School of Electrical Engineering and Telecommunications

Term 1, 2019
Course Outline

ELEC/TELE4123
Electrical Engineering Design Proficiency

COURSE STAFF

Course Convener: Dr. Kaavya Sriskandaraja, Room 414, k.sriskandaraja@unsw.edu.au
Laboratory Contact: Dr. Kaavya Sriskandaraja, Room 414, k.sriskandaraja@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. Lecturer consultation times will be advised during lectures. You are welcome to email the lecturer, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC4123 in the subject line; otherwise they will not be answered. Additionally, the Course Convener will usually be available during the laboratory sessions, to field any additional questions. Please note that consultation sessions are not a replacement for attendance at lectures. It is expected that you attend all lectures, which will often be interactive in nature, allowing questions of broad interest to be fielded by the Lecturer for the benefit of all students.

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

This course involves 52 hours of scheduled laboratory contact, plus a weekly 1 hour lecture or tutorial, as detailed below. Attendance at laboratories is mandatory, since these are the primary assessed components of the course. All laboratories are assessment opportunities.

	Day	Time	Location
Lectures	Tuesdays W1-W9	11am-12pm	Webster Theatre B (K-G15-290)
Tutorials	Tuesdays W8-10	Various	TBD
Labs*	Tuesdays W1-W10	3pm-7pm	EE201, EEG224, EE225
Labs**	Mondays W3, W5, W7	5pm-9pm	EE201, EEG224, EE225
Open Labs*	TBD	TBD	TBD

* Formal lab for all topics
** Additional formal lab for topics 1, 2 and 3
*** Open labs are not assessed, with minimal demonstrators; schedule is indicative only

Context and Aims

This is a rather unusual course, in that there is no final or mid-term examination and the majority of your contact hours are spent in the laboratory. The course is organized around 4 proficiency topics, each of which has three (3) formal lab sessions, each lasting 4 hours. The first three topics cover the core disciplines of Electronics,

Signal Processing and Control, while the fourth topic involves an elective choice of three or four different projects. With some exceptions for the elective topic, all formal lab sessions are assessment opportunities. To accommodate the 10 week term, some weeks have two formal lab slots, one corresponding to the final assessment opportunity for a previous topic and the other corresponding to the first assessment opportunity for the next topic.

The purpose of lectures is to keep the course on track and to help to correct weaknesses in your understanding. Lectures are scheduled prior to the formal laboratories of each week. Lectures in Weeks 1, 3, 5 and 7 are used in part to introduce the topic that commences in that week. Beyond this, however, lectures are intended to be interactive. Topics covered in these interactive lectures will be based on questions raised by students, as well as the lecturer's observation of common issues that arise during the formal laboratory sessions.

The principle purpose of this course is to test your design proficiency, through a sequence of design challenges. Some of the challenges are very basic, but there is also plenty of scope for you to demonstrate superior skills. The design challenges within each of the non-elective (core) topics are organized into 5 or 6 tasks that can be undertaken and assessed progressively. Your designs, implementation and assessment for the non-elective topics are to be undertaken on an individual basis, not as group work. Moreover, you are expected to regard the laboratory sessions as **miniature examinations**.

A secondary aim of the course is to fill in any major holes in your fundamental design knowledge, so as to ensure that all graduating students have at least a minimum level of proficiency. Although some of you might initially feel uncomfortable about this, it is important to realize that prospective employers will be very pleased indeed to know that you are able to demonstrate your proficiency. You should expect that this course will reinforce your existing knowledge and increase your confidence in design and some of the fundamental disciplines you have been studying. Opportunities to correct misunderstandings mostly occur between laboratory sessions, including within the course lectures.

A third objective of the course is to expose you to a healthy balance between team work and individual responsibility. For practical reasons, team-based design is restricted to the elective topic, which takes place over weeks 8-10 and is assessed very differently from the other topics. In place of the weekly lecture, you will be assigned to tutorial groups for these last three weeks of the course, with a tutor who can both help to keep you on track and also keep an eye on the functioning of your team and the level of contribution that each team member appears to be making to the design. The elective topic will involve both individual and group assessment components.

Indicative Lecture Schedule

Period	Summary of Lecture Program
Week 1	Intro and guide to Topic - 1
Week 2	Interactive lecture
Week 3	Interactive lecture + Intro and guide to Topic - 2
Week 4	Interactive lecture
Week 5	Interactive lecture + Intro and guide to Topic - 3
Week 6	Interactive lecture + Intro and guide to Electives
Week 7	Interactive lecture
Week 8	Interactive lecture + Elective-specific tutorials **(partly assessed)**
Week 9	Elective-specific tutorials **(partly assessed)**
Week 10	Elective-specific tutorials **(partly assessed)**

Deadlines
1. Elective topic selection (with optional team formation preferences): Week 6, Friday, 5pm (29 March 2019)
2. Elective topic report due: Week 11, Wednesday, 5pm (01 April 2019)

