



# ELEC2134

## Circuits and Signals

### COURSE INTRODUCTION - Session 1, 2009

#### Course Staff

Course convener: Dr. Branislav Hredzak, room 204, e-mail: b.hredzak@unsw.edu.au

**Consultations:** Students are encouraged to use the open consultation hour rather than contact by email; students may seek consultation with the course convener at other times by appointment.

#### Course details

**Credits:** The course is 6 Units of Credit; expected workload is 10-12 hours per week throughout the 12 week session.

**Contact hours:** The course consists of 2 hours of lectures per week, 1 hour of tutorial per week and 3 hours of laboratory sessions per week.

Check the website <http://www.timetable.unsw.edu.au/current/ELEC2134.html> for updated schedule.

- Tutorials start in Week 2.
- Laboratory starts in Week 1.
- Consultation sessions start in Week 3.

#### Course details

#### 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 (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.

The course will:

- a. further enhance students understanding of simple as well as more complex ac and dc circuits and circuit elements
- b. introduce students to signals and signal processing
- c. help students understand the importance of signals as basic elements of systems, with reference to electric circuits
- d. familiarise students with the time and frequency domain analysis of continuous-time signals, and circuits up to the second order
- e. give students an understanding of basic transform techniques for continuous-time signals
- f. provide opportunities for students to gain practical experience in the use of computer design and analysis tools such as Matlab and PSPICE.

## **Relation to other courses**

This course encourages a continuing exploration of electric circuit design and analysis. It provides an introduction to concepts of signals and signal processing, and to how circuits and signals are related. It is a prerequisite for the core courses and most electives offered in the signal processing, control, energy and communication area, as well as those courses involving more advanced electric circuit design. In undertaking this course, knowledge and experience are drawn from first year electric circuit courses and first year courses in mathematics.

**Pre-requisites:** This course builds on the Year 1 course in Electrical Engineering ELEC1111 which introduced concepts of fundamental electricity and electrical circuits.

**Assumed knowledge:** It is assumed that the students have a good computer literacy.

**Following courses:** The course is a prerequisite for the core courses and most electives offered in the signal processing, control, energy and communication area, as well as those courses involving more advanced electric circuit design.

## **Learning outcomes**

After the successful completion of the course, the student will be able to

1. demonstrate the ability to analyse simple to moderately complex electric circuits up to the second order using a variety of methods, and have an intuition as to which methods are preferable for different circuits
2. demonstrate intuition of the effects different types of signals have on systems, in particular the electric circuits under study

3. demonstrate the ability to perform transformation and analysis of continuous-time signals

## Teaching strategies

The course consists of the following elements: lectures, tutorials, laboratories, and assignments:

### Lectures

The lectures provide the students with explanation of the core material in the course. Numerous examples of analysis and design of simple to moderately complex electric circuits using a variety of methods are discussed in order to convey a qualitative understanding of the electric circuits. Students are expected to attend the lectures and prepare themselves for them.

### Tutorials

The tutorials enable students to apply various methods to analyze and design electric circuits. Students are expected to attend the tutorials and are expected to attempt to solve given tutorial questions before attending the tutorial.

### Laboratories

The laboratories provide the students with hands-on experience to design, analyse and test electric circuits. Students will also learn how to use of Matlab and PSpice for circuit analysis. Students must come prepared for the laboratory sessions.

### Assignments

The assignments evaluate understanding of a given topic that the students will have to self-study. Understanding of the topic is tested by providing solution to a set of given problems.

## Assessment

There are three components of the assessment in this course:

- **Final examination (60%)** - The final examination is a standard closed-book three hours written examination. The examination will test knowledge and understanding of all major aspects covered in the course.
- **Laboratory assessment (20%)** - after completing each experiment, your work will be assessed by the laboratory demonstrator.
- **Quizzes (20%)** – There will be two short quizzes conducted during the lecture times in Week 5 (10%) and Week 10 (10%). You will be advised of exact timing.

# Course Schedule

## Lectures and Tutorials

Week No	Topic	Tutorial No
1	Ohm's Law, Simplifying networks, Kirchhoff's laws, Nodal analysis	-
2	Mesh analysis, Thevenin and Norton equivalents, Superposition	1
3	Operational amplifiers, Capacitors and Inductors	2
4	Transient response in first order RLC circuits	3
5	Transient response in second order RLC circuits	4
6	Sinusoidal signals, sinusoidal steady-state analysis of circuits	5
7	AC power analysis	6
8	Frequency response, Resonant circuits,	7
9	Introduction to filter design, Laplace transform	8
10	Laplace transform	9
11	Applications of the Laplace transform	10
12	Two-port networks	Revision

## Laboratory

Week No	Topic
1	Introduction to Elvis and PSpice
2	Using Matlab and PSpice for Circuit Analysis
3	
4	Superposition Theorem
5	Introduction to Operational Amplifiers
6	
7	Step Response of an RLC circuit
8	RLC Series Circuit Resonance
9	Op-Amp Filters
10	
11	Network Synthesis
12	

## Resources for Students

### Textbooks

#### Prescribed textbook

The following textbook is prescribed for the course:

Alexander, C. K., Sadiku, M. N. O., *Fundamentals of Electric Circuits*, McGraw Hill, 3<sup>rd</sup> Edition.

Students are strongly encouraged to purchase a copy of this book as it provides coverage of the topics in the syllabus. Lecture notes will not be handed out.

### Reference books

The following books are good additional resources for topics on circuits and signals:

Oppenheim and Willsky, *Signals and Systems*, Prentice Hall.

R.C. Dorf and J.A. Svoboda, *Introduction to Electric Circuits*, Wiley.

Etter, D.M., *Engineering Problem Solving with MATLAB*, Prentice Hall.

Goody, R. W., *MicroSim PSPICE for Windows - Volume 1*, Prentice Hall.

J.W. Nilsson, S.A. Riedel., *Introduction to PSpice*, Prentice Hall.

### Online resources

Some additional on-line resources relevant to the course:

Resource:	course webct	<a href="http://vista.elearning.unsw.edu.au">http://vista.elearning.unsw.edu.au</a>
	book website	<a href="http://www.mhhe.com/alexander">http://www.mhhe.com/alexander</a>
		<a href="http://highered.mcgraw-hill.com/sites/0072463317/student_view0/index.html">http://highered.mcgraw-hill.com/sites/0072463317/student_view0/index.html</a>
	MATLAB	<a href="http://www.mathworks.com">http://www.mathworks.com</a>
	LABVIEW	<a href="http://www.ni.com/labview/">http://www.ni.com/labview/</a>
	library resources	<a href="http://info.library.unsw.edu.au/web/services/teaching.html">http://info.library.unsw.edu.au/web/services/teaching.html</a>

### Computer resources

#### Matlab and PSpice

The laboratories make use of these programs. It is advantageous for students who have their own computers to install Matlab and PSpice, as these programs will be useful not only in ELEC2134 but also in courses in subsequent years of the course. A CD containing Matlab and PSpice may be borrowed overnight (against a student card) from room EE G15A. PSpice is also available for download from many internet sites.

For those students who do not have their own computers, access to these two programs is available in the undergraduate computer laboratory (EE G16).

### 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. For more information about plagiarism, please refer to <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 or via the Course and Teaching Evaluation and Improvement Process.

### **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, see <http://scoff.ee.unsw.edu.au/>.