UNSW Course Outline

ELEC9781 Special Topics in Electrical Engineering 1 - 2024

Published on the 25 May 2024

General Course Information

Course Code : ELEC9781
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
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This is an elective course at the graduate level, covering some special or advanced topics in electrical engineering of particular interests or needs at the time. The course content varies with the changing topics.

Course Aims

The course aims to expose students to some selected topics of special interest such as new emerging areas of technological advances or industry practices in the field of electrical engineering.

Relationship to Other Courses

This course is a special topic of electrical engineering covering a comprehensive advanced technology of renewable energy resources, energy storage systems, electrification of transportation, and AI techniques for energy. No prerequisite is required for students.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : After successful completion of this course, students will gain a sound technical knowledge of the specific advanced electrical engineering topics covered in this course.

Course Learning Outcomes	Assessment Item
CLO1 : After successful completion of this course, students will gain a sound technical knowledge of the specific advanced electrical engineering topics covered in this course.	• Final Result

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Zoom

Learning and Teaching in this course

All students are encouraged to learn basic programming skills, including Python and Matlab. Machine learning techniques, i.e. regression, are preferred.

Other Professional Outcomes

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

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

PE1.3 In-depth understanding of specialist bodies of knowledge: CLO 1, 2, 3, 4, 5

PE1.4 Discernment of knowledge development and research directions: CLO 3

PE1.5 Knowledge of engineering design practice: CLO 3, 4, 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 3, 4, 5

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

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 3,4,5

PE3.3 Creative, innovative and pro-active demeanour: CLO 3,4,5

PE3.4 Professional use and management of information: CLO 3,4,5

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

Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- **Application of Basic Science and Technologies**: Apply fundamental science and technology knowledge to energy storage systems.
- **Effective Communication**: Develop the ability to communicate technical information clearly to both engineering peers and the wider community.
- **Challenging Analysis and Design**: Tackle complex analysis and design problems in energy storage and find optimal solutions.
- **Problem Decomposition and Scope Definition**: Break down problems into manageable parts and clearly define the scope of each part.
- **Information Resource Utilization**: Efficiently locate and utilize information resources to support engineering tasks.
- **Project Planning and Evaluation**: Develop and implement effective project plans, explore alternative solutions, and critically evaluate different strategies.
- **Global and Social Responsibility**: Understand the societal, cultural, and global responsibilities of professional engineers in the context of energy storage.
- **Teamwork and Individual Work**: Work effectively both as an individual and as part of a team.

- **Professional and Ethical Responsibility**: Demonstrate an understanding of professional and ethical responsibilities.
- **Lifelong Learning**: Engage in lifelong learning to continuously enhance knowledge and skills in energy storage systems.

https://www.unsw.edu.au/engineering/student-life/student-resources/program-design

Additional Course Information

Relationship to Other Courses

The course is a postgraduate course with a special topic of energy storage systems offered to students following a ME (ELEC) course at UNSW. The course gives an introduction for integration of energy storage systems and renewable energy resources into power system networks; the course would normally be taken concurrently with thesis work in the energy systems area.

Pre-requisites and Assumed Knowledge

This is one of the special topic courses for Master of Engineering Science and Master of Engineering programs in Electrical Engineering where one industry guest lecture will be delivered. It is assumed that the students have good computer literacy, i.e., MATLAB and mathematical skills.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Final Result Assessment Format: Individual	100%	Start Date: 31/05/2024 12:00 AM Due Date: 16/08/2024 11:59 PM

Assessment Details

Final Result

Assessment Overview

The assessment will be divided into sub-assessment items that will vary with the special topic that is covered in the course in a particular term. The sub-assessments aim to evaluate a student's level of understanding and mastery of the course materials. The sub-assessments may include group research and presentation. Marks for sub-assessment items will be awarded based on the correctness of the response and against specific criteria in a marking guide. Formal individual feedback on submitted sub-assessment items, excluding any final exam component,

will be provided within two weeks of their submission.

Course Learning Outcomes

- CLO1 : After successful completion of this course, students will gain a sound technical knowledge of the specific advanced electrical engineering topics covered in this course.

Detailed Assessment Description

Sub-assessment item 1 (15%):

Start date: 31/05/2024 12:00 AM
Assessment length: 3000 words for each
Due date: 27/06/2024 11:59 PM

Essay A is required to have a comprehensive literature review on energy storage systems technology and its applications.
It should be but not limited to:
1. The technology review of the energy storage system to date
2. The state-of-art planning and operation of energy storage system technology.
3. The future vision of energy storage systems toward net-zero emission by 2050.
4. The conclusion of the literature review.
This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.
Assessment criteria
The marking criteria for essay A are as below.
- understanding/knowledge of the concept - 5 marks
- completion of the literature review - 5 marks
- report submission (3000 words) - 5 marks
TOTAL: 15 marks that will be scaled to 15% towards the course.

Sub-assessment item 2 (25%):

Start date: 28/06/2024 12:00 AM
Assessment length: 2000
Due date: 2/8/2024 11:59 PM
Essay B is required to design a home PV system with a battery for improving renewable energy usage.
It should be but not limited to:
1. The background of the home battery system.

2. How to predict that renewable energy will be generated by the home PV system?
3. Given the size of the PV system in a house, what's the optimal size of the battery?
4. What is the likely payback period on this solar system plus the battery?
This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.
Assessment criteria
The marking criteria for essay B are as below.
- understanding the engineering practice - 5 marks
- completion of the Project Design - 15 marks
- report submission (3000 words)- 5 marks
TOTAL: 25 marks that will be scaled to 25% towards the course.

