School of Electrical Engineering & Telecommunications

Faculty of Engineering

ELEC 2134

Circuits and Signals

Summer Session, 2015

ELEC2134: Circuits and Signals

COURSE INTRODUCTION – Summer Session, 2015

Course staff

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Course details

Credits (UOC)

Course ELEC2134 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 1/12/14-19/12/14 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 26 hours of lab and 16 hours of face-to-face tutorial in total.

Lectures: The course consists of pre-recorded lecture videos provided for online download. There will be an introduction lecture held Monday December 2 from 12:00am-2pm in ElecEng Rm 224.

Tutorials: Week 3, 4 and Week 7, 8 only
See timetable in Moodle

Laboratories: Week 3, 4 and Week 7, 8 only
See timetable in Moodle

Consultations:

Your mentor and tutor will be your main source of assistance for ELEC2134. 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 ELEC2134 in the subject line otherwise they will not be answered.

Course Information

Context and aims

Electrical Engineering is concerned with three primary activities: the first deals with electricity and its direct control and use within electrical circuits (are they used for power systems, electronics, instrumentation, communications and so on). The second activity is concerned with modelling systems which use electricity as the primary source of energy for functioning. The third activity concerns the handling of data which relies on

electrical phenomena (wired and wireless) for data transmission. This course provides the fundamental techniques for carrying out the first two activities.

This course aims to:

- Provide a basic understanding of electronic components on which analysis and design of electronic circuits and systems are based, including operational amplifiers.
- Provide the ability to formulate and solve the differential equations describing the time behaviour of the first and second order circuits.
- Provide the capability to design and construct circuits, take measurements of circuit behaviour and performance, compare with predicted circuit models and explain discrepancies.
- Introduce a system-based approach for solving linear circuits using the Laplace and Fourier transforms.

Relation to other courses

This course builds on the year 1 course in Electrical Engineering ELEC1111/ELEC1112, which introduced concepts of fundamental electricity and electrical circuits. It provides the basis for all the future compulsory and elective courses in the signal processing, control, energy and communication area, as well as those involving more advanced electric circuit design.

Pre-requisites and assumed knowledge:

The minimum pre-requisite for the course is ELEC1111, MATH 1231 and MATH 1241.

Learning Outcomes (LO)

After successful completion of this course, you should

1. Be able to develop and employ circuit models for elementary electronic components, e.g. resistors, sources, inductors, and capacitors.
2. Become expert at using various methods of circuit analysis, including simplified methods such as series-parallel reduction, voltage and current dividers, and nodal analysis.
3. Know how to analyse the first and second order linear circuits containing memory elements.
4. Fully understand the concept of sinusoidal steady-state and using the impedance method to analyse the sinusoidal steady-state response of first and second-order electronic circuits.
5. Gain an understanding of the role of the power flow and energy storage in electronic circuits at a specific instant of time.
6. Have an intuitive insight into the behaviour of a physical system driven near resonance, in particular the relationship to the transient response and the significance of the quality factor Q.
7. Be able to use the Laplace and Fourier transform in linear circuits to solve differential equations and calculate the frequency response.
8. Become familiar with the concept of four-terminal or two-port devices and know how to analyse them using transfer impedance parameters
9. Gain practical experience in the use of computer design and analysis tools such as MATLAB and PSPICE

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 Mohaddese Nosratighods, Dr Rukmi Dutta and other EE&T staff. 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 to establish 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.

Indicative Lecture Schedule:

Period	Summary of Lecture Program	Ref (Chapters)
Week 1	Background, Ohm’s Law, Methods of Circuit Analysis	1, 2, 3
Week 1	Circuit Theorems	4
Week 2	Capacitors , Inductors and Operational Amplifiers	5, 6
Week 3	Transient response in first order RLC circuits	7
Week 3	Transient response in second order RLC circuits	8
Week 3	Sinusoidal signals, sinusoidal steady-state analysis of circuits	9, 10
Week 5	AC Power Analysis	11
Week 5	Magnetically coupled circuits	13
Week 6	Frequency Response, transfer function, Resonant circuits	14
Week 6	Introduction to Laplace transform, Applications and state variables	15, 16
Week 7	Fourier Series and Fourier Transform	17, 18
Week 7	Two-Port Networks, Revision	19

Indicative Lab Schedule:

Week 4	Introduction to El vis and PSpice (not to be marked) Using Matlab and PSpice for Circuit Analysis Checkpoint 1 Superposition Theorem Checkpoint 2 Step Response of an RLC circuit and RLC Seri es Circuit Resonance
Week 8	Checkpoint 3 Introduction to operational amplifiers and Op-amp filters

	Checkpoint 4 Network synthesis Checkpoint 5

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.

Laboratory
The laboratories provide the student with hands-on experience to design, analyse and test the
electric circuits. Students will also learn how to use MATLAB and PSPICE for circuit analysis. Students must come prepared for laboratory sessions. During the laboratory, you may consult with others in the class, but you are encouraged to keep your own notes of the laboratory. In particular, note that laboratory assessment (checkpoints) will be conducted individually, not on a per-group basis. Laboratory reports are to be marked by the lab demonstrators. There are five
reports to be marked, each of which worth 2%. Group reports are acceptable provided there are no more than 2 members in the group.

There will be five checkpoints to assess your theoretical and experimental skills throughout the labs which are worth 3% each. **Please also note that you must pass the laboratory component in order to pass the course.**

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.

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, 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 will further enhance your learning experience. Group learning is also encouraged.

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Activity	Assessment	Remarks
Laboratory practical experiments	25%	Must pass laboratory component
Weekly quiz	10%	
Mid-session assessment	15%	Date to be advised

Final written examination	50%	Date to be advised, between Feb 13-18th Must pass final exam
TOTAL	**100%**	

Weekly Quizzes
Weekly quizzes worth 2% each will take place at the end of Weeks 1, 2, 5, 6 and 7. The aim of weekly quizzes is to ensure that learning activities are conducted evenly through 8 weeks rather than in a bulk manner. The video lectures will be viewable only if a satisfactory grade (pass) is gained from the previous weekly quiz.

Mid-Session Assessment
There will be one quiz conducted probably in Week 5 which has a 15% weighting. This short examination will provide you with the feedback on your strengths and weaknesses which assists the learning process and thereby sustains a sense of motivation and interest.

Final Examination
The exam in this course is a standard closed-book 3 hours written examination, comprising five compulsory questions. University approved calculators are allowed.

The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course, unless specifically indicated otherwise by the lecture staff. **Please note that you must pass the final exam in order to pass the course.**

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.

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.

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) Oppenheim and Willsky, *Signals and Systems*, Prentice-Hall.
2) R.C. Dorf and J.A. Svoboda, *Introduction to Electric Circuits*, Wiley.

3) Etter, D.M., *Engineering Problem Solving with MATLAB*, Prentice-Hall.
4) Goody, R. W., *MicroSim PSPICE for Windows-Volume 1*, Prentice-Hall.

MIT course website for Circuits and Electronics
http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-002Spring-2007/CourseHome/

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.

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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 indetification, 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

	Learning Outcomes (numbered according to p3)						
Assessment	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	-