

ELEC1111

Electrical Circuit Fundamentals

Summer, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Mr. Hua Chai	hua.chai@unsw.edu.au	By appointment via email	Room 346, Level 3, Electrical Engineering Building (G17)	

Demonstrators

Name	Email	Availability	Location	Phone
Mr. Barry Feng	barry.feng@student.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

Fundamental analogue electrical elements: sources, resistors, capacitors, inductors, diodes; Fundamental DC and AC circuit analysis techniques: Ohm's and Kirchhoff's laws, nodal and mesh analysis, circuit theorems (superposition, source transformation, Thévenin & Norton equivalents), phasors, impedances, AC power; Fundamental DC and AC analogue electrical circuits: resistor-capacitor (RC) and resistor-inductor (RL) circuits, operational amplifiers.

Course Aims

At the end of the course you should be able to:

- Have an overview of what can be achieved with electrical engineering.
- Understand elementary concepts of electrical and telecommunications circuits, and their analysis.
- Be familiar with basic laboratory equipment and techniques to measure electrical quantities.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Systematically analyse DC and AC electrical circuits by deriving and solving equations using circuit laws and theorems	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
2. Obtain the transient and steady state behaviour of a first order circuit	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
3. Apply phasors and sinusoidal steady state analysis to AC circuits	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
4. Apply concepts of DC and AC circuit analysis in circuits with ideal operational amplifiers	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
5. Demonstrate competency in building basic electrical circuits, operate fundamental electrical engineering equipment, work in a laboratory environment and follow work, health and safety (WHS) regulations	PE1.1, PE1.3, PE2.2, PE3.2, PE3.3
6. Evaluate relevant information to design simple engineering systems that use electrical circuits	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE3.2, PE3.3
7. Validate analysis results experimentally and/or using basic simulation software	PE1.1, PE1.3, PE2.2, PE3.3

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered by using pre-recorded lecture videos, interactive lectures which will require student contributions, tutorials which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material and laboratory sessions which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.

Additional Course Information

Contact Hours

- Asynchronous Lectures (Pre-recorded lecture videos): 6 hours every week, starting from Week 1.
- Synchronous Lectures (LEC) (face-to-face): 3 hours every week, starting from Week 1.
- Tutorial-laboratories (TLB) (face-to-face): 6 hours every week, starting from Week 1.
- Workshops (WKS) (face-to-face): 2 hours every week, starting from Week 1.

Workload

ELEC1111 is a 6 UoC course. The expected average workload is approximately **30 hours per week** throughout the 5-week term, including class contact hours (asynchronous lectures, synchronous lectures, workshops and tutorial-laboratories) and self-studying.

Relationship to Other Courses

This is a 1st year course in the School of Electrical Engineering and Telecommunications. It is an introduction to electrical engineering, not only for Electrical and Telecommunications Engineering students, but also for other engineering disciplines across the faculty. It is a pre-requisite for many other courses both in electrical and other engineering schools.

Pre-requisites and Assumed Knowledge

There are no particular pre-requisites for this subject, but it is essential to have physics and mathematics background at high-school level.

Following Courses

This course is a pre-requisite for Circuits and Signals (ELEC2134).

Learning in this course

You are expected to attend all lectures, workshops, tutorial-labs and the mid-term exam in order to maximise learning. You must prepare well for your tutorial-labs. The importance of adequate preparation prior to each tutorial-lab cannot be overemphasized, as the effectiveness and usefulness of the tutorial-lab depends to a large extent on this preparation. You must also prepare well for your workshops. 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. 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.*

- **Asynchronous lectures** ▶ Pre-recorded lecture videos provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding; The pre-recorded lectures form the core of this subject. Topics presented in the

pre-recorded lectures will generally be followed by detailed examples to equip students with analytical and problem-solving skills in the area of circuit analysis. Detailed explanations of the topics will be available to students in the form of lecture slides.

