UNSW Course Outline

ELEC9713 Industrial and Commercial Power Systems - 2024

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General Course Information

Course Code : ELEC9713
Year : 2024
Term : Term 1
Teaching Period : T1
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
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course aims at students wishing to specialise in power engineering in their degree. It provides practical knowledge on the design and operation of electrical distribution systems in large commercial buildings or industrial sites.

Topics covered include: regulatory aspects; switchboards, cabling systems; transformers and switchgear; earthing systems; electrical safety issues including personnel protection and fire protection; protection of electrical systems (including both overcurrent and surge protection) and condition monitoring; lightning protection; electrical lighting systems; communication systems in buildings; emergency systems; energy efficiency and energy management; power quality and effects of voltage and current harmonics; power frequency magnetic fields and their impact in building and industrial sites. Equipment operation will also be covered, together with condition monitoring aspects of major plant.

Course Aims

The course aims to provide the student with the fundamentals of electrical power distribution systems: their design, construction, maintenance, and operation. In particular, it provides practical and essential knowledge for designing the electrical distribution infrastructure in large commercial buildings or industrial sites. Particular emphasis is on compliance with current practices and regulations within Australia. The course also touches on some aspects of utilisation.

Relationship to Other Courses

This is a power engineering course. The student is assumed to have basic knowledge on power engineering.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Calculate the maximum power demand by a new building;
CLO2 : Determine the electrical specifications of power apparatuses or devices for the power supply system to the new building, including switchboard, cables/transmission lines, distributed power transformers, lightning protection devices and select suitable ones from the suppliers;
CLO3 : Design the earthing or grounding system;
CLO4 : Calculate the fault current for a three-phase symmetrical fault;
CLO5 : Design overcurrent protection for the distributed power supply system to the new building;
CLO6 : Analyze power quality and implement reactive power compensations for the distributed power system.

Course Learning Outcomes	Assessment Item
CLO1 : Calculate the maximum power demand by a new building;	• Mid-Term Exam
CLO2 : Determine the electrical specifications of power apparatuses or devices for the power supply system to the new building, including switchboard, cables/transmission lines, distributed power transformers, lightning protection devices and select suitable ones from the suppliers;	• Switch Board Selection • Lightning protection • Mid-Term Exam
CLO3 : Design the earthing or grounding system;	• Final Examination • Switch Board Selection • Lightning protection
CLO4 : Calculate the fault current for a three-phase symmetrical fault;	• Final Examination
CLO5 : Design overcurrent protection for the distributed power supply system to the new building;	• Final Examination
CLO6 : Analyze power quality and implement reactive power compensations for the distributed power system.	• Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System

Other Professional Outcomes

Engineers Australia, Professional Engineer Stage 1 Competencies

The learning outcomes of this course contribute to your development of the following EA competencies:

	EA Stage 1 Competencies	Course Learning Outcomes (CLOs)
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	1
PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing		1, 2, 3, 4, 5, 6
PE1.3 In-depth understanding of specialist bodies of knowledge		1, 2, 3, 4, 5, 6
PE1.4 Discernment of knowledge development and research directions		2
PE1.5 Knowledge of engineering design practice		1, 2, 3, 4, 5, 6
PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice		1, 2, 3, 4, 5, 6
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	1, 2, 3, 4, 5, 6
PE2.2 Fluent application of engineering techniques, tools and resources		1, 2, 3, 4, 5, 6
PE2.3 Application of systematic engineering synthesis and design processes		1, 2, 3, 4, 5, 6
PE2.4 Application of systematic approaches to the conduct and management of engineering projects		1,2,3,4,5,6
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	1
PE3.2 Effective oral and written communication (professional and lay domains)		2
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		

Additional Course Information

Nil.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Switch Board Selection Assessment Format: Individual	10%	
Lightning protection Assessment Format: Individual	10%	
Mid-Term Exam Assessment Format: Individual	20%	
Final Examination Assessment Format: Individual	60%	

Assessment Details

Switch Board Selection

Assessment Overview

This assignment involves a detailed study of switchboards and the selection of a switchboard for a specific application according to the requirements on insulation, ingress protection, and compartmentalization. A written report (up to 10 pages) is to be submitted and marked against specific criteria in a marking guide.

Course Learning Outcomes

- CLO2 : Determine the electrical specifications of power apparatuses or devices for the power supply system to the new building, including switchboard, cables/transmission lines, distributed power transformers, lightning protection devices and select suitable ones from the suppliers;
- CLO3 : Design the earthing or grounding system;

Assessment information

This is the first part of the assignment. Submission date will be specified at a later time.

Assignment submission Turnitin type

This is not a Turnitin assignment

Lightning protection

Assessment Overview

This assignment involves designing a lightning protection system for a building. The dimensions of the building are given. The students are required to use the Rolling Sphere method and/or

other methods to design a lightning protection system with consideration for the safety of the building and the people inside the building. A written report (up to 10 pages) is to be submitted and marked against specific criteria in a marking guide.

