Circuit and Signals

COURSE INTRODUCTION - Session 1, 2010

Course Staff

Course conveners:  Dr Brislav Hredzak (weeks 1-7), room 204,  
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Dr Jayashri Ravishankar (weeks 8-13), room 309,  
Email: jayashri.ravishankar@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 3 hours of lectures per week, 1 hour of tutorial  
per week and 2 hours of laboratory sessions per week.

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

• Lectures start in Week 1.  
• Tutorials start in Week 2.  
• Laboratory starts in Week 2.  
• Consultation sessions start in Week 3 (check Blackboard for current consultation hours).

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.

Quizzes

The quizzes evaluate understanding of given topics. Understanding of the topic is tested by providing answers to a set of given questions.

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.

Note: Considering there are a few new experiments running in Session 1, 2010, no lab exemptions will be allowed in Session 1, 2010. If a student has a valid reason not to attend a quiz then the exam weightage will be increased by the quiz weightage.
## Course Schedule

### Lectures and Tutorials

<table>
<thead>
<tr>
<th>Week No</th>
<th>Topic</th>
<th>Tutorial No</th>
<th>Lecturer in charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ohm’s law, Simplifying networks, Kirchoff’s laws, Nodal analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mesh analysis, Thevenin and Norton equivalents, Superposition</td>
<td>1</td>
<td>Dr Branislav Hredzak</td>
</tr>
<tr>
<td>3</td>
<td>Capacitors and Inductors, Transient response in first order RLC circuits</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Transient response in second order RLC circuits</td>
<td>3</td>
<td></td>
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<tr>
<td>5</td>
<td>Laplace transform</td>
<td>4</td>
<td></td>
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<tr>
<td>6</td>
<td>Application of Laplace transform</td>
<td>5</td>
<td></td>
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<tr>
<td>7</td>
<td>Frequency response, Introduction to Fourier series</td>
<td>6</td>
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<tr>
<td>8</td>
<td>Sinusoids, Complex notation, Phasor relationships</td>
<td>7</td>
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<tr>
<td>9</td>
<td>Series &amp; parallel circuits, Kirchoff’s laws in AC, AC power analysis</td>
<td>8</td>
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<tr>
<td>10</td>
<td>Mesh &amp; Node analysis, Network theorems in AC</td>
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<td></td>
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<tr>
<td>11</td>
<td>Series &amp; parallel resonance</td>
<td>10</td>
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<tr>
<td>12</td>
<td>Coupled circuits</td>
<td>11</td>
<td></td>
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<tr>
<td>13</td>
<td>No lectures.</td>
<td>Revision</td>
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### Laboratory

<table>
<thead>
<tr>
<th>Week No</th>
<th>Topic</th>
<th>Room</th>
<th>Lecturer in charge</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Introduction to Elvis and PSpice</td>
<td>125</td>
<td>Dr Branislav Hredzak</td>
</tr>
<tr>
<td>3</td>
<td>Using Matlab and PSpice for Circuit Analysis</td>
<td>125</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>Superposition Theorem</td>
<td>125</td>
<td></td>
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<tr>
<td>6</td>
<td>Step Response of an RLC circuit</td>
<td>125</td>
<td></td>
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<tr>
<td>7</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>Thevenin’s Theorem</td>
<td>119</td>
<td>Dr Jayashri Ravishankar</td>
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<td>9</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Measurement of power and power factor improvement</td>
<td>119</td>
<td></td>
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<td>11</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td>RLC Series Circuit Resonance</td>
<td>125</td>
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<tr>
<td>13</td>
<td>Parallel Circuit Resonance</td>
<td>125</td>
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## Resources for Students

### Textbooks

**Prescribed textbook**

The following textbook is prescribed for the course:

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.

**Online resources**

Some additional on-line resources relevant to the course:

<table>
<thead>
<tr>
<th>Resource</th>
<th>URL</th>
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</thead>
<tbody>
<tr>
<td>Blackboard</td>
<td><a href="http://lms-blackboard.telt.unsw.edu.au/webapps/portal/frameset.jsp">http://lms-blackboard.telt.unsw.edu.au/webapps/portal/frameset.jsp</a></td>
</tr>
<tr>
<td>book website</td>
<td><a href="http://www.mhhe.com/alexander">http://www.mhhe.com/alexander</a></td>
</tr>
<tr>
<td>MATLAB</td>
<td><a href="http://www.mathworks.com">http://www.mathworks.com</a></td>
</tr>
<tr>
<td>LABVIEW</td>
<td><a href="http://www.ni.com/labview/">http://www.ni.com/labview/</a></td>
</tr>
<tr>
<td>library resources</td>
<td><a href="http://info.library.unsw.edu.au/web/services/teaching.html">http://info.library.unsw.edu.au/web/services/teaching.html</a></td>
</tr>
</tbody>
</table>

**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/](http://scoff.ee.unsw.edu.au/).

Occupational health and safety (OHS)

For non-thesis students, signing OHS declaration form [http://scoff.ee.unsw.edu.au/forms/Safety_Form1_UG-v08.pdf](http://scoff.ee.unsw.edu.au/forms/Safety_Form1_UG-v08.pdf) is needed after they read and understand the content in the lab safety manual [http://scoff.ee.unsw.edu.au/forms/Safety_Manual_UG-Feb2009-final.pdf](http://scoff.ee.unsw.edu.au/forms/Safety_Manual_UG-Feb2009-final.pdf) before they enter the school labs. Some students did this in the first year class and do not need to lodge this form again. Any students who have not done this are required to do it as soon as possible and pass the signed form to the course convener.