School of Electrical Engineering & Telecommunications

UNSW Engineering

ELEC2134

Circuits and Signals

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Jarryd Pla	jarryd@unsw.edu.au		Room 103B, Level 1, Newton Building (J12)	

Demonstrators

Name	Email	Availability	Location	Phone
Cameron Jones	cameron.jones@unsw.edu.au			

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

Circuit elements - energy storage and dynamics. Ohm's Law, Kirchhoff's Laws, simplifying networks of series/parallel circuit elements. Nodal analysis. Thivenin and Norton equivalents, superposition. Operational amplifiers. Transient response in first-order RLC circuits. Solutions via solving differential equations. Transient response in second-order RLC circuits. State equations, zero input response, zero state response. Using MATLAB to solve state equations. Sinusoidal signal: frequency, angular frequency, peak value, RMS value, and phase. DC vs AC, average vs RMS values. AC circuits with sinusoidal inputs in steady state. Use of phasor and complex impedance in AC circuit analysis. AC power (real, reactive, apparent), power factor, leading/lagging. Resonance. Transformers and coupled coils. Laplace transforms of signals and circuits. Network functions and frequency response. Periodic signals and Fourier series. Introduction to filter design. Introduction to nonlinear circuits and small signal analysis.

Course Aims

The course aims to:

a. further enhance understanding of simple as well as more complex AC and DC circuit elements and circuits, and their analysis;
b. provide an introduction to signals and signal processing;
c. develop an understanding of the importance of signals as basic elements of systems, with reference to electric circuits;
d. build skills in time and frequency domain analysis of continuous-time signals, and analysis of circuits up to second-order;
e. explain the basis for and develop skills in applying basic transform techniques for continuous-time signals;
f. provide opportunities to gain practical experience in the use of computer simulation, design and analysis tools such as LTSpice.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Apply transform methods to analyse continuous-time linear systems	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
2. Demonstrate an understanding of how signals and linear systems interact	PE2.1, PE2.2, PE1.1, PE1.2, PE1.3, PE3.2, PE3.5
3. Analyse simple and complex electric and magnetic circuits	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
4. Demonstrate an understanding of concepts related to AC analysis	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE3.2, PE3.5, PE1.6

Teaching Strategies

Delivery Mode

The teaching in this course aims to establish a strong fundamental understanding of the areas covered using:

- Formal live lectures (face-to-face and simultaneously streamed via Teams), which focus on the core analytical material in the course, together with qualitative, alternative explanations, worked examples and interactive class discussion to aid your understanding;
- Online forum discussion, online consultation and Moodle-based self-paced exercises;
- Integrated tutorial-labs, which allow for analytical skill development in a practical context and with direct guidance/feedback from course staff;
- Video lecture recordings posted via the Teams page.
- Weekly online quizzes, which are designed to practice the concepts learned in the previous week's lectures.

Learning in this course

You are expected to attend all lectures, tutorial-labs, and mid-term exam in order to maximise learning. You must prepare well for your laboratory classes and your lab work will be assessed. In addition to the lecture notes/video, you should read relevant sections of the recommended text, and attempt the recommended problem sets. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW assumes that signifiant self-directed study of this kind is undertaken in addition to attending live classes throughout the course.

Lectures

Recorded videos of the scheduled face-to-face lectures will be made available after each lecture ends. You should note that watching recordings is not a substitute for actually attending the classes, where live questions can be asked. In particular, note that having access to recorded lectures on its own does not imply improved exam preparation, without significant and consistent additional self-directed study, over a period of time that allows practice of example problems and resolution of conceptual misunderstandings.

Tutorial-Laboratory program

The integrated tutorial-laboratory sessions are designed to help you develop your analytical skills and see how they are applicable in a practical context. You may divide your time between the analytical and the laboratory components as per your convenience but you should complete both within the allocated time. **The analytical problems in tutorial-labs will often be more involved** than the sample problems posted to Moodle or in the recommended textbook (i.e. often more challenging that typical exam questions, and more like assignment questions) and also may combine knowledge/skills from more than one topic.

It is expected that you attempt to solve the sample problems from the lectures, from the problem sheets/questions posted to Moodle and from the recommended textbook before undertaking the tutorial-lab questions, which will usually be more challenging.

The tutorial-laboratory schedule is deliberately designed to provide extended and practical exposure to the concepts conveyed in lectures soon after they are covered in class. You are required to attend

this from Week 1 to Week 10. **Tutorial-laboratory attendance will be kept, and you are expected to attend all of each tutorial-lab**. If you complete the allocated tasks, you may use the time to revise for the course, with the assistance of the tutorial-laboratory demonstrators.

Tutorial-Laboratory Exemption

There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous terms, all students enrolled in this course for Term 3 2022 must complete the tutorial-labs. If, for medical reasons (note that a valid medical certificate must be provided), you are unable to attend a tutorial-lab, you will need to apply for a catch-up lab during another lab time, as agreed by the tutorial-laboratory coordinator.

