Course Staff

Course Conveners:	Prof. E. Ambikairajah, Room G8, e.ambikairajah@unsw.edu.au
	Dr. V. Sethu, Room 304, v.sethu@unsw.edu.au
Lab & Tutorial Coordinator:	Dr. Phu Ngoc, Room 306, ngoc.le@unsw.edu.au

Consultations: You are encouraged to ask questions on the course material, after the lecture class times in the first instance, rather than via email. Consultation times are also listed below where you can ask questions about the lectures and the integrated tutorial labs. Any email enquiry regarding the course should be made from your student email address with ELEC2134 in the subject line, otherwise they may not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. 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 course consists of 3 hours of lectures, and a 3-hour **integrated tutorial-lab session** each week.

Lectures	Day	Time	Location
	Monday	9am - 11am	Law Theatre G04
	Thursday	10am - 11am	Physics Theatre
Tutorial-Labs	Mon-Fri	Enrolled times	ElecEng Room 125/101
Consultations	Monday	4pm-5pm	Rm TBA (Lecture Consultation)

Context and Aims

This course covers the fundamentals of circuit, system and signal analysis on which most other courses in the electrical engineering curriculum build upon. The concepts covered in this course are assumed knowledge for all following core courses (ELEC2133, ELEC3104, ELEC3106, ELEC3115, ELEC3105, ELEC3114, ELEC3117, TELE3113). Consequently it is important that you put in as much effort as you can in understanding the concepts. The course covers a wide range of topics that build on each other and require regular revisiting - this will make the course difficult to follow if you defer learning instead of regular weekly study.

Aims

The course aims to equip students with:
- An understanding of basic mathematical tools (Fourier and Laplace transforms) for analysing linear systems.
- Skills to analyse continuous-time signals and systems in both time domain and frequency domain.
- Ability to analyse complex AC circuits (including magnetic circuits).
- Computer design and analyses experience using tools such as LTSPICE

Indicative Lecture Schedule

Period	Monday	Thursday
Week 1	**Circuit Analysis:** • Introduction to AC • AC circuit elements • AC circuit theorems • AC Power analysis • AC Resonance	**Transform Methods and Applications:** • Fourier Series • Fourier Transform • Laplace Transform
Week 2		
Week 3		
Week 4		
Week 5		
Week 6		
Week 7	**Mid-session test** • Magnetic coupled circuits • Transient analysis • Introduction to 2-port networks	
Week 8		
Week 9		
Week 10		
Week 11	**Signals & Systems**	
Week 12		

Indicative Laboratory Schedule

Period	Summary of Tutorial-Laboratory Program
Weeks 3-4	Tutorial-lab 1:
Weeks 5-6	Tutorial-lab 2:
Weeks 7-8	Tutorial-lab 3:
Weeks 9-10	Tutorial-lab 4:
Weeks 11-12	Tutorial-lab 5:
Week 13	Catch-up

Assessment

Tutorial-Laboratory Assessment	15%
Mid-Semester Exam	15%
Final Exam (3 hours)	70%

Course Details

Credits

This is a 6 UoC course and the expected workload is 10-12 hours per week throughout the 13 week semester.

Relationship to Other Courses

This is a 2nd year course in the School of Electrical Engineering and Telecommunications. It is a core course for students following a BE/BE ME (Electrical) or BE (Telecommunications) program and other combined degree programs.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC1111/ELEC1112. It is essential that the students are familiar with concepts of fundamental DC and AC electric circuits. It is also essential that the students have good mathematical skills. This course will require an understanding of linear algebra, complex numbers, differential calculus and integral calculus (covered in first year mathematics courses).

Following Courses

The course is a pre-requisite for ELEC2133, ELEC3104, ELEC3106, ELEC3115, ELEC3105, ELEC3114, ELEC3117, TELE3113.

Learning outcomes

After successful completion of this course, you should be able to:
1. Be able to apply transform methods to analyse continuous-time linear systems.

2. Demonstrate an understanding of how signals and linear systems interact.

3. Be able to analyse simple and complex electric and magnetic circuits.

4. Demonstrate an understanding of concepts related to AC power analysis.

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*.

Syllabus

Transform Methods: Periodic signals and Fourier series, Aperiodic signals and Fourier transform, Laplace transforms of signals and circuits.
Circuit Analyses: AC circuits with sinusoidal inputs in steady state, use of phasors and complex impedance in AC circuit analysis, AC power (real, reactive, apparent), power factor, leading/lagging, series and parallel resonance, transformers and coupled coils, application of network theorems in ac circuit analysis.
System Analysis: linear systems and convolution, impulse response, frequency response and transfer functions, steady-state analysis of linear systems, transient analysis of 1st and 2nd order systems, circuit analyses using transform methods.