Course Learning Outcomes

- CLO2 : Determine the electrical specifications of power apparatuses or devices for the power supply system to the new building, including switchboard, cables/transmission lines, distributed power transformers, lightning protection devices and select suitable ones from the suppliers;
- CLO3 : Design the earthing or grounding system;

Assessment information

This is the second part of the assignment. Submission date will be specified at a later time.

Mid-Term Exam

Assessment Overview

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

Course Learning Outcomes

- CLO1 : Calculate the maximum power demand by a new building;
- CLO2 : Determine the electrical specifications of power apparatuses or devices for the power supply system to the new building, including switchboard, cables/transmission lines, distributed power transformers, lightning protection devices and select suitable ones from the suppliers;

Detailed Assessment Description

This mid-term examination is arranged in week 7 during lecture hours.

Final Examination

Assessment Overview

The final examination is a two-hour written examination, comprising 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

- CLO3 : Design the earthing or grounding system;
- CLO4 : Calculate the fault current for a three-phase symmetrical fault;

- CLO5 : Design overcurrent protection for the distributed power supply system to the new building;
- CLO6 : Analyze power quality and implement reactive power compensations for the distributed power system.

Assessment information

The details on the final examination will be announced at the end of the term.

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 5 February - 11 February	Other	This is O-week.
Week 1 : 12 February - 18 February	Lecture	Overview
Week 2 : 19 February - 25 February	Lecture	Overview + Cable sizing
Week 3 : 26 February - 3 March	Blended	Cable sizing + tutorial 1
Week 4 : 4 March - 10 March	Lecture	Distribution transformers
Week 5 : 11 March - 17 March	Blended	Earthing or grounding system + tutorial 2
Week 6 : 18 March - 24 March	Lecture	Earthing or grounding system + Fault analysis
Week 7 : 25 March - 31 March	Assessment	Mid-term examination
Week 8 : 1 April - 7 April	Blended	Fault analysis + Overcurrent protection + tutorial 3
Week 9 : 8 April - 14 April	Blended	Overcurrent protection + tutorial 4
Week 10 : 15 April - 21 April	Blended	Power quality and reactive power compensation + tutorial 5 + tutorial 6

Attendance Requirements

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

General Schedule Information

Totally there will be ten-week teaching. Tutorials will be conducted during lecture hours.

Course Resources

Prescribed Resources

On-line resourcesMoodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials, and host forums. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Recommended Resources

1. AS/NZS 3000:2007 Wiring Rules.

2. AS/NZS 3017:2007 Electrical installations – Verification guidelines.

3. AS/NZS 3019:2007 Electrical installations – Periodic verification.

4. AS/NZS 4836:2001 Safe working on low-voltage electrical installations.

5. AS/NZS 3018:2001 Electrical installations – Domestic installations.

6. AS3439.1-2002 Low Voltage Switchgear and Controlgear Assemblies – Part 1: Type-tested and partially type-tested assemblies.

7. AS/NZS 3439.2:2002 - Particular requirements for busbar trunking systems (busways).

8. AS/NZS 3439.3:2002 - Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use - Distribution boards (IEC 60439-3:1990, MOD).

9. AS 2067-2008 - Substations and high voltage installations exceeding 1 kV a.c.

10. AS/NZS 3008.1.1:1998 Electrical Installations - Selection of Cables Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV – Typical Australian installation conditions.

11. AS/NZS 5000.1:1999 Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 kV.

12. AS/NZS 3198:1996 Approval and test specification - Electric cables - XLPE insulated - For working voltages up to and including 0.6/1 kV (superseded).

13. AS/NZS 1429.1:2000 Electric cables - Polymeric insulated - For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV.

14. BS 7671: 2008, IET Wiring Regulations.

15. AS60076.1-2005: Power transformers – General.

16. AS2374.7-1997: Power transformers - Loading guide for oil-immersed power transformers.

17. AS2374.8-2000: Power transformers - Application guide.

18. AS60076.11-2006: Power transformers - Dry-type transformers.

19. AS3953-1996: Loading guide for dry-type power transformers .

20. AS60044.2-2003: Instrument transformers - Voltage transformers.

21. AS/NZS 60479.1:2002 : Effects of current on human beings and livestock - General aspects; and AS/NZS 60479.2:2002 : Special aspects.

22. IEEE-Standard.#80-1986, Guide for Safety in Substation Grounding.

23. IEEE Green Book John Wiley(1986).

24. IEEE Standard #141: Recommended Practice for Electric Power Distribution for Industrial Plants. (IEEE Red Book). IEEE/Wiley (1986).

25. IEEE Standard #242: Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. (IEEE Buff Book). IEEE/Wiley (1986).

26. AS/NZS 1768:2007 Lightning Protection.

Course Evaluation and Development

Students can raise their questions during lectures and tutorials, which are addressed immediately;

Students can send their questions through emails to the lecturer which will be handled in a timely manner;

Students can apply for online meetings via Teams which will be accommodated;

Face-to-face meetings can also be arranged to address students' doubts and questions on the course materials.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Daming Zhang		EET, G17, Room317	02-93854070	Thursday 5pm-8pm; Monday 4pm-5pm.	No	Yes

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