MONASH University

Unit Guide

ECE4053
Electrical energy - generation and supply

Semester 2, 2017

Table of contents

Unit handbook information

Synopsis

This unit aims to develop an understanding of the structure and operation of electrical power systems using different resources, and considering their environmental impacts. It covers current and future energy scenarios for the world and Australia. This requires an understanding of the basic concepts and modelling of electrical power systems, including techniques for power flow and fault analysis, control of voltage, frequency, harmonic distortion, and system stability. Methods are presented to identify and clear faults, maximise power system economy and estimate the capital cost as well as unit price of electricity ($/kWh) using various energy conversion technologies.

Mode of delivery

Clayton (Day)

Workload requirements

3 hours lectures, 3 hours laboratory and practice classes and 6 hours of private study per week

Unit relationships

Prerequisites

ECE2061 or TRC2500

Prohibitions

ECE4503, ECE4057, ECE4507, ECE5507, ECE5053, ECE5503

Co-requisites

ECE3051 or (TRC3501 and TRC3600)

Chief Examiner(s)

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Academic Overview

Engineers Australia Stage 1 competencies

The Engineers Australia Policy on Accreditation of Professional Engineering Programs requires that all programs ensure that their engineering graduates develop to a substantial degree the stage 1 competencies. Listed below are the activities in this unit that will help you to achieve these competencies.

Note: that not all stage 1 competencies are relevant to each unit.

Stage 1 competencies	Activities used in this unit to develop stage 1 competencies
PE1.1 Knowledge of science and engineering fundamentals	Theoretical lecture material, prescribed texts and recommended reading
PE1.2 In-depth technical competence in at least one engineering discipline	Laboratory experiments, tutorial problem sheets
PE1.3 Techniques and resources	Practical laboratory experiments, industry-grade computer software for power systems analysis
PE1.4 General knowledge	Load flow and dynamic stability analysis, power system protection, power quality electricity generation and distribution, the economic and technical bases for generation scheduling and electricity market operation
PE2.1 Ability to undertake problem identification, formulation, and solution	Laboratory experiments, tutorial problems, written assignments
PE2.2 Understanding of social, cultural, global, and environmental responsibilities and the need to employ principles of sustainable development	Lectures on electricity generation from renewable resources.
PE2.3 Ability to utilise a systems approach to complex problems and to design and operational performance	The entire unit content revolves around electricity generation and supply as a system
PE2.4 Proficiency in engineering design	Written assignment on power system protection
PE3.1 Ability to communicate effectively, with the engineering team and with the community at large	Team work in the lab, written assignment
PE3.2 Ability to manage information and documentation	Laboratory experiments and reports

PE3.5 Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member	Laboratory experiment experience

Teaching and learning method

The unit consists of lectures, laboratory practice and tutorial classes. Laboratories and tutorials will be of 3-hour duration. Students are required to complete prescribed preliminary work for each laboratory experiment. The purpose of a tutorial is to resolve any difficulties that students might have encountered while attempting to solve prescribed tutorial problems. It is essential that students do attempt to solve problems prior to attending tutorials.

Tutorial and laboratory allocation

Students must enrol in a practice class only using Allocate+. Students not allocated to a particular practice class will not be accepted into that session without the written consent of the unit coordinator. Once a particular session is full, no more students will be accepted, unless evidence is shown that timetabling means that is the only session possible.

Learning outcomes

To understand energy conversion technologies, electric power system modelling, power flow analysis faults in power systems electrical grid power and frequency control power stability and quality of supply economy of electric power systems.

Your feedback to us

One of the formal ways students have to provide feedback on teaching and their learning experience is through the Student Evaluation of Teaching and Units (SETU) survey. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied with and areas for improvement.

Previous student evaluations of this unit

In response to previous SETU results of this unit, the following changes have been made:

N/A

Student feedback has highlighted the following strength(s) in this unit:

N/A

If you wish to view how previous students rated this unit, please go to:
https://unitevaluations.connect.monash.edu.au/unitevaluations/index.jsp

