ELEC494

Electrical Energy Networks

S1 Day 2019

School of Engineering

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
ELEC324 and ELEC395 and 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 low-inertia renewable generators, new loads (EV) and storage.

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:

Model and analyse major types of components including renewable generators and battery energy storage systems used in distributed power systems

Calculate the steady state and transient responses of power systems and investigate the impact of renewable energy integration

Analyse the stability of power systems with symmetrical and unsymmetrical faults and design controllers for reliable operations

Determine the economic dispatch in power systems and understand Australian power market mechanism

Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results

Write a range of technical reports for professional engineering projects which include diverse contexts

General Assessment Information

Conditions required to pass the unit**: e. g.: 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/ HD). For further details about grading, please refer below in the policies and procedures section.

Late submissions and Resubmissions

Late submissions will attract a penalty of 10/100, 10% marks per day. Extenuating circumstances will be considered upon lodgment of a formal notice of disruption of studies.

Resubmissions of work are not allowed.

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial	20%	No	At the end of tutorial session
Laboratory	20%	No	At the end of lab session
Project	20%	No	Week 12
Final Exam	40%	No	During central exam period

Tutorial

Due: **At the end of tutorial session**
Weighting: **20%**

There are ten tutorial sessions throughout the semester. **There is no tutorial session in week 1**. Each tutorial will have several problem solving questions. Few questions will be solved interactively by the lecturer in the scheduled tutorial class. You will be asked to solve remaining questions either individually or as a group. You will submit the solution document to the lecturer at the end of the class. The problems will be designed to help you enhance your understanding of the topics covered in lectures and provide you with an opportunity to apply the knowledge they have learned from lectures to solving practical problems. In the tutorial class you will: (i) analyse tper unit conversion, power flow, faults on power networks (ii) identify, formulate and provide solutions to complex problems related to power transmission and distribution networks.

Criteria & Marking: (i) calculation accuracy; (ii) communications of assumptions; (iii) methodology and (iv) completeness. Detail of the marking criteria will also be notified on iLearn.

On successful completion you will be able to:

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- Determine the economic dispatch in power systems and understand Australian power market mechanism

Laboratory

Due: **At the end of lab session**
Weighting: **20%**

There are ten laboratory sessions throughout the session. **There is no laboratory session in week 1**. The laboratories are strongly recommends; attendance, participation, and completion of all the laboratory activities are required in order to satisfactorily complete the course. You are required to record all the laboratory results (and printouts) and submit a report for each experiment. Completion of a laboratory activity is determined by having the laboratory tutor sign off the student log book, nominally at the end of the laboratory class.

On successful completion you will be able to:

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- Write a range of technical reports for professional engineering projects which include diverse contexts

Project

Due: **Week 12**
Weighting: **20%**

Task Description:

You will do a project in a group but you will submit your report, journal, workbook and final oral presentation individually. You will design a project and pose a question/problem hypothesis. You will select a project from one of the following areas: (i) Modelling of power system devices using commercial software packages (ii) Load flow studies (iii) Fault analysis (iv) Power system planning (v) Power system stability (vi) Power system protection (vii) Microgrid with renewable generation Professional software packages, for example, PSSE, PSCAD and PowerWorld which are used by the Australian power industry are available to conduct the project. Industry standard hardware for example, machines, transmission lines, loads, circuit breakers and renewable generators are also available in the power laboratory. The brief description of the project will be posted on learning@griffith in the project folder.

Criteria & Marking: The following items will be used to assess the project: (i) Project report, (ii) Reflective journal, (iii) Work book and (iv) Final presentation. The project report should include the steps taken in doing the project and the results obtained. The reflective journal must include the issues arising from the conduct of the project as well as reflection on what you set out to learn, how you have approached your learning and what you do differently in next phase to improve your learning. The workbook should contain the intermediate work done by your group in performing the project. Finally you will present your work individually at the end of semester (week 12). Oral presentation: Each student will give a short presentation based on their project. Details of the presentation will be discussed in the class. Important marking criteria: (i) hold attention of entire audience with the use of direct eye contact; seldom looking at notes, (ii) demonstrates a strong, positive feeling about topic during entire presentation; (iii) use a clear voice so that all audience members can hear presentation; (iv) present information in logical, interesting sequence that audience follows; (v) visual aids are readable, clear and professional looking, enhancing the message; and (vi) answer questions clearly and able to stimulate discussion.

On successful completion you will be able to:

- Model and analyse major types of components including renewable generators and battery energy storage systems used in distributed power systems
- Calculate the steady state and transient responses of power systems and investigate the impact of renewable energy integration
- Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results
- Write a range of technical reports for professional engineering projects which include diverse contexts

Final Exam

Due: **During central exam period**
Weighting: **40%**

Final Exam will cover all of the course content. This will be a closed book exam, and involve short answers and problem solving.

On successful completion you will be able to:

- Calculate the steady state and transient responses of power systems and investigate the impact of renewable energy integration
- Analyse the stability of power systems with symmetrical and unsymmetrical faults and design controllers for reliable operations
- Determine the economic dispatch in power systems and understand Australian power market mechanism

Delivery and Resources

Lecture materials, Tutorial Questions, Laboratory Instruction Manuals, and Tutorial Solutions will be uploaded to iLearn.

Lectures will be recorded on Echo Recordings.

Laboratories will use different generators, transmission line modules, transformers, meters and loads.

Textbook:

1. J. Duncan Glover, M. S. Sarma and T. J. Overbye, **Power System Analysis and Design**, Sixth Edition SI, Cengage Learning, 2015, ISBN 978-1111425777

Recommended Textbook:

1. Hadi Sadat, **Power System Analysis**, Third Edition, McGraw Hill, 2010, ISBN 978-0984543809
2. Fundamentals of Power System Economics, by D. S. Kirschen and G. Strbac. Reprinted edition. John Wiley & Sons Ltd. 2009.

Unit Schedule

For details, please refer to the Unit Schedule on the ELEC494 iLearn webpage.

Learning and Teaching Activities

Unit Schedule

Weekly learning and teaching topics and activities are outlined in the Unit Schedule, together with relevant sections of the text and references.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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 *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/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 improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Assessment tasks

- Project
- Final Exam

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- Write a range of technical reports for professional engineering projects which include diverse contexts

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Model and analyse major types of components including renewable generators and battery energy storage systems used in distributed power systems
- Calculate the steady state and transient responses of power systems and investigate the impact of renewable energy integration
- Determine the economic dispatch in power systems and understand Australian power market mechanism

Assessment tasks

- Tutorial
- Laboratory
- Final Exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to

have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcome

- Analyse the stability of power systems with symmetrical and unsymmetrical faults and design controllers for reliable operations

Assessment tasks

- Tutorial
- Laboratory
- Final Exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Model and analyse major types of components including renewable generators and battery energy storage systems used in distributed power systems
- Calculate the steady state and transient responses of power systems and investigate the impact of renewable energy integration
- Determine the economic dispatch in power systems and understand Australian power market mechanism

Assessment tasks

- Tutorial
- Final Exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results
- Write a range of technical reports for professional engineering projects which include diverse contexts

Assessment tasks

- Laboratory
- Project
- Final Exam

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results
- Write a range of technical reports for professional engineering projects which include diverse contexts

Assessment tasks

- Laboratory
- Project

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results
- Write a range of technical reports for professional engineering projects which include diverse contexts

Assessment task

- Project

Changes from Previous Offering

This is a new unit and offering first time in S1 2019.