UNSW Course Outline

ELEC4617 Power System Protection - 2024

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General Course Information

Course Code : ELEC4617
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Electrical Engineering & Telecommunications
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course is ideally suited to electrical engineering students planning to pursue a career in Power Engineering. It provides an in-depth coverage on the fundamental aspects of power system protection against electrical faults, vital for the reliable, secure and safe operation of the

electricity generation / transmission / distribution networks.

Topics covered include: Fundamental protection concepts and protection schemes for various power system configurations; Fault current calculations: review of sequence components, symmetrical and unsymmetrical faults; Protection devices: fuses, circuit breakers, relays, their operating principles, device rating determination, relay setting and coordination; Instrument transformers (CTs and VTs): selection and transient performance; Distance protection and protection signalling; Protection of generators, transformers, transmission lines, busbars, and feeders. The class will also discuss emerging issues and challenges in the power system protection field related to increasing penetrations of distributed generation and intelligent, self-healing networks.

Course Aims

The aim of this course is to equip students with fundamental knowledge of power system protection. Laboratory experiments incorporating state-of-art protection technology used in industry will allow students to be better prepared for a career in power engineering.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Analyse both symmetrical and un-symmetrical faults in power system circuits
CLO2 : Explain the fundamentals of electromechanical relays and digital protection relays
CLO3 : Apply methods to calculate the magnitude and angle of voltage and current for the digital relaying
CLO4 : Choose suitable current transformers, voltage transformers, circuit breakers, etc., for fulfilling power system protection requirements
CLO5 : Design typical power system protection schemes, including overcurrent protections and their coordination, directional overcurrent protection, differential protection, distance protection.

Course Learning Outcomes	Assessment Item
CLO1 : Analyse both symmetrical and un-symmetrical faults in power system circuits	• Laboratory sessions • Quiz
CLO2 : Explain the fundamentals of electromechanical relays and digital protection relays	• Laboratory sessions • Quiz
CLO3 : Apply methods to calculate the magnitude and angle of voltage and current for the digital relaying	• Laboratory sessions • Quiz
CLO4 : Choose suitable current transformers, voltage transformers, circuit breakers, etc., for fulfilling power system protection requirements	• Laboratory sessions • Quiz
CLO5 : Design typical power system protection schemes, including overcurrent protections and their coordination, directional overcurrent protection, differential protection, distance protection.	• Final Exam • Laboratory sessions

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Other Professional Outcomes

The Course Learning Outcomes (CLOs) contribute to the Engineers Australia (National Accreditation Body) Stage I competencies as outlined below

Engineers Australia (EA), Professional Engineer Stage 1 Competencies

PE1: Knowledge and Skill Base:

PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals: CLO 1, 2, 3, 4,

5

PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing: CLO 1, 2,3,4,5

PE1.3 In-depth understanding of specialist bodies of knowledge: CLO 1, 2, 3, 4

PE1.4 Discernment of knowledge development and research directions: n/a

PE1.5 Knowledge of engineering design practice: CLO 1, 2, 3, 5.

PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice: n/a

PE2: Engineering Application Ability:

PE2.1 Application of established engineering methods to complex problem solving: CLO 1, 3, 4, 5, 6

PE2.2 Fluent application of engineering techniques, tools and resources: CLO 1, 2,3, 4, 5, 6

PE2.3 Application of systematic engineering synthesis and design processes: n/a

PE2.4 Application of systematic approaches to the conduct and management of engineering projects: n/a

PE3: Professional and Personal Attributes:

PE3.1 Ethical conduct and professional accountability: n/a

PE3.2 Effective oral and written communication (professional and lay domains): CLO 5, 6

PE3.3 Creative, innovative and pro-active demeanour: CLO 6

PE3.4 Professional use and management of information: n/a

PE3.5 Orderly management of self, and professional conduct: n/a

PE3.6 Effective team membership and team leadership: n/a

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Laboratory sessions Assessment Format: Individual	20%	
Quiz Assessment Format: Individual	20%	
Final Exam Assessment Format: Individual	60%	

Assessment Details

Laboratory sessions

Assessment Overview

There are four lab experiments in total. Although some experiments are group work activities, students are assessed individually in all experiments. Students are to carry out their experiments according to specific instructions. They are required to prepare pre-lab answers and complete the remaining questions in the lab after the experiments. The demonstrators do the marking and give verbal feedback.

