ELEC1111

Electrical Circuit Fundamentals

Term 1, 2023
Course Overview

Staff Contact Details

Convenors

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Inmaculada (Inma) Tomeo-Reyes</td>
<td><a href="mailto:i.tomeo-reyes@unsw.edu.au">i.tomeo-reyes@unsw.edu.au</a></td>
<td>CONTENT-RELATED SUPPORT: By appointment via email</td>
<td>Room 414, Level 4, Electrical Engineering Building (G17)</td>
<td>Via Teams</td>
</tr>
<tr>
<td>Dr. Felipe Arraño-Vargas</td>
<td><a href="mailto:f.arranovargas@unsw.edu.au">f.arranovargas@unsw.edu.au</a></td>
<td>COURSE-RELATED QUERIES: Via email</td>
<td>Room 323, Level 3, Tyree Energy Technologies Building (H6)</td>
<td>Via Teams</td>
</tr>
</tbody>
</table>

Lab Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEC1111 Tutorial-Lab (TLB) Queries Team</td>
<td><a href="mailto:ELEC1111_TLB_queries@unsw.edu.au">ELEC1111_TLB_queries@unsw.edu.au</a></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Systematically analyse DC and AC electrical circuits by deriving and solving</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>equations using circuit laws and theorems</td>
<td></td>
</tr>
<tr>
<td>2. Obtain the transient and steady state behaviour of a first order circuit</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>3. Apply phasors and sinusoidal steady state analysis to AC circuits</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>4. Apply concepts of DC and AC circuit analysis in circuits with ideal</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>operational amplifiers</td>
<td></td>
</tr>
</tbody>
</table>
Learning Outcome

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Demonstrate competency in building basic electrical circuits, operate</td>
<td>PE1.1, PE1.3, PE2.2, PE3.2, PE3.3</td>
</tr>
<tr>
<td>fundamental electrical engineering equipment, work in a laboratory environment</td>
<td></td>
</tr>
<tr>
<td>and follow work, health and safety (WHS) regulations</td>
<td></td>
</tr>
<tr>
<td>6. Evaluate relevant information to design simple engineering systems that use</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE3.2,</td>
</tr>
<tr>
<td>electrical circuits</td>
<td></td>
</tr>
<tr>
<td>7. Validate analysis results experimentally and/or using basic simulation software</td>
<td>PE1.1, PE1.3, PE2.2, PE3.3</td>
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</tbody>
</table>

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered by using (1) formal lectures, which are interactive lectures which will require student contributions; (2) workshops, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material; and (3) tutorial-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

- Lectures (LEC) (hybrid): 4 hours every week, starting from Week 1.
- Tutorial-laboratories (TLB) (choice of face-to-face or online): 3 hours every week, starting from Week 1.
- Workshops (WKS) (hybrid): 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, 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 overemphasised, 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.*

- **Lectures**  ► Lectures are interactive and require student input. 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.

- **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.

If you have any questions regarding your tutorial-laboratory session allocation, please send an email to: ELEC1111_TLB_queries@unsw.edu.au
Assessment

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Course Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Weekly Online Quizzes</td>
<td>10%</td>
<td>Not Applicable</td>
<td>1, 2, 3, 4, 6</td>
</tr>
<tr>
<td>2. Tutorial-laboratory Assessment and Exam</td>
<td>25%</td>
<td>Not Applicable</td>
<td>1, 4, 5, 7</td>
</tr>
<tr>
<td>3. Midterm Exam</td>
<td>20%</td>
<td>17/03/2023</td>
<td>1, 2, 3, 6</td>
</tr>
<tr>
<td>4. Final Exam</td>
<td>45%</td>
<td>As per final exam timetable</td>
<td>1, 2, 3, 4, 6</td>
</tr>
</tbody>
</table>

**Assessment 1: Weekly Online Quizzes**

Weekly Online Quizzes through Moodle

Each week starting from Week 1, there will be an online quiz related to the materials covered in the corresponding topic. 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 safely (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 9**, 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

Start date: 17/03/2023
Due date: 17/03/2023

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, 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

