



School of Electrical Engineering & Telecommunications

Faculty of Engineering

ELEC 1112

Electrical Circuits

Summer Session, 2015

ELEC1112: Electrical Circuits

COURSE INTRODUCTION – Summer Session, 2015

Course staff

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Course details

Credits (UOC)

Course ELEC1112 is 6 UOC with an expected average workload of approximately 16 hours per week during session.

Contact Hours:

The summer session officially runs over two periods, Period A from 1/12/14-18/12/14 and Period B from 5/01/14-6/02/14.

Contact hours are restricted to Weeks 4 and Week 8 of session for labs and tutorials only. There are 24 hours of lab and 10 hours of face-to-face tutorial in total. There is also a tutorial scheduled for Week 3 before the Christmas break.

Lectures: The course consists of pre-recorded lecture videos provided for online download. There will be an introduction lecture held Monday December 1 from 10:00am-12pm in ElecEng Rm 224.

Tutorials: Week 3/4 and Week 8 only
See timetable in Moodle

Laboratories: Week 3/4 and Week 8 only
See timetable in Moodle

Consultations:

Your mentor and tutor will be your main source of assistance for ELEC1112. Please direct all communication to him in the first instance. Your mentor will be available online via the Moodle learning management system regularly and will be providing consultation times for which students can discuss technical and other issues in the course. Any and ALL email enquiries should be made from your student email address with ELEC1112 in the subject line otherwise they will not be answered.

Course Information

Context and aims

ELEC1112 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.

Course Objectives:

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

- (a) Give an overview of what can be achieved with electrical engineering.
- (b) Understand and apply elementary concepts of electrical circuits, and their analysis.
- (c) Use basic laboratory equipment and techniques to measure electrical quantities.

Relation to other courses

This course is an introduction to electrical engineering for both electrical and telecommunications engineering students, but may also be applicable to students studying in other engineering disciplines such as computer engineering. It is a pre-requisite for many other courses both in electrical and other engineering schools. This course is similar to ELEC1111 Electrical and Telecommunications Engineering, which serves as an introduction to electrical engineering for non-electrical engineers. Although there is much in common between the two courses, differences do exist in the material taught.

Pre-requisites and assumed knowledge:

There are no pre-requisites for this subject but it is assumed that students will have a physics and mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiation and integration techniques is assumed.

Learning Outcomes (LO)

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

1. Use Kirchhoff's laws, circuit theorems and node voltage methodology to solve simple DC as well as AC circuits.
2. Be able to solve simple 1st order transient circuits.
3. Apply simple steady state sinusoidal analysis to circuits.
4. Demonstrate a basic understanding of phasors and phasor diagrams for AC circuit analysis.
5. Reflect a basic understanding of transformer operation.
6. Reflect an understanding of ideal operational amplifier application circuits.
7. Demonstrate basic proficiency in building basic electrical circuits and operating fundamental electrical engineering equipment.

This course is designed to provide the above learning outcomes arising from the targeted graduate capabilities listed in **Appendix A**. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate attributes. This course also addresses the Engineers Australia (National Accreditation body) Stage 1 competency standard as outlined in **Appendix B**.

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 in the form of smaller modules by Dr Ray Eaton, Dr Jayashri Ravishankar and A/Prof Julien Epps. In addition, tutorials and laboratories are carried out in "block-mode", where students are required to attend in Weeks 3/4 and 8 only, where they will undertake all labs and tutorials in an intensive fashion.

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. Small periodic quizzes are also provided, to enable students to assess their understanding of the concepts.

Draft Lecture schedule:

Period	Summary of Lecture Program
Week 1-3	Introduction, Circuit Basics Overview + Lab Safety
Week 1-3	Kirchhoff's laws - Resistive circuits, Series & Parallel circuits, Power & Energy
Week 1-3	Nodal & Mesh analysis
Week 1-3	Network Theorems – Thévenin, Norton, Superposition, MPT
Week 1-3	Energy storage elements - inductors and capacitors, energy storage
Week 1-3	First order circuits – RL & RC circuits, transient responses
Week 5-7	Introduction to AC/sinusoidal analysis, phasors & phasor diagrams; Mid-session test
Break	
Week 5-7	Sinusoidal steady-state analysis, AC circuit analysis, AC power analysis
Week 5-7	Transformers and voltage shaping circuits
Week 5-7	Operational amplifiers
Week 5-7	Digital systems, number representation
Week 5-7	Combinations logic, digital circuit analysis

Lectures

The entire course will be delivered in a non-traditional 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 in Weeks 3/4 and 8. Advantages of the video recordings include:

- 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.

