ULO3, ULO4, ULO5
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, ULO3, ULO4, ULO5
	1.4 Discernment of knowledge development and research directions	ULO1, ULO4, ULO5

EA Competency Standard		Unit Learning Outcomes
	1.5 Knowledge of engineering design practice	ULO2, ULO3, ULO4, ULO5
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO1, ULO2, ULO3, ULO4
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO2, ULO3, ULO4, ULO5
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO3, ULO4, ULO5
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, ULO5
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO5
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	ULO5
	3.2 Effective oral and written communication in professional and lay domains.	ULO5
	3.3 Creative, innovative and pro-active demeanour.	ULO1, ULO2, ULO3, ULO4, ULO5
	3.4 Professional use and management of information.	ULO1
	3.5 Orderly management of self, and professional conduct.	ULO5
	3.6 Effective team membership and team leadership	ULO5