Course Learning Outcomes

- CLO1 : Analyse both symmetrical and un-symmetrical faults in power system circuits
- CLO2 : Explain the fundamentals of electromechanical relays and digital protection relays
- CLO3 : Apply methods to calculate the magnitude and angle of voltage and current for the digital relaying
- CLO4 : Choose suitable current transformers, voltage transformers, circuit breakers, etc., for fulfilling power system protection requirements
- CLO5 : Design typical power system protection schemes, including overcurrent protections and their coordination, directional overcurrent protection, differential protection, distance protection.

Assignment submission Turnitin type

This is not a Turnitin assignment

Quiz

Assessment Overview

This is a 90-minute in-class examination scheduled at mid-term. Questions cover the contents taught up to one week before the assessment. The assessment leads to a graded mark according to the correct fraction of answers to the examination questions. Verbal class-wide feedback will be given during lectures.

Course Learning Outcomes

- CLO1 : Analyse both symmetrical and un-symmetrical faults in power system circuits
- CLO2 : Explain the fundamentals of electromechanical relays and digital protection relays
- CLO3 : Apply methods to calculate the magnitude and angle of voltage and current for the digital relaying
- CLO4 : Choose suitable current transformers, voltage transformers, circuit breakers, etc., for fulfilling power system protection requirements

Final Exam

Assessment Overview

The final exam is a 2-hour written examination to be scheduled during the final exam period. It comprises four questions. The examination will test students' understanding of the course material and analytical skills. Questions may be drawn from any aspect of the course unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses.

Course Learning Outcomes

- CLO5 : Design typical power system protection schemes, including overcurrent protections and their coordination, directional overcurrent protection, differential protection, distance protection.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 20 May - 26 May	Reading	
Week 1 : 27 May - 2 June	Lecture	Introduction to power system protection and review on fault analysis
Week 2 : 3 June - 9 June	Lecture	Fundamentals of electromechanical relays and digital protective relaying
Week 3 : 10 June - 16 June	Lecture	Instrument transformers, circuit breakers and fuse
Week 4 : 17 June - 23 June	Lecture	Instrument transformers, circuit breakers and fuse
Week 5 : 24 June - 30 June	Lecture	Overcurrent protection and coordination
Week 6 : 1 July - 7 July	Lecture	Overcurrent protection and coordination
Week 7 : 8 July - 14 July	Blended	Directional overcurrent protection; Mid-term examination is arranged in this week.
Week 8 : 15 July - 21 July	Lecture	Differential protection
Week 9 : 22 July - 28 July	Lecture	Distance protection
Week 10 : 29 July - 4 August	Lecture	Distance protection; Summary on course.
Week 11 : 5 August - 11 August	Tutorial	Tutorial

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

Recommended Resources

1.Protective Relaying: Principles and Applications, Third Edition, J. Lewis Blackburn, Thomas J. Domin, CRC Press, 2007.
2.Power System Analysis, John J. Grainger and William D. Stevenson, JR., McGraw-Hill, 1994.
3.Digital protection for power system, AT Johns and SK Salman, IEE Power series 15, Peter Peregrinus Ltd., 1995.
4.Power system protection and communications, Akhtar Kalam, DP Kothari, New Age Science, 2010.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Daming Zhang		EET Room 317	93854070	By appointment	No	Yes
Convenor	Daming Zhang		EET Room 317	93854070	By appointment	No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance

- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit:

student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,

- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Use of AI for assessments

Your work must be your own. If you use AI in the writing of your assessment, you must acknowledge this and your submission must be substantially your own work. More information can be found on this website.

Workplace Health & Safety (WHS)

WHS for students and staff is of utmost priority. Most courses involve laboratory work. You must

follow the rules about conduct in the laboratory. About COVID-19, advice can be found on this website.

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage