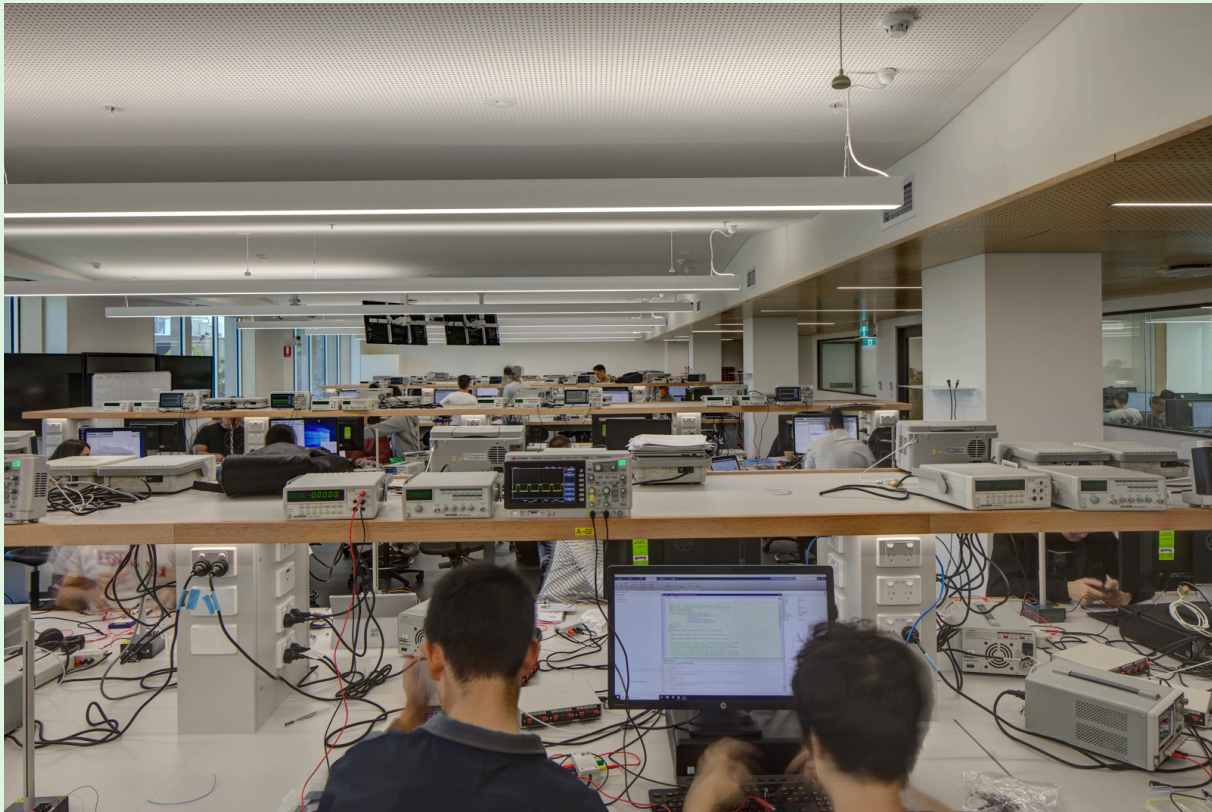


ELEC1111

Electrical Circuit Fundamentals

Term 1, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Dr. Inmaculada (Inma) Tomeo-Reyes	i.tomeo-reyes@unsw.edu.au	By appointment via email	Electrical Engineering Building (G17), Level 4, Room 444	+61 2 9385 4933

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

Can you imagine your life without electricity, computers or mobile phones? Circuits are all around us. Electrical engineers are most commonly associated with the development of circuits, but they are not the only ones who know about or work with circuits. All engineers need to have a basic understanding of the relationship between electricity, electrical energy, electronic instrumentation and measurements. Mechanical engineers use circuits, for example, when designing motors or controls for spacecrafts. Robotics are usually considered a Computer Science specialty, but it is hard to imagine doing anything in robotics without considerable knowledge of electrical circuits. ELEC1111 is an introductory course in Electrical Engineering, which provides an introduction to fundamental electrical elements and circuits, as well as the technical skills to analyse such circuits.

Syllabus

- 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 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

Learning Outcome	EA Stage 1 Competencies
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:

- Formal lectures, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding.
- Tutorials, which allow for exercises in problem solving and allow time for you to resolve problems in understanding of lecture material and laboratory content.
- Laboratory sessions, which support the formal lecture and tutorial material and provide you with practical construction, measurement and debugging skills.

Additional Course Information

Contact Hours

- Lectures (LEC) (online): 4 hours every week, starting from Week 1.
- Tutorials (WKS) (choice of face-to-face or online):
 - Class tutorials: 2 hours every week, starting from Week 2.
 - Independent tutorials: to complete at your own pace, starting from Week 1.
- Laboratory Experiments (TLB/LAB) (choice of face-to-face or online): 2 hours every week, starting from Week 2.