Laboratory

Students are required to attend laboratory from Week 4 to Week 12 as outlined in the *Contact hours* on Page 2. Laboratory attendance WILL be kept, and students MUST attend at least 80% of labs.

Students must view the safety lecture in Week 1 and sign the lab safety declaration form before being allowed to undertake the labs from Week 4. The safety lecture and declaration form can be obtained via Moodle.

Laboratory Purchase

The following items will be required in the laboratory:

- Soldering and components kit - \$10.
- Safety goggles - \$5 (or bring your own)

Optional items:

- Prototyping board - \$15 (useful if you are continuing with EE&T).

Pay money at School Office in Elec. Eng. Building (room EEG1) for soldering and components kit. Once a receipt is issued, pick up the items from the Electronic Workshop (room EEG14A)

Tutorials

Students are required to attend tutorials in Week 3/4 and 8 as specified in the *Contact hours* on Page 2. **Tutorials are not in place as another form of lecture. It is important that you come to tutorials prepared and ready with questions to ask the tutor.** The tutorial sessions are meant to be interactive, allowing students to participate in the solving of problems.

Note that no marks are awarded directly for any part of the tutorial program in this course. However, they should still be treated as an important aspect of the course, not to be taken lightly. There are three components of the tutorial program:

1. 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. Solutions to a majority of these problems will be provided only after students have had sufficient time to attempt the problems.
2. Demonstrations of important problem solving techniques by tutors.
3. Additional tutorial problems will be provided with no solutions for the benefit of further study.

Assessment

You are expected to view all lectures, and attend all tutorials, labs and quizzes, in order to maximize learning. It is a UNSW requirement that you attend at least 80% of your classes. **As the tutorial contact time is limited to 8-10 hours total, 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 and video lectures, you should read relevant sections of the recommended text. Reading additional texts would further enhance your learning experience. Group learning is also encouraged.

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Activity	Assessment	Remarks
Laboratory practical experiments	15%	Must attend at least 7/8 labs and obtain a pass mark average
Laboratory practical test	5%	Must pass to pass course
Weekly quizzes	5%	Held at the end of Weeks 1, 2, 3, 5, 6 each worth 1%
Mid-session assessment	15%	Week 7 – Thursday 11am-12pm in lecture OMB149

Final written examination	60%	Must pass to pass course
TOTAL	100%	

As shown in the table above, there are four main components to the overall assessment, namely:

1. Laboratory assessment:

You are required to maintain a lab book for recording your observations. A lab book is an A4 size notebook containing a mix of plain pages and graph sheets. You have to purchase your own lab book from any stores.

It is essential that you complete the laboratory preparation before coming to the lab. You are required to write the aim of the experiment and draw the circuit diagram if any in your lab book. This will be verified and signed by your demonstrators in the lab. You will be recording your observations/readings in your lab book first and then complete and submit the results sheet before leaving the lab.

After completing each experiment, your work will be assessed by the laboratory demonstrator. Both the results sheet and your lab book will be assessed by the laboratory demonstrator.

A practical test will be run during the laboratory periods later in the session, typically Weeks 10 and 11. **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.**
- **For ELEC1112 during Weeks 4-12 you must attend at least 7 out of 8 lab classes plus the lab test (or have handed in medical certificates)**
- **Obtain a pass mark average for the laboratory experiments.**
- **Pass the LAB EXAM.**

There will be no lab exemptions.

2. Weekly quizzes: the lecture videos will be split up into approximately 5 “sets”, each being associated with a small online quiz. Quizzes must be taken at the end of Weeks 1, 2, 3, 5, and 6, and will be available for the remainder of the course. However for each quiz, there will be a deadline after which marks cannot be awarded. Students must obtain a minimum mark of 80% to be able to gain access to the next set of lecture videos.

Note: Negative Marks

- Failure to attempt any quiz on time will result in a 1% deduction.
- The quizzes will also attract negative marks for incorrect answers or guessed answers.

There is no limit to how many times each quiz may be attempted to achieve the 80% minimum and gain access to the next set of lecture videos. However the mark which contributes to the final grade will be taken as the maximum of the first and second attempt only.

