School of Electrical Engineering & Telecommunications

UNSW Engineering

ELEC4617

Power System Protection

Term 2, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Daming Zhang	daming.zhang@unsw.edu.au	By appointment	EET Room 317	93854070

Lecturers

Name	Email	Availability	Location	Phone
Daming Zhang	daming.zhang@unsw.edu.au	By appointment	EET Room 317	93854070

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

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

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)

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, 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

Course Details

Units of Credit 6

Summary of the Course

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, protection schemes for various power system configurations. Fault current calculations: review of sequence components, symmetrical and unsymmetrical faults. Protection devices: fuses, circuit breakers, relays; operating principles, device rating determination, relay setting and coordination. Instrument transformers (CTs and VTs): selection, transient performance. Distance protection, protection signalling. Protection of generators, transformers, transmission lines, busbars, 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

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Calculation of both symmetrical and un-symmetrical fault currents	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
2. Understanding the fundamentals of electromechanical relays and digital protective relaying	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
3. The basic methods of calculating the magnitude and angle of voltage and current for the digital relaying	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
4. The methods to choose suitable current transformer, voltage transformer and circuit breakers etc for fulfilling power system protection	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4

Learning Outcome	EA Stage 1 Competencies
5. Design of overcurrent protection and its coordination	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
6. Design of directional overcurrent protection	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
7. Design of differential protection	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
8. Design of distance protection	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4
9. Understanding the basic concepts of islanding in the operation of microgrid; understanding of application of IEC61850 communication protocol in the power system protection	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2, PE3.3, PE3.4

Teaching Strategies

The course will be taught using face-to-face lectures with web supported delivery, and a laboratory component that supports taught material. Tutorial sheets and mid-term quizzes will be used for formative assessment of student abilities. The course content will be delivered by experts in their fields. This is viewed as offering the best method of learning for the material presented. Suggested and recommended texts will be provided to support student learning outcomes. Summative examinations will be used as a component of assessment.

Tutorials will be interactive involving students answering problem sets based on preceeding lecture material.

The laboratories are designed to reflect and support the concepts and thoeretical basis learned in the lecture program. Students will be required to not only undertake practical experiments, but also successfully communicate their results and findings for assessment. The laboratories will also be used as formative assessments for the students such that they can gauge their progress against the stated learning outcomes of the class.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Laboratory sessions	20%	05/08/2022 05:00 PM	1, 2, 3, 4, 5, 6, 7, 8
2. Quiz	20%	14/07/2022 06:00 PM	1, 2, 3, 4, 9
3. Final Exam	60%	To be determined.	5, 6, 7, 8

Assessment 1: Laboratory sessions (Group)

Start date: 27/06/2022 09:00 AM
Due date: 05/08/2022 05:00 PM

Totally there are four lab sessions for each of you. Due to current inconvenience, two laboratory sessions (Lab 1 annd Lab2) are converted into assignments. Only lab 3 and lab 4 will be conducted in the laboratory either physically or by remote access. Hardware session will start from week 5. Details will be sent out to you soon.

This is not a Turnitin assignment

Assessment 2: Quiz

Start date: 14/07/2022 04:00 PM
Due date: 14/07/2022 06:00 PM

Mid-term examination is arranged from 4pm to 6pm during lecture hour in week 7. Details will be sent out to you at due time.

Assessment 3: Final Exam

Start date: To be determined.
Due date: To be determined.

The final examination mainly covers those contents not covered by the mid-term examination. Details will be sent out at due time.

This is not a Turnitin assignment

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
O-Week: 23 May - 27 May		
Week 1: 30 May - 3 June	Lecture	Introduction to power system protection and review on fault analysis
Week 2: 6 June - 10 June	Lecture	Fundamentals of electromechanical relays and digital protective relaying
Week 3: 13 June - 17 June	Lecture	Instrument transformers, circuit breakers and fuse
Week 4: 20 June - 24 June	Lecture	Instrument transformers, circuit breakers and fuse (Cont'd)
Week 5: 27 June - 1 July	Lecture	Overcurrent protection and coordination
Week 6: 4 July - 8 July	Tutorial	This week is a flexible week. Nevertheless tutorial sessions will continue. It is open for questions.
Week 7: 11 July - 15 July	Lecture	Directional overcurrent protection; Mid-term examination is arranged in this week.
	Assessment	Quiz
Week 8: 18 July - 22 July	Lecture	Differential protection
Week 9: 25 July - 29 July	Lecture	Distance protection
Week 10: 1 August - 5 August	Lecture	Distance protection; Summary on course.
	Assessment	Laboratory sessions

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

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.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate**. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the Nucleus: Student Hub. If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for special consideration through the Special Consideration portal. To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this form.

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the Safe Return to Campus guide for students for more information on safe practices.

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/policy), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

https://student.unsw.edu.au/guide

https://www.engineering.unsw.edu.au/electrical-engineering/resources

Disclaimer

This Course Outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies:

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	