Sub-assessment item 3 (10%):

Start date: 13/07/2024 7:00 PM
Due date: 13/07/2024 9:00 PM
The mid-term examination tests your general understanding of the course material and is designed to give you feedback on your progress through the analytical components of the course. Questions may be drawn from any course material up to the end of week 5 (topics include up to AI technique-based operation of energy storage systems). Marks will be assigned according to the correctness of the responses. The test will be online via Moodle STACK questionnaire, held during Week 7 on Saturday.

Sub-assessment item 4 (30%):

Start date: TBC
Due date: TBC
The final exam in this course will cover the aspects of all courses. Note that the material previous to week 5 cannot be completely ignored, although there may not be specific questions from those topics that are already covered in the mid-term exam. Thorough knowledge of these topics is essential to answer the exam questions. The exam format will be announced closer to the time. The examination tests analytical and critical thinking and a general understanding of the course material in a controlled fashion.

Additional details
Please note that you must pass the written exam (final exam + mid-term exam put together) in

order to pass the course.

Sub-assessment item 5: Quizzes and Online Discussions (20%)

There will be four online quizzes on various topics contributing to 20% of the course. These quizzes will be via Moodle. The quizzes will aid in understanding the material. The quizzes should be submitted online on Sundays (8 pm) of the allocated weeks. Detailed course material and all lecture videos are available. Additionally, to apply the concepts learned in the course to the energy storage system, you are encouraged to complete Essay B with a system design, which is worth 25%. Your attendance and engagement during these lectures will also be considered as a performence indicator.

Assessment Length

3000

Assessment information

GPT can be used to help students handle data and debugging. But text content generation, case study, simulation, and answer creation through GPT are not allowed.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

General Assessment Information

There are 5 sub-assessment items for all students. Don't miss any opportunities to get a good mark.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Assessment	Assessment 1 is initialised for students that exploit a literature review on the energy storage system.
	Lecture	Introduction to Energy Storage Technology will be presented comprehensively as follows: 1. Energy storage technology overview. 2. Hydrogen energy storage 3. Configuration planning of BESS in power system
Week 2 : 3 June - 9 June	Lecture	Introduction to Convex Optimisation and its application in energy storage management 1. Foundation of Convex Optimisation 2. Matlab for solving optimization problems 3. Solving optimisaion problems of energy storage system operation.
	Homework	Quiz 1 is initialised to help students better understand the teaching materials in Lectures 1&2.
Week 3 : 10 June - 16 June	Lecture	AI technologies for energy storage operations will be introduced. 1. Foundation of Machine Learning in Time Series Forecasting 2. Python Programming for time series prediction 3. Time series forecsting technologies for coordinating renewable energy and battery in home.
Week 4 : 17 June - 23 June	Homework	Quiz 2 is initialised to help student better understand the teaching materials in Lecture 3&4.
	Lecture	Battery management system (BMS) will be introduced including 1. Charging methodologies 2. SoC estimation techniques
Week 5 : 24 June - 30 June	Lecture	Energy storage operation will be introduced for frequency regulation as follows. 1. Energy storage system for FCAS market 2. Autobidder in Hornsdale Power Reserve
	Tutorial	Mid-Term revision consultation
Week 6 : 1 July - 7 July	Tutorial	This is Flexible Week. A short tutorial about Convex Optimization and Matlab solver.
	Homework	Quiz 3 is initialised to help students better understand the teaching materials in Lecture 5&6.
Week 7 : 8 July - 14 July	Lecture	Planning of energy storage systems for renewable energy will be considered with sizing and localising issues of the energy storage system in the distribution network.
	Assessment	The mid-term exam will be arranged this Starduday 19:00 pm-21:00 pm, and it will involve teaching materials from Weeks 1 to 5.
	Tutorial	Tutorial for Assignment 2
Week 8 : 15 July - 21 July	Lecture	Mobile energy storage in the electrification of transportation will be proposed 1. Land-Marine-Space vehicle electrification 2. Charging/discharging management
	Homework	Quiz 4 is initialised to help students better understand the teaching materials in Lectures 7&8.
Week 9 : 22 July - 28 July	Lecture	Charging station planning for EVs in urban areas will be introduced 1. The planning approach and solution of EV charging station 2. Case study---EV charging infrastructure planning in Sydney
	Tutorial	Final exam revision
Week 10 : 29 July - 4 August	Lecture	Industry Guest Lecture
	Assessment	Final Exam

Attendance Requirements

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

Course Resources

Prescribed Resources

[1] M., Sterner and I. Stadler (Eds.). (2019). Handbook of energy storage: Demand, technologies, integration. Springer.

Recommended Resources

[2] Asian Development Bank, Handbook on Battery Energy Storage System, 2018.

[3] M. Hannan, S. Wali, P. Ker, M. Abd Rahman, M. Mansor, V. Ramachandaramurthy, K. Muttaqi, T. Mahlia, Z. Dong,Battery energy storage system: A review of technologies, optimization objectives, constraints, approaches, and outstanding issues, Journal of Energy Storage, Volume 42,2021, 103023.

[4] C. Li, Z. Dong, G. Chen, B. Zhou, J. Zhang and X. Yu, "Data-Driven Planning of Electric Vehicle Charging Infrastructure: A Case Study of Sydney, Australia," in IEEE Transactions on Smart Grid, vol. 12, no. 4, pp. 3289-3304, July 2021, doi: 10.1109/TSG.2021.3054763.

Course Evaluation and Development

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via myExperience. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Dr Chaojie Li		G17 Room 301	0410984430	Friday 2:00pm-5:00 pm	Yes	Yes
	Dr Rachel Zhang		G17 Room 301	0426538889	Tuesday 1:00-3:00pm	Yes	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