ELCT4004

Power Systems Analysis

Session 1, Weekday attendance, North Ryde 2021

School of Engineering

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Notice

As part of Phase 3 of our return to campus plan, most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to timetable viewer. To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

General Information

Unit convenor and teaching staff
Convenor/Lecturer
Seyedfoad Taghizadeh
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Contact via 9850 2315
1st floor, Desk 23, 44 Waterloo Rd Macquarie Park
Thursday 2:00 PM - 4:00 PM

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1st floor, Room 119, 44 Waterloo Rd Macquarie Park

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

- Late report submissions will attract a penalty of <10/100, 10%> marks per day. Extenuating circumstances will be considered upon lodgement of an application for special consideration.
- 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
Class Quiz (Lectorials)	20%	No	Week 8
Practical	20%	No	Weeks 2-7
Pre- Class Quiz (Lectorial)	10%	No	Weeks 2-7
Project	50%	No	Weeks 13 & 14

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.

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.

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.

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.

[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 1-8) 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 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.

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
- Grade Appeal Policy
- Complaint Management 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

Student Support

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

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

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.

Changes from Previous Offering

This Unit has been revised compared to previous offering as follows:

- The traditional weekly Lectures and Tutorials have been combined into two weekly Lectorials
- All Lectorials and PC Labs take place in the first part of the semester (Weeks 1-8).
    - *Note! Assessment tasks for Lectorials and PC Labs will take place during and/or at the end of this time interval.*
- The final exam has been replaced by Project assessment
- All Project activities take place in the second part of the semester (Weeks 8-13).
    - *Note! Assessment tasks for Projects will take place at the end of this time interval.*

Unit information based on version 2021.04 of the Handbook