UNSW Course Outline

ELEC2134 Circuits and Signals - 2024

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General Course Information

Course Code : ELEC2134
Year : 2024
Term : Term 3
Teaching Period : T3
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 : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Electrical Engineering is concerned with three primary activities: the first deals with electricity and its direct control and use within electrical circuits (electronics, power systems, instrumentation, communications and so on). The second activity is concerned with modelling

systems which use electricity as the primary source of energy for functioning. The third activity concerns the handling of data which relies on electrical phenomena (wired and wireless) for data transmission. ELEC2134 provides the fundamental techniques for carrying out the first two activities and will take your understanding of electrical circuits to new heights.

This course will enhance your understanding of simple and complex DC and AC circuits and circuit elements. You will explore AC power, power factor, and resonance, unravelling their implications in practical applications. With a solid foundation in AC analysis, you will be equipped to tackle complex challenges in power distribution, communications, and beyond in subsequent courses. From fundamental circuit elements to advanced network analysis, you will gain the skills to analyse electric and magnetic circuits. In addition to that, you will dive into network functions and frequency response, revealing the astounding interplay between electrical signals and linear systems such as circuits. You will explore the intricacies of time domain analysis and frequency domain analysis, which can provide invaluable insight into signals if properly used, equipping yourself with important tools to understand the behaviour of complex electrical systems in subsequent courses.

Course Aims

ELEC2134 plays a vital role in the program. It serves as a stepping stone for more advanced courses in electronics and lays the groundwork for understanding advanced topics like signal processing, control systems, microelectronics, power electronics, and communication systems.

ELEC2134 builds on foundational courses in mathematics, physics, and basic circuit theory (ELEC1111).

This course will:

- Enhance students' understanding of simple and complex DC and AC circuits and circuit elements.
- Help students understand the importance of signals as basic elements of systems, with reference to electric circuits, and introduce them to signal processing.
- Familiarise students with the time and frequency domain analysis of continuous-time signals, and circuits up to the second order.
- Provide opportunities for students to gain practical experience in the use of computer design and analysis tools such as LTspice.

Relationship to Other Courses

This is a 2nd year course in the School of Electrical Engineering and Telecommunications. It is a core course for students following a BE (Hons) (Electrical, Telecommunications or Quantum) or

BE (Hons) ME (Electrical) program and related dual degree programs.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC1111. ELEC2134 builds heavily on ELEC1111 skills, and the content progresses quickly, so if you do not already have a mastery of ELEC1111 concepts and problem-solving, revise early and revise often. It is also essential that you have good mathematical skills. This course will require fluent understanding and correct application of linear algebra, complex numbers, differential calculus and integral calculus (covered in first year mathematics courses).

Following Courses

The course is a pre-requisite for core courses ELEC2133, ELEC3104, ELEC3105, ELEC3106, ELEC3114, TELE3113, and other ELEC electives.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply transform methods to analyse continuous-time linear systems.
CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by correctly applying analytical tools.
CLO3 : Analyse simple and complex electric and magnetic circuits
CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.
CLO5 : Validate analysis results experimentally and/or using simulation software.

Course Learning Outcomes	Assessment Item
CLO1 : Apply transform methods to analyse continuous-time linear systems.	• Laboratory Assessment • Mid-term Exam • Final Exam • Weekly Online Quizzes
CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by correctly applying analytical tools.	• Laboratory Assessment • Mid-term Exam • Final Exam • Weekly Online Quizzes
CLO3 : Analyse simple and complex electric and magnetic circuits	• Laboratory Assessment • Mid-term Exam • Final Exam • Weekly Online Quizzes
CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.	• Laboratory Assessment • Mid-term Exam • Final Exam • Weekly Online Quizzes
CLO5 : Validate analysis results experimentally and/or using simulation software.	• Laboratory Assessment

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360 | Microsoft Teams

Learning and Teaching in this course

- Moodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials.

Recorded video lectures will be made available to students to support the scheduled lectures.

Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/

login/index.php.

- Mailing list

Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your UNSW student email address).

- Microsoft Teams

Microsoft Teams (accessed using your University zID) will be used as a support tool: https://teams.microsoft.com.

Other Professional Outcomes

Engineers Australia (EA), 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, 2, 3, 4
PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing		1, 2, 3, 4
PE1.3 In-depth understanding of specialist bodies of knowledge		1, 2, 3, 4, 5
PE1.4 Discernment of knowledge development and research directions		
PE1.5 Knowledge of engineering design practice		3, 4
PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice		
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	1, 2, 3, 4, 5
PE2.2 Fluent application of engineering techniques, tools and resources		1, 2, 3, 4, 5
PE2.3 Application of systematic engineering synthesis and design processes		
PE2.4 Application of systematic approaches to the conduct and management of engineering projects		
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication (professional and lay domains)		1, 2, 3, 4, 5
PE3.3 Creative, innovative and pro-active demeanour		
PE3.4 Professional use and management of information		1, 2, 3, 4, 5
PE3.5 Orderly management of self, and professional conduct		1, 2, 3, 4, 5
PE3.6 Effective team membership and team leadership		5

Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes

- Comprehensive, theory based understanding of the underpinning natural and physical

sciences and the engineering fundamentals applicable to the engineering discipline
- Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline
- In-depth understanding of specialist bodies of knowledge within the engineering discipline
- Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline

Engineering application ability

- Application of established engineering methods to complex engineering problem solving
- Fluent application of engineering techniques, tools and resources

Professional and personal attributes

- Effective oral and written communication in professional and lay domains
- Orderly management of self, and professional conduct

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

Additional Course Information

Students are strongly encouraged to attend *all* lectures, laboratories, and the mid-term exam in order to maximise learning. In addition to the lecture notes/videos, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. You must also prepare well for your laboratory classes. The importance of adequate preparation prior to each laboratory cannot be overemphasised, as the effectiveness and usefulness of the laboratory depends to a large extent on this preparation. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending classes. *Group learning/ study and collaboration throughout the course is strongly encouraged.*

- **Lectures** Recorded lecture videos will be made available to students after the scheduled lecture has concluded. Students should note that watching recordings is no substitute for attending the lectures, where live questions can be asked and problems will be solved collectively. Note that having access to recorded lectures does not imply improved exam preparation, without significant and consistent additional self-directed study through the term.

- **Laboratories** The laboratory schedule is deliberately designed to provide practical exposure to the concepts conveyed in lectures soon after they are covered in class. The laboratories are an integral part of learning in this course. You must prepare well for your laboratory classes as your work will be assessed during each session.

NOTE: ***There is no laboratory exemption for this course.*** Regardless of whether equivalent laboratories have been completed in previous terms, all students enrolled in this course must take the laboratories. If, for medical reasons (note that a valid medical certificate must be provided), you are unable to attend a laboratory, you will need to apply for a catch-up laboratory, as agreed with the head lab demonstrator.

If you have any questions regarding your laboratories, please send an email to the head lab demonstrator (email address provided via Moodle).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Laboratory Assessment Assessment Format: Individual	20%	
Mid-term Exam Assessment Format: Individual	25%	Start Date: 09/10/2024 04:00 PM Due Date: 09/10/2024 06:00 PM
Final Exam Assessment Format: Individual	50%	
Weekly Online Quizzes Assessment Format: Individual	5%	

Assessment Details

Laboratory Assessment

Assessment Overview

The laboratory sessions are primarily to promote active learning, and you are encouraged to bring questions to the classes. The assessment during laboratories is designed mainly to check your knowledge as you progress through each stage of the analytical and experimental tasks. You are required to maintain a lab book for recording all your preparation, analytical working and experimental observations. A lab book is an A4 size notebook containing a mix of plain pages and graph sheets. You need to purchase your own lab book.

After completing both the analytical questions given in the lab sheet and the experimental work, you will be assessed by the laboratory demonstrator. You must present your lab book with the analytical solutions and the experimental results during this assessment. Lab demonstrators may ask questions to test your knowledge of the analytical and experimental parts of these tasks during these checks. Assessment marks will be awarded according to your analytical work,

how much of the lab you were able to complete, your understanding of the experiments conducted during the lab, the quality of the code (if relevant), and your understanding of the topic revealed through lab staff questions (which may include related analytical questions). Feedback will be provided in class during marking.

Course Learning Outcomes

- CLO1 : Apply transform methods to analyse continuous-time linear systems.
- CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by correctly applying analytical tools.
- CLO3 : Analyse simple and complex electric and magnetic circuits
- CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.
- CLO5 : Validate analysis results experimentally and/or using simulation software.

Detailed Assessment Description

Assessed live during laboratory session.

Assessment information

Late penalty of five percent does not apply to this assessment.

Hurdle rules

Attendance and full participation in all laboratory classes is a requirement to pass this course.

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Mid-term Exam

Assessment Overview

There will be one mid-term examination, testing your understanding of the principles and your analytical skills through a number of set problems. The mid-term exam covers all material taught in Weeks 1-4. Marks will be assigned according to the correctness of the responses. Feedback will be provided via an exam review session.

Course Learning Outcomes

- CLO1 : Apply transform methods to analyse continuous-time linear systems.
- CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by

correctly applying analytical tools.
- CLO3 : Analyse simple and complex electric and magnetic circuits
- CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.

Detailed Assessment Description

- Mid-Term Exam: Week 5 Wednesday, 9th October 2024, during lecture time (16:00-18:00 Sydney time)
- The instructions for the exam will be confirmed prior to the exam
- Covers all material taught in weeks 1-4 (both lecture and lab)
- All questions must be answered

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Final Exam

Assessment Overview

There will be one final examination, testing your understanding of the principles and your analytical skills from the entire lecture and laboratory program through a number of set problems. The final exam will cover all chapters/topics covered in the term. Marks will be assigned according to the correctness of the responses.

Course Learning Outcomes

- CLO1 : Apply transform methods to analyse continuous-time linear systems.
- CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by correctly applying analytical tools.
- CLO3 : Analyse simple and complex electric and magnetic circuits
- CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.