Unit schedule

Week	Lecture	Tutorial	Power Lab	Simulation Lab
1 24 July	**AC circuit** fundamentals **Load flow**: the power- or load-flow problem. **Load flow**: network and component models	3 phase systems Per-unit representation		
2 31 July	**Load flow**: nodal analysis solution strategies, Newton, Gauss **Voltage control**: reactive power in AC systems, basic stability concepts **Voltage control**: discrete and continuous measures			Network analysis Load Flow (1)
3 7 Aug.	**3-phase transformers**: winding arrangements and equivalent circuits **3-phase transformers**: neutral currents, power system earthing **Fault studies**: symmetrical components theory	Load Flow		
4 14 Aug.	**Fault studies**: component models **Fault studies**: fault types, fault calculations **Fault calculations**: example			Network analysis Load Flow (2)
5 21 Aug.	**Interconnected power systems** **Frequency control**: role of governors **Frequency control**: single- and multi-area systems	Fault studies		

6 **28 Aug.**	**Voltage stability** **Small signal stability** **Transient stability** fundamentals: equal area criterion		3-phase transformers	
7 **4 Sept.**	***Mid-semester test*** **Transient stability**: system implications **Transient stability**: stability controls		Symmetrical components	
8 **11 Sept.**	**Generation scheduling**: optimal power flow and constrained dispatch Introduction to **electricity markets** **Generation technology**: 'classical' thermal, hydro		System operation demonstration	
9 **18 Sept.**	**Protection**: Principles and over-current protection Differential and directional **protection** Distance/impedance **protection**. Equipment protection applications			Stability studies (1)
Mid Semester Break				
10 **2 Oct.**	**Power quality**: harmonics, filter design **Power quality:** flicker etc **HV circuit breakers**: arc quenching media, circuit breaker types and applications	Market operation and frequency control		
11 **9 Oct.**	**Generation technology**: **PV** and "solid-state" sources **Generation technology: wind** and "**wet renewables**" **System operation** with renewable resources		Harmonics	

12 16 Oct.	**Transmission** systems and **interconnection** **Energy storage** Developments in **distribution** systems			Stability studies (2)
	SWOT VAC			
	Examination period	LINK to Assessment Policy: http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html		

Assessment requirements

Assessment summary

Continuous assessment: 40%
Examination (2 hours): 60%
Students are required to achieve at least 45% in the total continuous assessment component (assignments, tests, mid-semester exams, laboratory reports) and at least 45% in the final examination component and an overall mark of 50% to achieve a pass grade in the unit. Students failing to achieve this requirement will be given a maximum of 45% in the unit.

Assessment task	Value	Due date
Laboratory Experiments and Simulations	21%	Weeks 2-4-6-7-8-9-11-12
Mid-Term Test	15%	First Session of Week 7
Assignment	4%	Week 11
Final Exam	60%	To be advised

Hurdle requirements

The unit coordinator reserves the right to moderate the assessments given by the individual tutors. This process will occur at the end of the semester.

Note: Attendance at the laboratory briefing session is a mandatory requirement. Students who have not attended the briefing session will not be allowed to undertake laboratory work, and will therefore not be able to pass the continuous assessment component of the unit.

Assessment details and criteria

Students are required to achieve at least 45% in the total continuous assessment component (midsemester test, preliminary laboratory work, and laboratory experiments) and at least 45% in the final examination component and an overall mark of 50% to achieve a pass grade in the unit.

Students failing to achieve this requirement (hurdle) will be given a maximum of 45% in the unit.

Assessment tasks

Assessment title: Laboratory Experiments and Simulations
Mode of delivery: Laboratory work both with hardware and software (PSSE)
Details of task: Each student must keep a laboratory record book, paper or electronic, in which all experimental results and on the spot analysis are recorded. Failure to bring and use a laboratory record book will be given an automatic zero for the experimental achievement section of the laboratory assessment.

Release dates (where applicable): N/A
Word limit (where applicable): N/A
Due date: Weeks 2-4-6-7-8-9-11-12
Value: 21%
Presentation requirements:
Hurdle requirements (where applicable): A minimum of 45% in the continuous assessment must be achieved for a pass.
Individual assessment in group tasks (where applicable): N/A
Criteria for marking: Each student must submit a report for each lab activity (simulation labs and experiment labs). There are 7 labs in total, and each lab report is worth 3% of the final mark. The reports have a page limit of 5. Laboratory marks of each student will be totalled and averaged at the end of the semester to make 21% of the overall assessment.
Additional remarks: N/A

Assessment title: Mid-Term Test
Mode of delivery: Paper Exam
Details of task: N/A
Release dates (where applicable): N/A
Word limit (where applicable): N/A
Due date: First Session of Week 7
Value: 15%
Presentation requirements: N/A
Hurdle requirements (where applicable): A minimum of 45% in the continuous assessment must be achieved for a pass.
Individual assessment in group tasks (where applicable):
Criteria for marking:
Additional remarks:

Assessment title: Assignment
Mode of delivery: Written
Details of task: The assignment details will be disclosed in week 8.
Release dates (where applicable): Week 8
Word limit (where applicable): N/A

Due date: Week 11
Value: 4%
Presentation requirements:

Assignments must include a cover sheet. The coversheet is accessible via the Monash portal page located at http://my.monash.edu.au under the heading 'Learning and teaching tools.' Please keep a copy of tasks completed for your records.

