# ELEC 1111 - Electric Circuits

Course Outline – Summer Semester 2016

Never Stand Still | Faculty of Engineering | School of Electrical Engineering and Telecommunications

## Course Staff


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**Consultations:** You are encouraged to ask questions on the course material, after the lecture class times in the first instance, rather than via email. You can also post questions in the Moodle discussion forums. **ALL** email enquiries should be made from your student email address with "ELEC1111" in the subject line, otherwise they will not be answered.

Consultation times for the course are: **Monday, Wednesday &Friday, 3:30 pm to 4:30 Pm.**

**Keeping Informed:** The main announcements regarding the course and its assignments will be made through Moodle https://moodle.telt.unsw.edu.au/login/index.php. Announcements may also be made during classes but everything will be formally announced in the relevant sections of Moodle.

Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

## Course Summary

### Contact Hours

The summer session officially runs over two periods:

- Period A from 28-11-2016 to 16-12-2016
- Period B from 3-01-2017 to 13-02-2017.

| Session | Day | Time | Location |
|---|---|---|---|
| Introduction | 2 December 2017 | 9am-12pm | Chem Sci M11 |
| Lectures | Pre-recorded lecture videos | | |
| Tutorials | See detailed Schedule below | | Chem Sci M11 , TETB LG03 |
| Laboratories | See detailed Schedule below | | EE 113-114 |

## Context and Aims

ELEC1111 is an introductory course in Electrical Engineering, providing an introduction to simple electrical circuits as well as the technical skills to analyse such simple circuits. It is a course suitable for students pursuing further studies in electrical or telecommunications engineering as well as some other related Engineering disciplines including computer engineering. In the practical section, it provides hands-on experience in building and testing circuits. It is packaged in such a way that students, having taken this course, can go away and build and analyse some practical, useful devices afterwards.

It is a pre-requisite for the subsequent course on Circuits and Signals.

The aims of the course are to:

- Provide students with practical design experience.
- Ensure the students' design skills are adequate and to the level desirable for a professional Engineer.
- Give the students the opportunity to improve their design skill base and engineering practice skills required by professional engineers.

## Indicative Lecture Schedule

| Period | Summary of Lecture Program |
|---|---|
| Week 1 | Introduction, Circuit Basics Overview, Lab Safety & Kirchhoff's laws. |
| Week 2 | Power & Energy, Series & Parallel, Node Equations & Circuit analysis |
| Week 3 | Thevenin, Superposition Theorems, Circuit analysis |
| Week 4 | Inductors, Capacitors ands First Order Circuits |
| Week 5 | Operational Amplifiers, Phasors, Sinusoidals, Sinusoidal Steady State Analysis |
| Week 6 | Sinusoidal Steady State Analysis, AC analysis |
| Week 7 | AC Power & AC Operational Amplifiers |
| Week 8 | Digital Logic |

## Indicative Lab Schedule

| Period | Summary of Lab Program |
|---|---|
| Lab 1 | Laboratory introduction and administration. Safety issues. Familiarization with laboratory equipment |
| Lab 2 | Circuit construction and Kirchhoff's laws |
| Lab 3 | Series and parallel circuits |
| Lab 4 | Network theorems |
| Lab 5 | RC transients |
| Lab 6 | Operational amplifiers |
| Lab 7 | Digital logic circuits / Power & Energy |
| Lab 8 | Digital logic circuits / Power & Energy |

## Analytical Timetable

### Tutorials

| Date | Time | Location |
|---|---|---|
| 9 December 2016 | 10am-12pm | Chemical Sciences Mezzanine M11 |
| 12 December 2016 | 10am-12pm | Chemical Sciences Mezzanine M11 |
| 14 December 2016 | 10am-12pm | Chemical Sciences Mezzanine M11 |
| 16 December 2016 | 10am-12pm | Chemical Sciences Mezzanine M11 |
| 4 January 2017 | 10am-12pm | TETB LG03 |
| 6 January 2017 | 10am-12pm | TETB LG03 |
| 13 January 2017 | 10am-12pm | TETB LG03 |
| 16 January 2017 | 10am-12pm | TETB LG03 |
| 20 January 2017 | 10am-12pm | TETB LG03 |
| 23 January 2017 | 10am-12pm | TETB LG03 |

### Laboratories

| Date | Time | Location |
|---|---|---|
| 9 January 2017 | 1pm-3pm | EE113 |
| 13 January 2017 | 1pm-3pm | EE113 |
| 16 January 2017 | 1pm-3pm | EE113 |
| 18 January 2017 | 1pm-3pm | EE113 |
| 20 January 2017 | 1pm-3pm | EE113 |
| 23 January 2017 | 1pm-3pm | EE113 |
| 27 January 2017 | 10am - 12pm | EE113 |
| 27 January 2017 | 1pm-3pm | EE113 |

### Assessment

| | |
|---|---|
| Mid-term Exam | 15% |
| Mid-term Peer-Review | 5% |
| Laboratory Reports | 15% |
| Lab Exam | 5% |
| Final Exam | 60% |
| Completion Badges | 3% (Bonus) |

# Course Details

## Credits

ELEC1111 is 6 UOC course. The expected average workload is approximately **16-20 hours per week** during the summer session.