Hurdle rules

You must pass the final exam to pass the course.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are

not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Weekly Online Quizzes

Assessment Overview

Each week, an online quiz will become accessible. Once a quiz is made available online, you can complete the quiz at your own convenience, but the deadline for each quiz will be one week from the opening date. You will have three attempts for each quiz and will receive instant feedback after every attempt. You will be marked on your best attempt. The average mark of all quizzes accounts for the total mark of this assessment.

Course Learning Outcomes

- CLO1 : Apply transform methods to analyse continuous-time linear systems.
- CLO2 : Describe how signals and linear systems interact in the time and frequency domain, by correctly applying analytical tools.
- CLO3 : Analyse simple and complex electric and magnetic circuits
- CLO4 : Explain and analyse the behaviour of circuits with steady-state AC, periodic and transient voltages and currents.

Assessment information

Late penalty of five percent does not apply to this assessment (i.e., quizzes will receive a mark of zero if not completed by the specified date).

Generative AI Permission Level

Planning/Design Assistance

You are permitted to use generative AI tools, software or services to generate initial ideas, structures, or outlines. However, you must develop or edit those ideas to such a significant extent that what is submitted is your own work, i.e., what is generated by the tool, software or service should not be a part of your final submission. You should keep copies of your iterations to show your Course Authority if there is any uncertainty about the originality of your work.
If your Convenor has concerns that your answer contains passages of AI-generated text or media that have not been sufficiently modified you may be asked to explain your work, but we recognise that you are permitted to use AI generated text and media as a starting point and some traces may remain. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

For more information on Generative AI and permitted use please see here.

General Assessment Information

Grading Basis

Standard

Requirements to pass course

Attendance and full participation in all laboratory classes is a requirement to pass this course.

You must pass the final exam to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	AC review, AC power
	Laboratory	Lab 1: Introduction to PSpice, AC circuit analysis, AC power (Note: significant preparation in advance required)
Week 2 : 16 September - 22 September	Lecture	Transfer functions, Fourier series
	Laboratory	Lab 1: AC power (experimental)
Week 3 : 23 September - 29 September	Lecture	AC resonance, Magnetically coupled circuits (I)
	Laboratory	Lab 2: Transfer functions, Fourier series, AC resonance (Note: Significant preparation in advance required)
Week 4 : 30 September - 6 October	Lecture	Fourier transform
	Laboratory	Lab 2: Transfer functions, Fourier series, AC resonance
Week 5 : 7 October - 13 October	Lecture	Magnetically coupled circuits (II), Mid-term exam
	Laboratory	Lab 3: Fourier transform (Note: Significant preparation in advance required)
Week 6 : 14 October - 20 October	Lecture	Examples and Revision
	Laboratory	Catch-up lab
Week 7 : 21 October - 27 October	Lecture	Transient analysis
	Laboratory	Lab 4: Magnetically coupled circuits, Transient analysis (Note: Significant preparation in advance required)
Week 8 : 28 October - 3 November	Lecture	Laplace transform
	Laboratory	Lab 4: Transient analysis (experimental)
Week 9 : 4 November - 10 November	Lecture	Laplace application to circuits, Two-port networks
	Laboratory	Lab 5: Laplace transform, Two-port networks (Note: Significant preparation in advance required)
Week 10 : 11 November - 17 November	Lecture	Poles and zeroes, Review
	Laboratory	Lab 5: Laplace transform, Two-port networks

Attendance Requirements

You are strongly encouraged to attend all classes as well as review lecture recordings, but note in particular that laboratory attendance will be kept, and you are expected to attend all the laboratory sessions.

Course Resources

Prescribed Resources

Textbooks

Prescribed textbook

- C. K. Alexander and M. N. O. Sadiku, Fundamentals of Electric Circuits, 7th ed., McGraw-Hill, 2021.

Available at UNSW Bookshop, UNSW Library, McGraw-Hill website, or online retailers.

Recommended Resources

Other reference books

- L.S. Bobrow, “Elementary Linear Circuit Analysis”, Oxford, 1987 [P621.3192/106].
- J. Svoboda, & R. Dorf, “Introduction to Electric Circuits”, 9th edition, Wiley & sons, 2014.
- A. Hambley, “Electrical Engineering Principles and Applications”, Prentice Hall, 2002.
- S. Franco, “Electric Circuits Fundamentals”, Saunders College Publishing, 1995.
- R.L. Boylestad, Introductory Circuit Analysis, 9th Edition, Prentice-Hall, 2000 [PQ621.3815/198].
- J.R. Cogdell, Foundations of Electrical Engineering, 2nd Edition, Prentice Hall, 1990 [P621.3/198].
- J. Millman and A. Grabel, Microelectronics, McGraw-Hill, 1987 [P621.38173/68].

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 the online student survey 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.

Some changes made in Term 3, 2024 in response to previous feedback include:

- Refinement of the new laboratories designed in Term 1, 2024.
- Use of Ed Discussion Forum instead of Moodle Forum.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Inmaculada (Inma) Tomeo-Reyes		Room EE414			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