Hurdle requirements (where applicable):

A minimum of 45% in the continuous assessment must be achieved for a pass.

Individual assessment in group tasks (where applicable): NA
Criteria for marking:

High Distinction

The assignment report shows clear evidence of critical analysis, and reflection on the experimental results obtained. There is a broad range of insights into the work performed. Quality professional understanding is evident and this is used to enrich the discussion and critique of the reported work. Familiarity with the subject matter is evident. All assignment-writing requirements are met to the highest standard in terms of presentation, coherency, spelling, referencing, grammar etc.

Distinction

The assignment report shows clear evidence of critical analysis and reflection on the experimental results obtained. There is some original thinking evident in the discussion. Professional understanding of the topic is shown in the discussion. Familiarity with the subject matter is evident. All assignment-writing requirements are met to the highest standard in terms of presentation, coherency, spelling, referencing, grammar etc.

Credit

The assignment report is focused on the experiment description although there is some attempt to critically analyse the results obtained. Professional approach to the topic is evident but the report is limited in scope and quality. The discussion shows that there is a fair understanding of the subject matter. Guidelines for assignment writing have been met at a satisfactory standard.

Pass

Overall, the assignment report is focused on description with scant evidence of critical analysis or reflection. The discussion reveals a limited understanding of the experiment. There is little evidence of professional reading on the chosen topic. Guidelines for assignment writing have been met at the satisfactory level.

Additional remarks:

If you are late in applying for an extension or you don't have a good reason, you should still submit the work, but 10% of the total marks available for that assessment component will usually be deducted for each day late.

No assignment will be accepted once an assignment has been returned to the class.

Deferred tests and examinations may be granted in cases of extenuating personal circumstances such as serious personal illness or bereavement.

Remember, you are required to keep an up-to-date copy of all submitted assignments to safeguard against the loss of work through accident or error.

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Assessment for the unit as a whole is in accordance with the provisions of the Monash University Education Policy at:

Examination(s)

Exam title: Final Exam
Weighting: 60%
Length: 2 hours (with 10 minutes reading time)
Type (Open/closed book): Closed Book
Hurdle requirements (where applicable): 45%
Electronic devices allowed: Faculty-approved calculators are allowed.
Remarks (where applicable):

Calculators
A list of the Faculty of Engineering approved calculators and the process for obtaining a sticker is available online at:
http://www.eng.monash.edu.au/current-students/calculators.html

IMPORTANT: Only these listed calculators with the **authorised Monash University-Science or Monash University-Engineering STICKER** will be allowed into the examination by the invigilators.

A list of the Faculty of Engineering approved calculators and the process for obtaining a sticker is available online at:
http://www.eng.monash.edu.au/current-students/calculators.html
IMPORTANT: *Only these listed calculators with the* ***authorised Monash University-Science or Monash University-Engineering STICKER*** *will be allowed into the examination by the invigilators.*

Plagiarism and collusion

Intentional plagiarism or collusion amounts to cheating under Part 7 of the Monash University (Council) Regulations.

Plagiarism: Plagiarism means taking and using another person's ideas or manner of expressing them and passing them off as one's own. For example, by failing to give appropriate acknowledgement. The material used can be from any source (staff, students or the internet, published and unpublished works).

Collusion: Collusion means unauthorised collaboration with another person on assessable written, oral or practical work and includes paying another person to complete all or part of the work. Where there are reasonable grounds for believing that intentional plagiarism or collusion has occurred, this will be reported to the Associate Dean (Education) or delegate,

Referencing requirements

The University regards most seriously any acts of dishonesty in assessment such as plagiarism, collusion, resubmission of previously marked work in different units, examination misconduct and theft of other students' work.