Teaching Strategies

Delivery Mode

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding;
- Integrated Tutorial-labs, which allows for analytical skill development in a practical context.

Learning in this course

You are expected to attend <u>all</u> lectures, tutorial-labs, and mid-semester exams in order to maximise learning. You must prepare well for your laboratory classes and your tutorial-lab work will be assessed. In addition to the lecture notes/video, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending face-to-face classes throughout the course.

Tutorial-Laboratory classes

The integrated tutorial-laboratory sessions are designed to help you develop your analytical skills and see how they are applicable in a practical context. You may divide your time between the analytical and the laboratory components as per your convenience but you should complete both within the allocated time. The analytical problems you will be given in these sessions will tend to be more involved than the sample problems in the recommended textbook and will also tend to involve more than one topic. **It is expected that you are able to solve the sample problems in the lecture notes and the recommended text book prior to undertaking the tutorial-lab questions.**

The tutorial-laboratory schedule is deliberately designed to provide practical, hands-on exposure to the concepts conveyed in lectures soon after they are covered in class. You are required to attend this from Week 3 to Week 12. Laboratory attendance WILL be kept, and you MUST attend all tutorial-labs.

Tutorial-Laboratory Exemption

<u>There is no laboratory exemption for this course</u>. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course for Semester 1, 2015 must take the tutorial-labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, please meet the co-ordinator (Dr. Phu Le) to discuss the situation.

Assessment

The assessment scheme in this course reflects the intention to assess your learning progress through the semester. Ongoing assessment occurs through tutorial-lab assessments and the mid-semester exam.

Tutorial-Laboratory Assessment (15%)

The integrated tutorial-laboratories are primarily about learning, and the assessment is designed mainly to check your knowledge as you progress through each stage of the analytical and laboratory tasks. 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.

After completing both the analytical questions given in the lab sheet and the laboratory work, it will be assessed by the laboratory demonstrator. You must present your lab book with the analytical solutions and the practical results during this assessment.

Assessment marks will be awarded according to your analytical work, how much of the lab you were able to complete, your understanding of the experiments conducted during the lab, the quality of the code (if relevant), and your understanding of the topic covered by the question.

Mid-Semester Exam (15%)

There will be one mid-semester examination, testing your understanding of the principles and your analytical skills through a number of set problems.

- Mid-Semester Exam: Monday, 20th April, 2015: 9am – 11am
- Location of the exam will be confirmed prior to the exam
- Covers all lecture material taught in weeks 1-6

If for medical reasons (note that a valid medical certificate must be provided) or any other reasons, you are unable to attend the mid-semester exam, you will be given an oral examination of approximately 1 hour.

Final Exam (70%)

There will be one final examination, testing your understanding of the principles and your analytical skills through a number of set problems. If for medical reasons, (note that a valid medical certificate must be provided to the university) you are unable to attend the final exam, you will be given another exam (either oral or written, at the discretion of the course convenor). **You must pass this final exam to pass the course.**

- The final exam will be 3 hours long
- The final exam consists of 5 questions (with many parts) and all of them must be answered

The final exam will cover all chapters covered in the semester

Relationship of Assessment Methods to Learning Outcomes

Assessment	Learning outcomes			
	1	2	3	4
Tutorial-Laboratory assessments	✓	✓	✓	✓
Mid-semester exam	✓	✓	✓	✓
Final exam	✓	✓	✓	✓

Course Resources

Textbooks

Prescribed textbook

- Alexander, C. K., & Sadiku, M.N.O., (2013) "Fundamentals of Electric Circuits", 5th edition, McGraw Hill

Reference books

- Soboda, J & Dorf, R (2014) "Introduction to Electric Circuits", 9th edition, Wiley & sons.
- Hambley, A "(2002) "Electrical Engineering Principles and Applications", Prentice Hall.
- Franco, S (1995) "Electric Circuits Fundamentals", Saunders College Publishing.

On-line resources

Moodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Mailing list

Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your student email address).

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 http://www.lc.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://my.unsw.edu.au/student/atoz/ABC.html), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **ten to twelve hours per week** studying a 6 UoC course, 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.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

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://my.unsw.edu.au/student/atoz/SpecialConsideration.html.

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.

Based on regular feedback over the last 3 years from ELSOC committee members and other class representatives the course has been structured in a way to maximise learning and the integrated tutorial-labs have been introduced.

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 and UNSW policies:
http://www.engineering.unsw.edu.au/electrical-engineering/policies-and-procedures
https://my.unsw.edu.au/student/atoz/ABC.html

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:

- 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.

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	

END OF COURSE OUTLINE