- **Synchronous Lectures** ▶ Lectures are interactive and require student input. These sessions will be held in the scheduled lecture times where the key material and examples presented in the lecture videos will be revised and problems solved in a group setting. Students will also be provided the opportunity to ask questions about concepts that need clarification. 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. Note that having access to recorded lectures does not imply improved exam preparation, without significant and consistent additional self-directed study through the term.
- **Workshops (WKS)** ▶ These two-hour sessions will run as problem-solving sessions, where problems will be solved collectively. The tutors will mentor the students to solve the questions correctly.
- **Tutorial-laboratory sessions (TLB)** ▶ The tutorial-laboratory schedule is deliberately designed to provide practical, hands-on exposure to the concepts conveyed in lectures soon after they are covered in class. The tutorial-labs are an integral part of learning in this course as they allow you to, first, analyse circuits based on what was explained in the lecture (tutorial part of tutorial-lab), and then, build/configure, measure, and observe in real life the previously analysed circuits (laboratory part of tutorial-lab). You are expected to attend all tutorial-labs, and the lab exam. You must prepare well for your tutorial-lab classes as your work will be assessed during each session.

NOTE: *There is no laboratory exemption for this course.* Regardless of whether equivalent tutorial-labs have been completed in previous terms, all students enrolled in this course must take 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 tutorial-lab, as agreed with the laboratory coordinator.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Weekly Online Quizzes	10%	Not Applicable	1, 2, 3, 4, 6
2. Tutorial-laboratory Assessment and Exam	25%	Not Applicable	1, 4, 5, 7
3. Midterm Exam (In-person)	20%	19/01/2023	1, 2, 3, 6
4. Final Exam (In-person)	45%	As per final exam timetable	1, 2, 3, 4, 6

Assessment 1: Weekly Online Quizzes

Weekly Online Quizzes through Moodle.

Each week starting from Week 1, there will be online quizzes related to the materials covered in the corresponding lecture. The average mark of the 9 quizzes accounts for the total mark of this assignment.

Assessment 2: Tutorial-laboratory Assessment and Exam

Tutorial-laboratory Assessment

The tutorial-laboratory assessment is designed to check your knowledge as you progress through each stage of the laboratory tasks.

NOTE: Students MUST upload the completed work health and safety (WHS) form to the submission page provided on Moodle before attending the first practical laboratory session in order to be assessed.

The tutorial-laboratory assessment comprises of two parts:

1. Tutorial questions. These are questions that **must be completed** during the first part of the tutorial-lab. While they will not be marked, answers are required to complete the lab experiment, so you need to attend the whole tutorial-lab (both tutorial and experimental part) to be marked for it.
2. Lab experiments. The experimental part **must be completed** in the second half of the tutorial-lab session and will be marked in-class. The tutorial-laboratory assessment accounts for 15% of the total course mark out of the 25% allocated mark.

Laboratory Exam

In Week 4, after the first 6 tutorial-labs have been completed, a practical exam will take place to check whether you have achieved the practical learning outcomes for the course. The exam will be based on what you have learned in your tutorial-lab classes and the applied theory from lectures. Marks will be awarded for the correct understanding of practical and relevant theoretical concepts, correct operation of laboratory equipment, and correct interpretation of measured results. The lab exam accounts for 10% of your total course mark out of the 25% allocated mark.

Hurdle requirement

You MUST attend at least 6 out of the 7 tutorial-labs plus the introductory lab AND pass the tutorial laboratory assessment AND pass the lab exam to pass the course. A satisfactory performance in the tutorial-lab assessment and the lab exam is a necessary requirement to pass this course. This means that even if you score 100% on the examinations and on the quizzes, you will not pass the course if your overall mark for tutorial-lab assessment and the lab exam is not satisfactory.

Assessment 3: Midterm Exam (In-person)

Start date: 19/01/2023

Due date: 19/01/2023

There will be an in-person invigilated exam scheduled in **Week 3 (19 Jan 2023)**, which tests your general understanding of the course material. It is designed to give you feedback on your progress through the analytical components of the course. Questions may be drawn from any material already covered in the course schedule. Marks will be assigned according to the correctness of the responses.

Assessment 4: Final Exam (In-person)

Start date: As per final exam timetable

Due date: As per final exam timetable

The final examination tests analytical and critical thinking and general understanding of the course material. Questions may be drawn from any aspect of the course that has been presented in lectures, tutorial-labs and/or workshops, unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses.