## Relationship to Other Courses

This course is an introduction to electrical engineering for both Electrical and Telecommunications Engineering students and engineers in general 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 pre-requites for this subject but it would be helpful to have a physics and mathematics background at high school level.

## Learning outcomes

After successful completion of this course, you should be able to:

**LO1**: Systematically analyse ac and dc electric circuits by deriving and solving its equations using Kirchhoff's laws and circuit theorems.
**LO2**: Obtain the steady state and transient behavior of a first order circuit.
**LO3**: Demonstrate a basic understanding of phasors and phasor diagrams for ac circuit analysis.
**LO4**: Apply sinusoidal steady state analysis to ac circuits and distinguish between ac power definitions.
**LO5**: Apply concepts of circuit analysis in circuits with ideal operational amplifiers and ideal transformers.
**LO6**: Demonstrate basic proficiency in building basic electric circuits, operate fundamental electrical engineering equipment, work in a laboratory environment and follow OH&S regulations.
**LO7**: Perform basic simulations of dc and ac circuits using appropriate software.

The course delivery methods and course content address a number of core UNSW graduate attributes; these include:

- The capacity for analytical and critical thinking and for creative problem solving.
- The ability to engage in independent and reflective learning.
- Information Literacy – the skills to locate evaluate and use relevant information.
- The capacity for enterprise, initiative and creativity.
- The skills of effective communication.

This course is designed to provide the above learning outcomes which arise from targeted graduate capabilities listed in **Appendix A.** The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities **(listed in Appendix B)**. This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in **Appendix C**.

# Teaching Strategies

## Delivery Mode

The teaching strategies employed in this course are different, in so far as the lectures will not be face-to-face, but provided as pre-recorded videos available for online download. The lectures have been recorded by Dr Jayashri Ravishankar in the running of ELEC1111 in S2 2010. Additional lecture videos in the form of small modules will be provided, recorded by Dr Ray Eaton.

The teaching in this course aims at establishing a good fundamental understanding of the areas covered by using the lecture material, 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.

## Lectures

The entire course will be delivered in a new mode of teaching, using pre-recorded video lecture presentations. You will need to watch these video lectures in your own time before the tutorials and labs. With video recordings:

- You will be able to watch them at your own pace.
- You can revisit the lecture content as many times as you like.
- Things that you might miss in a normal live lecture (e.g. difficult mathematical concepts) are available on the recording.

Note that not all video recordings will be released at once. Upon downloading and viewing a set of lectures, students will be required to undertake a small quiz on Moodle to gain feedback on their understanding. These quizzes ARE assessable and WILL contribute to your final grade. They are to ensure that students are viewing the lecture recordings.

## Tutorials

Students are required to attend the tutorials as specified in the Contact hours. There are two components of the tutorial program:

- Sets of problems are provided to give the student personal practice in solution and understanding. These problems will be related to recent lecture material with an emphasis on the basic concepts.
- Demonstrations of important problem solving techniques by tutors.
- Occasional quizzes will be held during the tutorial periods to allow the students to assess their own progress in the course.

## Laboratories

Students are required to attend the laboratories as outlined in the Contact hours.

# Assessment [1]

You are expected to view all lectures, and attend all tutorials, labs and quizzes, in order to maximize learning. It is important to prepare your tutorial questions in advance of attending the tutorial classes. You must prepare well for your laboratory classes, and will be tested on this preparation at the beginning of each lab exercise. In addition to the lecture notes, you should read relevant sections of the recommended text. Reading additional texts would further enhance your learning experience. *Group learning is also encouraged*.

## Laboratory Exam

After completing each experiment, your work will be assessed by the laboratory demonstrator. After all labs have been completed, a practical test will be run. You have to attend at least 80% of the labs **AND** attain a pass assessment in labs **AND** pass the lab test to pass the course. Students must hand in a signed safety form before starting the practical laboratory component. If a student attends laboratory sessions without having submitted a signed safety form the marks for those labs will be zero.

A satisfactory performance in the laboratory component is a necessary requirement to pass this course. This means that even if you score 100% on the final written examination and on the quizzes, you will not pass the course if your laboratory assessment is not satisfactory.

In Summary to pass the laboratory component and therefore the course you MUST do all of the following:

- Hand in a signed Safety Form.
- Attend all of the lab classes including the lab test (or have handed in medical certificates)
- Obtain a pass mark average for the laboratory experiments.
- Pass the Lab Exam.