Workload

ELEC1111 is a 6 UoC course. The expected average workload is approximately **15 hours per week** throughout the 10-week term, including class contact hours (lectures, class tutorial and 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, tutorials, labs, and the mid-term exam in order to maximise learning. You must prepare well for your tutorial classes. The importance of adequate preparation prior to each tutorial cannot be overemphasized, as the effectiveness and usefulness of the tutorial depends to a large extent on this preparation. You must also prepare well for your laboratory classes, as you will be tested for this preparation at the beginning of each lab session. 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.*

- **Lectures** ▶ Lectures are interactive and require student input. Recorded lecture videos will be made available to students after the scheduled online lecture has concluded. Students should note that watching recordings is no substitute for attending the online classes, 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.
- **Tutorials** ▶ Two modes of tutorials will be provided in ELEC1111.
 1. *Class tutorials (labelled WKS in timetable)*: In these two-hour sessions, students will solve the given problems by applying their learnings from the lectures. The tutors will mentor the students to solve the questions correctly. It is important to note that tutorial problems are directly related to the laboratories, so it is essential to attend the tutorials in order to be able to fully understand the laboratories (i.e., you can consider class tutorials as pre-laboratories).
 2. *Independent tutorials*: These are pre-recorded solutions of typical tutorial questions, that you can watch at your own pace. It is strongly encouraged that you attempt to solve the questions of these tutorials before watching the videos to observe the methods and theory used in each question. The format of the videos is typically 3 - 5 minutes long, which is a lot more concentrated than a normal tutorial class. It is expected that you spend at least one hour per week on solving and watching these tutorials.
- **Laboratory sessions (labelled TLB or LAB in timetable)** ▶ The 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 laboratories are an integral part of learning in this course as they allow you to build/configure circuits, measure, and observe in real life the theory of the lectures. You are expected to attend all labs, and the lab exam. You must prepare well for your laboratory classes as your lab work will be assessed during each lab session.

NOTE: 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 must take the labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, you will need to apply for a catch-up lab during another lab time, as agreed by the laboratory coordinator.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online Quizzes	15%	Not Applicable	1, 2, 3, 4, 6
2. Laboratory Assessment and Exam	20%	Not Applicable	1, 4, 5, 7
3. Midterm Exam	20%	18/03/2022	1, 2, 3, 6
4. Final Exam	45%	As per final exam timetable	1, 2, 3, 4, 6

Assessment 1: Online Quizzes

Weekly Online Quizzes through Moodle.

Each week **starting from Week 1**, there will be one an online quiz related to the materials covered in the corresponding lecture. Quizzes have **an individual and a group component**. The average mark of the 8 quizzes accounts for the total mark of this assignment.

Assessment 2: Laboratory Assessment and Exam

Laboratory Assessment

The 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 laboratory assessment comprises of two parts:

1. Pre-lab questions (25%). These are questions that must be completed during the class tutorial before you attend each of the lab sessions.
2. Lab experiments (75%). The experimental part must be completed within the allocated 2 hours of each lab session.

The laboratory assessment accounts for 10% of the total course mark out of the 20% allocated mark.

Laboratory Exam

In **Week 8**, after the first 5 lab experiments 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 laboratory classes and the applied theory from lectures and tutorials. 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 20% allocated mark.

Hurdle requirement

You **MUST** attend at least 6 out of the 7 lab experiments **AND** pass the laboratory assessment **AND** pass the lab exam to pass the course. A satisfactory performance in lab assessments 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 lab assessments and the lab exam is not satisfactory.

Assessment 3: Midterm Exam

Start date: 18/03/2022

Due date: 18/03/2022

There will be an exam scheduled in **Week 5**, 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

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, tutorials and/or laboratories, 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

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

Course Schedule

Indicative Lecture Schedule

Period	Summary of Lecture Program
Week 1	Introduction, Circuit Basics, Ohm's law, Sources and Diodes
Week 2	Kirchhoff's laws, Series & Parallel, Nodal and Mesh Analysis
Week 3	Circuit Theorems (Superposition, Thevenin, Norton, Source Transformation)
Week 4	Capacitors and Resistor-Capacitor (RC) Circuits
Week 5	Inductors and Resistor-Inductor (RL) Circuits, Mid-term exam
Week 6	<i>Flexibility Week</i>
Week 7	Operational Amplifiers (Op Amps)
Week 8	AC Analysis I - Phasor and Impedance
Week 9	AC Analysis II - Circuit Theorems and AC Op Amps
Week 10	AC Power

Indicative Laboratory Schedule

Period	Summary of Laboratory Program
Week 2	Lab/Experiment 1: Familiarization with Laboratory Equipment
Week 3	Lab/Experiment 2: Basic Elements
Week 4	Lab/Experiment 3: V-I Characteristics & Basic Laws
Week 5	Lab/Experiment 4: Circuit Theorems
Week 6	<i>Flexibility Week - Open and Catch-up Laboratories</i>
Week 7	Lab/Experiment 5: First-order Circuits
Week 8	Lab exam
Week 9	Lab/Experiment 6: Operational Amplifiers (Op Amps)
Week 10	Lab/Experiment 7: AC Circuits

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 1, 2022 in response to previous feedback include:

- Completely new tutorials and laboratories designed so that they are more relevant to each other and focused on real-world applications. With the new tutorials and laboratories, 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.
- Improvement of quizzes so that feedback is released right after the due date. Multiple attempts allowed for individual quiz.

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>

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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	