3. Mid-session test: There will be a midsession assessment in Week 7. This will be an examination scheduled on Thursday in the lecture time, i.e. in the usual class, and may cover course content up to the end of Week 6.
4. Final examination: the final exam will be a closed book exam 3 hour for ELEC1112. In principle, the examination may cover any aspect of the course that has been presented in lectures, tutorials and/or laboratories. **You MUST pass the final exam to pass the subject.**

Note: For all class assessment tasks i.e. Laboratory and quizzes, if a student is unable to attend for medical or other serious reasons (e.g. a death in the family) they 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; i.e. the final exam will become a higher % of the assessment.

Resources for students

Course web site

Moodle is used as the course web site: <http://moodle.telt.unsw.edu.au/>

You will need your student z-pass to log on. It is important that you check Moodle several times per week. It serves as the class notice board where all important messages about this particular course are posted. In addition, students can download lecture notes, lab notes, tutorial handouts and other course-related materials. Also, links to some useful web sites are provided.

As the course progresses, students' marks from assessments such as labs and the mid-session test are available for personal viewing on this website.

Recommended Text(s):

1. "Fundamentals of Electric Circuits" Alexander & Sadiku, McGraw Hill. (This is also the text for 2nd yr EE.)

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.

- 1) L.S. Bobrow, *Elementary Linear Circuit Analysis*, Oxford, 1987 [P621.3192/106]. This was the previous text for this course and also for ELEC2134.
- 2) J.F. Wakerly, *Digital Design: Principles and Practices*, 3rd Edition, Prentice-Hall, 2000 [P621.395/100]. The previous edition was the text for this course and also for ELEC2141.
- 3) R.L. Boylestad, *Introductory Circuit Analysis*, 9th Edition, Prentice-Hall, 2000 [PQ621.3815/198].

- 4) K.J. Breeding, *Digital Design Fundamentals*, 2nd Edition, Prentice-Hall, 1992 [P621.3815/214].
- 5) J.R. Cogdell, *Foundations of Electrical Engineering*, 2nd Edition, Prentice Hall, 1990 [P621.3/198].
- 6) J. Millman and A. Grabel, *Microelectronics*, McGraw-Hill, 1987 [P621.38173/68].

Other Matters

Academic honesty and plagiarism

Plagiarism is the unacknowledged use of other peoples work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a serious offence by the University and severe penalties may apply:

<http://www.lc.unsw.edu.au/plagiarism>

Continual Course Improvement

Students are advised that the course is under constant revision in order to improve the learning outcomes of its students. Please forward any feedback (positive or negative) on the course to the course convener and/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.

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 policies: <http://scoff.ee.unsw.edu.au>.

Guidelines on learning that inform teaching at UNSW are available at www.guidelinesonlearning.unsw.edu.au.

Appendix A: Targeted Graduate Capabilities

The 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: Engineers Australia (EA) Stage 1 Competency Standard

	Program Intended Learning Outcomes	ELEC1112
PE1: Knowledge Base	PE1.1 Knowledge of Science and Engineering Fundamentals	X
	PE1.2 In-depth technical competence in at least one engineering discipline	X
	PE1.3 Techniques and resources	X
	PE1.4 General Knowledge	X
PE2: Engineering Ability	PE2.1 Ability to undertake problem identification, formulation, and solution	X
	PE2.2 Understanding of social, cultural, global and environmental responsibilities and the need to employ principles of sustainable development	
	PE2.3 Ability to utilise a systems approach to complex problems and to design and operational performance	
	PE2.4 Proficiency in engineering design	
	PE2.5 Ability to conduct an engineering project	
	PE2.6 Understanding of the business environment	
PE3: Professional Attributes	PE3.1 Ability to communicate effectively, with the engineering team and with the community at large	
	PE3.2 Ability to manage information and documentation	X
	PE3.3 Capacity for creativity and innovation	
	PE3.4 Understanding of professional and ethical responsibilities, and commitment to them	X
	PE3.5 Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member	
	PE3.6 Capacity for lifelong learning and professional development	X
	PE3.7 Professional Attitudes	X

Appendix C: Assessment Methods Linked to Learning Outcomes

Assessment	Learning Outcomes (numbered according to p3)						
	1	2	3	4	5	6	7
Lab practical experiments (15%)	X	X	X	-	X	X	X
Lab test (5%)	X	-	-	-	-	-	X
Weekly Quizzes (5%)	X	X	X	X	X	X	-
Mid-session assessment (15%)	X	X	-	-	-	-	-
Final examination (60%)	X	X	X	X	X	X	-