## Mid-session test

There will be a 1 hour quiz during session as scheduled above. *Repeat students are NOT exempt from these tests.*

## Final Exam

The final exam will be a closed book exam 3 hour for ELEC1111. In principle, the examination may cover any aspect of the course that has been presented in lectures, tutorials and/or laboratories.

There are **no supplementary exams** for ELEC/TELE courses that run over the summer semester.

## Submission of Assessment Tasks

Assessment tasks will be submitted via the Moodle page of the course.

[1] For all class assessment tasks (i.e. Laboratories and mid-term, if the student is unable to attend for medical or other serious reasons, the student must present medical certificates and/or other documentation within 3 days of the assessment to the lecturer in charge. If this is not done within the required time period then no consideration will be given. In the case of missing a quiz/test for one of the reasons above, the assessment will be carried over to the final exam ie the final exam will become a higher % of the assessment.

## Relationship of Assessment Methods to Learning Outcomes

| | Learning Outcomes | | | | | | |
|---|---|---|---|---|---|---|---|
| | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 |
| Laboratory practical assessments | ✓ | | | | | ✓ | ✓ |
| Lab exam | ✓ | | | | | ✓ | |
| Mid-semester exam | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Final exam | ✓ | ✓ | ✓ | ✓ | ✓ | | |

# Course Resources

## On-line resources

### Moodle

As a part of the teaching component, Moodle will also be used. Lab assessment marks will also be available via Moodle https://moodle.telt.unsw.edu.au/login/index.php. As the course progresses, students' marks from assessments such as labs and the quizzes are available for personal viewing on this website.

## Textbooks

### Prescribed textbook

Recommended Text(s): For those proposing to continue in Electrical & Telecommunications engineering:

[1] Fundamentals of Electric Circuits, Alexander & Sadiku ed. 6, *McGraw Hill.* (This is also the new text for 2nd year EE.)

For those proposing to follow other areas

[2] Electrical Engineering Principles and Applications" Allan R Hambley, *Prentice Hall.*

### Further Text(s) and Reference(s)

The reference books provide further reading in electrical engineering as well as a detailed treatment of circuit theory and digital circuits.

[3] L.S. Bobrow, Elementary Linear Circuit Analysis, Oxford, 1987 [P621.3192/106]. This was the previous text for this course and also for ELEC2031.

[4] A.S. Sedra and K.C. Smith, Microelectronic Circuits, 4th Edition, Oxford, 1998 [P621.3815/292]. This book is the text for ELEC3006 but is useful because small signal analysis of micro-electronic circuits is a major source of application of linear circuit theory.

[56] R.L. Boylestad, Introductory Circuit Analysis, 9th Edition, Prentice-Hall, 2000 [PQ621.3815/198].

[6] J.R. Cogdell, Foundations of Electrical Engineering, 2nd Edition, Prentice Hall, 1990 [P621.3/198].

# Other Matters

## 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.

## Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/guide , and particular attention is drawn to the following:

## Workload

It is expected that you will spend at least sixteen to twenty hours per week studying a 6 UoC course over the summer semester, from Week 1 until the final assessment, including both face-to-face classes and independent, self-directed study. In periods where you need to 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.

## 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.

## 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 should seek assistance early if you suffer illness or misadventure which affects your course progress. All applications for special consideration must be lodged online through myUNSW within 3 working days of the assessment, not to course or school staff. For more detail, consult:
https://student.unsw.edu.au/special-consideration.

## Continual Course Improvement

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 Course and Teaching Evaluation and Improvement Process. 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.

## Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrollment, rights, and general expectations of students, please refer to the School and UNSW policies:
https://www.engineering.unsw.edu.au/electrical-engineering/resources/undergraduate-resources/policies-and-procedures
https://student.unsw.edu.au/guide

# Appendices

## Appendix A: Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning.

## Appendix B: UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows <select those which apply (maybe 3-5) and adapt to suit course>:

- Developing scholars who have a deep understanding of their discipline, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through assignment work.
- Developing ethical practitioners who are collaborative and effective team workers, through group activities, seminars and tutorials.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
- Developing citizens who can apply their discipline in other contexts, are culturally aware and environmentally responsible, through interdisciplinary tasks, seminars and group activities.

## Appendix C: Engineers Australia (EA) Professional Engineer Competency Standard

| | Program Intended Learning Outcomes | |
|---|---|---|
| PE1: Knowledge and Skill Base | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals | ✓ |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing | ✓ |
| | PE1.3 In-depth understanding of specialist bodies of knowledge | ✓ |
| | PE1.4 Discernment of knowledge development and research directions | |
| | PE1.5 Knowledge of engineering design practice | |
| | PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice | |
| PE2: Engineering Application Ability | PE2.1 Application of established engineering methods to complex problem solving | ✓ |
| | 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 | |
| PE3: Professional and Personal Attributes | PE3.1 Ethical conduct and professional accountability | ✓ |
| | PE3.2 Effective oral and written communication (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 | |