Plagiarism While some people incorrectly assume that plagiarism occurs only where someone copies verbatim, it really involves taking and using another person's ideas or work and passing these off as one's own by failing to give appropriate acknowledgement; that is, not indicating by referencing that the ideas expressed are not your own. Good scholarship is marked by an acknowledgement of the origin of ideas you use, develop or synthesise.

Collusion (or unauthorised collaboration) Means joint effort in preparing material submitted for assessment, between students or others, except where this has been approved by the lecturer-in-charge of the unit.

Cheating Means seeking to obtain an unfair advantage in an examination or in other written or practical work required to be submitted or completed by a student for assessment. Hence, if the passing off was done intentionally you have cheated, if it was not intentional, the offence you have committed is the academic misdemeanor of failing to reference a source correctly.

Acts of dishonesty in assessment could result in penalties, including failure in the unit and possible exclusion from the University. For further details please refer to the University's Discipline Statute (Statute 4.1).

University statements on plagiarism are contained in the University Discipline Statute 4.1 at: http://www.monash.edu.au/pubs/calendar/statutes/Statute04.html and accompanying guidelines at: http://www.adm.monash.edu.au/unisec/academicpolicies/policy/plagiarism.html and http://www.monash.edu.au/pubs/sii

To build your skills in citing and referencing, and using different referencing styles, see the online tutorial Academic Integrity: Demystifying Citing and Referencing at http://www.lib.monash.edu.au/tutorials/citing/

Assignment submission

Hard Copy Submission:

Only preliminary work is submitted in hard copy. Laboratory experimental records are kept in the laboratory record book kept by each student.

Online Submission: If Electronic Submission has been approved for your unit, please submit your work via the Moodle site or other; as directed by your demonstator for this unit.
Please keep a copy of tasks completed for your records.

Feedback to you

Monash aims to provide a learning environment in which students receive a range of ongoing feedback throughout their studies. In this unit it will take the form of group feedback via practice classes, individual feedback, peer feedback, self-comparison, verbal and written feedback, discussions in class, as well as more formal feedback related to assignment marks and grades. Students/You are encouraged to draw on a variety of feedback to enhance their/your learning.

Learning resources

Recommended textbooks

J.J. Grainger, W.D. Stevenson Jr, “Power System Analysis”, McGraw Hill, 1994.

Library resources (eBooks)

Leonard L. Grigsby (ed), Power Systems, CRC Press 2007

Leonard L. Grimsby (ed), Power System Stability and Control, CRC Press 2007

Hewitson, M. Brown, R. Balakrishnan, Practical Power System Protection, Elsevier Ltd., 2005

Ruben D. Garzon, High Voltage Circuit Breakers, CRC Press 2002

Monash Library Unit Reading List (if applicable to the unit):
http://readinglists.lib.monash.edu/index.html

Required resources

Students generally must be able to complete the requirements of their course without the imposition of fees that are additional to the student contribution amount or tuition fees. However, students may be charged certain incidental fees or be expected to make certain purchases to support their study. For more information about this, go to Administrative Information for Higher

Education Providers: Student Support, Chapter 21, Incidental Fees at: http://www.innovation.gov.au/HigherEducation/TertiaryEducation/ResourcesAndPublications/Pages/default.aspx

Other information

Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at: http://www.policy.monash.edu/policy-bank/academic/education/index.html

Graduate Attributes Policy

http://www.monash.edu/policy-bank/academic/education/course-governance-and-design/course-design-policy

Student Charter

http://www.monash.edu/students/policies/student-charter.html

Student Services

The University provides many different kinds of services to help you gain the most from your studies. Contact your tutor if you need advice and see the range of services available at: http://www.monash.edu/students

Monash University Library

The Monash University Library provides a range of services, resources and programs that enable you to save time and be more effective in your learning and research.
Go to http://www.monash.edu/library or the library tab in http://my.monash.edu.au portal for more information.

Disability Support Services

Students who have a disability, ongoing medical or mental health condition are welcome to contact Disability Support Services.

Disability Support Services also support students who are carers of a person who is aged and frail or has a disability, medical condition or mental health condition.

Disability Advisers visit all Victorian campuses on a regular basis.

- Website: monash.edu/disability
- Telephone: 03 9905 5704 to book an appointment with an Adviser;
- Email: disabilitysupportservices@monash.edu
- Drop In: Level 1, Western Annexe, 21 Chancellors Walk (Campus Centre) Clayton Campus