Hurdle requirement

You MUST achieve a minimum of 40 marks out of 100 in the final exam to pass the course.

Attendance Requirements

Please note students enrolled are required to attend all the in-person lectures/workshops/laboratories and exams as scheduled from the beginning of the summer term (i.e., 3rd January 2023). Given that the course will be running for five weeks only, you may consider dropping the course if you are unable to attend the following scheduled sessions. It would be unlikely to offer alternative times for the course assessments due to the limited timeframe of the summer term. You must contact the course authority in writing to make alternative arrangements with supporting documents provided for classes missed.

Course Schedule

Week	Lectures	Workshops	Tutorial-labs	Quizzes
Week 1 3 Jan - 6 Jan	Introduction, circuit basics, basic elements Kirchhoff's laws, nodal and mesh	Workshop 1 & 2	TLB 1 & 2	Quiz 1 & 2
Week 2 9 Jan - 13 Jan	Circuit theorems Capacitors and RC circuits	Workshop 3 & 4	TLB 3 & 4	Quiz 3 & 4
Week 3 16 Jan - 20 Jan	Inductors and RL circuits Mid-term exam (19 Jan)	Workshop 5	TLB 5	Quiz 5
Week 4* 23 Jan - 27 Jan	Operational amplifiers	Workshop 6	TLB 6 Lab exam	Quiz 6
Week 5 30 Jan - 3 Feb	AC analysis AC power	Workshop 7 & 8	TLB 7	Quiz 7 & 8 & 9

* Week 4 Thursday, 26 January - Public Holiday

Resources

Prescribed Resources

Textbooks

Prescribed textbook

- C. K. Alexander and M. N. O. Sadiku, *Fundamentals of Electric Circuits*, 7th ed., New York, NY, USA: McGraw-Hill, 2021.

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

Other reference books

- R. C. Dorf and J. A. Svoboda, *Introduction to Electric Circuits*, 9th ed., Hoboken, NJ: John Wiley and Sons, 2013.
- J. D. Irwin and R. M. Nelms, *Basic Engineering Circuit Analysis*, 11th ed., Hoboken, NJ: John Wiley and Sons, 2015.

On-line resources

Moodle

As a part of the teaching component, the online teaching and learning management system known as Moodle will be used to disseminate teaching materials and host forums. As the course progresses, students' marks from assessments such as labs and the quizzes will also be made available via Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>.

Simulation

Students are **strongly encouraged to familiarise** themselves with simulation tools, as well as measuring and interpreting results of simulations.

There are several simulation programs that can be used not only for this course, but also for the rest of your Electrical Engineering degree. One online simulation platform is a browser-based applet for simulation of electric circuits available at <http://www.falstad.com/circuit>. It is a simple-to-use and easy-to-understand online application that allows you to simulate simple electric circuits. It is also very simple to share cases and simulations with others. For those of you looking for a more sophisticated software to perform simulations, you can refer to MATLAB and Simulink: <https://au.mathworks.com>, LabVIEW: <https://www.ni.com/en-au/shop/labview.html>, OrCAD PSpice Designer: <http://www.orcad.com/products/orcad-pspice-designer/overview>, and Quite Universal Circuit Simulator: <http://qucs.sourceforge.net>. PSpice, MATLAB, and LabVIEW are most commonly used programming software in Electrical Engineering, which are worth learning at early stages in your degree.

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, 2022 in response to previous feedback include:

- New weekly problem-solving sessions run during workshop time (previously, problem-solving was only done in the lecture, which allowed a very limited number of problems to be completed).
- Tutorial-laboratories running in the same 3-hour session (rather than running the tutorial part and laboratory part in different sessions). With the tutorial-labs, students will have the possibility to design and implement the rear lights of a car, power a fan using a solar panel or design and implement a doorbell and an equaliser, among other practical applications, all in the same session (so that theoretical results are fresh for the experimental part).
- New introductory laboratory in Week 1. This will be run as a demonstration session so that the first assessed tutorial-laboratory is easier to complete in the given time.

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	