Additional Course Information

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 (e.g. using eemedia.ee.unsw.edu.au). 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, ELEC3106, ELEC3105, ELEC3114, TELE3113, and other ELEC electives.

Online Resources

- **Microsoft Teams**

Teams (accessed using your University zID) will be used for on-line tutorial-labs, communications with the lab demonstrators and Q&A sessions. Lectures will also be run on Teams and recorded video lectures will be made available to students to support the scheduled lectures.
https://teams.microsoft.com

- **Moodle**

As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. 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).

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Tutorial-Laboratory Assessment	20%		1, 2, 3, 4
2. Mid-semester Exam	25%		1, 2, 3, 4
3. Final Exam	50%		1, 2, 3, 4
4. Weekly Online Quizzes	5%	Not Applicable	1, 2, 3, 4

Assessment 1: Tutorial-Laboratory Assessment

The integrated tutorial-laboratories are primarily to promote active learning, and you are encouraged to bring questions to the classes. The assessment during tutorial-laboratories is designed mainly to check your knowledge as you progress through each stage of the analytical and laboratory 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 laboratory work, it will be assessed by the laboratory demonstrator. You must present your lab book with the analytical solutions and the practical results during this assessment. Tut-lab demonstrators may ask questions to test your knowledge of the analytical and practical 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). **Attendance and participation in at least nine tutorial-laboratory classes, together with completion of the tutorial-laboratory exercises, is a requirement to pass this course.**

Assessment 2: Mid-semester Exam

There will be one mid-term examination, testing your understanding of the principles and your analytical skills through a number of set problems.

Mid-Term Exam:

- Tue 11th October (week 5), 4:00pm - 6:00pm, 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 tutorial-lab)
- All questions must be answered

If for medical reasons (valid medical certificate must be provided) or any other reasons, you are unable to attend the mid-term exam, you may be given an oral examination of approximately 1 hour.

Assessment 3: Final Exam

There will be one final examination, testing your understanding of the principles and your analytical skills through a number of set problems. If for medical reasons (note that a valid medical certificate must be provided to the university) you are unable to attend the final exam, you will be given another exam (either oral or written, at the discretion of the course coordinator).

- The final exam will be 2 hours in duration
- All questions must be answered

The final exam will potentially cover all chapters/topics covered during the term. You must pass this final exam to pass the course.

Assessment 4: Weekly Online Quizzes

Each week starting from around the end of Week 1, an online quiz related to the materials covered in the previous week of the course 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 is one week from the opening date. The duration to complete of each quiz may vary from 30 minutes to 1 hour, depending on the difficulty level. You will have three attempts for each quiz and will receive instant feedback after every attempt. You will be marked on your last attempt. The average mark of the 9 quizzes accounts for the total mark of this assessment (5% of your total course mark).

Attendance Requirements

You are strongly encouraged to attend all classes as well as review lecture recordings, but note in particular that **tutorial-laboratory attendance will be kept, and you are expected to attend all of each tutorial-lab.**

Course Schedule

	Summary of Lecture Program	
	Tuesday **Circuits**	**Friday** **Signals and Transforms**
Week 1	AC circuit analysis, AC circuit theorems, AC network functions	Fourier series
Week 2	AC power analysis	Fourier series
Week 3	AC resonance	Fourier transform
Week 4	Magnetically coupled circuits	Fourier transform
Week 5	**Tuesday 11th October 4pm-6pm [1]** **Mid-term exam**	Laplace transform
Week 6	Flexibility Week	Flexibility Week
Week 7	Transient analysis	Laplace transform
Week 8	Transient analysis	Laplace transform applications
Week 9	Two-port networks	Laplace transform applications
Week 10	Two-port networks	Poles and zeroes

Period	**Summary of Tutorial-Laboratory Program**
Week 1	Tutorial-lab 1: Introduction and AC analysis[2]
Week 2	
Week 3	Tutorial-lab 2: AC Power Analysis and Fourier Analysis I
Week 4	
Week 5	Tutorial-lab 3: AC Power Analysis and Fourier Analysis II
Week 6	
Week 7	Tutorial-lab 4: Transient Analysis and Resonance Circuits
Week 8	
Week 9	Tutorial-lab 5: Magnetically Coupled Circuits
Week 10	

[1] Sydney time

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[2] Because tutorial-laboratories start on Tuesday of Week 1, Tut-Lab 1 will be mainly revision from ELEC1111

Resources

Prescribed Resources

Textbooks

Prescribed textbook

- “Fundamentals of Electric Circuits”, Alexander and Sadiku, McGraw-Hill.

e-book available via https://www.library.unsw.edu.au/

Problem sets issued by lecturing staff will refer to the 6th Edition of this text.

Example 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

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	