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

## Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Lectures</th>
<th>Workshops</th>
<th>Tutorial-labs</th>
<th>Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Introduction, circuit basics, basic elements</td>
<td></td>
<td>Introductory lab</td>
<td>Quiz 1</td>
</tr>
<tr>
<td>Week 2</td>
<td>Kirchhoff's laws, nodal and mesh</td>
<td>Workshop 1</td>
<td>Tutorial-lab 1</td>
<td>Quiz 2</td>
</tr>
<tr>
<td>Week 3</td>
<td>Circuit theorems</td>
<td>Workshop 2</td>
<td>Tutorial-lab 2</td>
<td>Quiz 3</td>
</tr>
<tr>
<td>Week 4</td>
<td>Capacitors and RC circuits</td>
<td>Workshop 3</td>
<td>Tutorial-lab 3</td>
<td>Quiz 4</td>
</tr>
<tr>
<td>Week 5</td>
<td>Inductors and RL circuits, Mid-term exam</td>
<td>Workshop 4</td>
<td>Tutorial-lab 4</td>
<td>Quiz 5</td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
<td>Open labs</td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td>Operational amplifiers</td>
<td>Workshop 5</td>
<td>Tutorial-lab 5</td>
<td>Quiz 6</td>
</tr>
<tr>
<td>Week 8</td>
<td>AC analysis I</td>
<td>Workshop 6</td>
<td>Tutorial-lab 6</td>
<td>Quiz 7</td>
</tr>
<tr>
<td>Week 9</td>
<td>AC analysis II</td>
<td>Workshop 7</td>
<td>Lab exam</td>
<td>Quiz 8</td>
</tr>
<tr>
<td>Week 10</td>
<td>AC power</td>
<td>Workshop 8</td>
<td>Tutorial-lab 7</td>
<td>Quiz 9</td>
</tr>
</tbody>
</table>
Resources

Prescribed Resources

Textbooks

Prescribed textbook


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

Other reference books


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, 2023 in response to previous feedback include:

- Increased demonstrator-to-student ratio to reduce waiting time during tutorial-labs.
- More structured tutorial-lab sessions - Analytical part will run in an hour and experimental part will run in two hours (rather than keeping timing flexible, which may lead to inconsistencies). 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).
- Well-established 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 (this was a trial in Term 3, 2022 and received very positive feedback).
- Infinite attempts allowed for quizzes AND right/wrong feedback per attempt (on top of detailed sample solution after quiz is due, which was already existing).
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. 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


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

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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

<table>
<thead>
<tr>
<th>Program Intended Learning Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Knowledge and skill base</td>
</tr>
<tr>
<td>PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</td>
</tr>
<tr>
<td>PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</td>
</tr>
<tr>
<td>PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline</td>
</tr>
<tr>
<td>PE1.4 Discernment of knowledge development and research directions within the engineering discipline</td>
</tr>
<tr>
<td>PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline</td>
</tr>
<tr>
<td>PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline</td>
</tr>
<tr>
<td>Engineering application ability</td>
</tr>
<tr>
<td>PE2.1 Application of established engineering methods to complex engineering problem solving</td>
</tr>
<tr>
<td>PE2.2 Fluent application of engineering techniques, tools and resources</td>
</tr>
<tr>
<td>PE2.3 Application of systematic engineering synthesis and design processes</td>
</tr>
<tr>
<td>PE2.4 Application of systematic approaches to the conduct and management of engineering projects</td>
</tr>
<tr>
<td>Professional and personal attributes</td>
</tr>
<tr>
<td>PE3.1 Ethical conduct and professional accountability</td>
</tr>
<tr>
<td>PE3.2 Effective oral and written communication in professional and lay domains</td>
</tr>
<tr>
<td>PE3.3 Creative, innovative and pro-active demeanour</td>
</tr>
<tr>
<td>PE3.4 Professional use and management of information</td>
</tr>
<tr>
<td>PE3.5 Orderly management of self, and professional conduct</td>
</tr>
<tr>
<td>PE3.6 Effective team membership and team leadership</td>
</tr>
</tbody>
</table>