Indicative Laboratory Schedule

Period	Summary of Laboratory Program
Week 1	Topic-1: Electronic Circuits (Tuesday)
Week 2	Topic-1: Electronic Circuits (Tuesday)
Week 3	Topic-1: Electronic Circuits (Monday) Topic-2: Signal processing (Tuesday)
Week 4	Topic-2: Signal processing (Tuesday)
Week 5	Topic-2: Signal processing (Monday) Topic-3: Control Systems (Tuesday)
Week 6	Topic-3: Control Systems (Tuesday)
Week 7	Topic-3: Control Systems (Monday) Flexible: possible supplementary tasks/catch-up (Tuesday)
Week 8	Elective Topic: no assessment (Tuesday)
Week 9	Elective Topic: no assessment (Tuesday)
Week 10	Elective Topic: **assessment** (Tuesday)

Assessment

The marks for this course will be assigned as follows:

Assessment Concept	Basis	Marks
Achievement of design objectives, as demonstrated in labs, core topics T1-T3	individual	36% (3x12%)
Understanding of relevant subject material, as demonstrated in labs, core topics T1-T3	individual	24% (3x8%)
Elective tutor mark: team performance T4	group	5%
Elective tutor mark: individual contribution T4	individual	5%
Elective interview: design understanding T4	individual	5%
Elective performance: design performance T4	group	10%
Team report on elective topic T4	group	15%

COURSE DETAILS

Credits

This is a 6 UoC course. Since this course has no final examination, the workload of the course is compacted into just 10 weeks, so your effort must be adjusted accordingly. The expected average workload is 15 hours per week, which includes 5 to 9 hours of scheduled formal contact and 4 to 8 hours of independent study, design and preparation, including open labs and time spent working with peers. This is not only an expectation – it is a reality that most **students undertaking this course do put in at least this amount of time!!**

Relationship to Other Courses

This is a 4th year course in the School of Electrical Engineering and Telecommunications, which is a core component of the BE programs (Electrical and Telecommunications) offered by the School.

This course directly ties into core courses in Electronics, Signal Processing, Control, Telecommunications, Data Networks and Energy Systems which you should have already taken (typically in the third year of your program). See below for more on what is expected.

Pre-requisites and Assumed Knowledge

The course has three core topics, for which the following knowledge is assumed:
- Electronics (to the level of ELEC3106)
- Signal Processing (to the level of ELEC3104)
- Control Systems (to the level of ELEC3114).

Through these and other courses, it is assumed that students have also developed good computer literacy and familiarity with Matlab, which is used in some topics.

Learning outcomes

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

1. Have demonstrated an ability to work both individually and within a group, to produce designs which draw upon a number of disciplines previously studied in other courses.

    o The 4 design topics and 12 formal laboratory sessions all reinforce and assess these abilities.

2. Have demonstrated an ability to contribute to and learn from peers.

    o The elective design topic and interactive lectures all reinforce this ability, while the tutorial sessions both reinforce and assess it.

3. Have demonstrated a sufficient level of understanding and skill within a range of disciplines, together with an ability to explain design decisions.

    o The assessment methodology in laboratories deliberately reinforces and assesses these outcomes.

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

The course involves three core competency components, as follows:
- Electronic Circuit Design: Devices, amplifiers, tuned circuits, op-amp circuits, etc.
- Control System Design: Feedback and stability, linear control, non-linear control, data acquisition and sampling, etc.
- Signal Processing Design: Filter design, frequency response, spectrum analysis, BIBO analysis, etc.

The elective component of the course involves competency components in at least one of the following areas:
- Power System Design: Transformer, motor, power electronic converter, power factor, harmonics, etc.
- Networked Communications: Computer programming, socket programming, network protocols, distributed asynchronous systems, estimation and exploitation of local and system-wide timing information, etc.

- Physical Communications: Modulation schemes, robust detection of signals in noise, multiplexing and interference suppression, efficient bandwidth utilization, error control, etc.

Laboratory assessment requires the design, construction and understanding of working solutions to specified problems.

TEACHING STRATEGIES

Delivery Mode

The teaching in this subject is heavily focused on laboratories. Each of 4 design topics has 3 assigned laboratories, each 4 hours in duration. The laboratories are designed to develop and assess proficiency. The majority of the assessment is individual, with a focus on objectively working solutions, in addition to understanding.

The laboratories are complemented by a mix of lectures and tutorials. For the first 3 topics, weekly lectures provide both input and an opportunity for class interaction, albeit on a large scale. In some previous incarnations of this course, small tutorials largely replaced the lecture, allowing for more interaction but leading to less uniform feedback to students, which was raised as an issue. This year, small group tutorials are used only for the final (elective) design topic, where they will be more focused on the topic selected by each group.

During the first 9 weeks of the course, lectures are intended both to address knowledge gaps and also to reinforce an approach to design, which focusses on **the need to identify early what is most problematic about a design problem**. Through this process, students are expected to be better prepared to approach the larger design problem that they will face as a team during the fourth (elective) design topic.

A very important aspect of the teaching in this course is the allocation of 3 weeks to each topic, which allows students to attempt design tasks multiple times and to learn from their mistakes between attempts. This strategy facilitates a reflective learning cycle.

Through these mechanisms, the course aims to build and ensure proficiency in the core areas of your program of study.

Design Topics

The course is divided into a sequence of three "core design topics" and one "elective design topic," each of which is assigned 3 formal laboratory sessions of 4 hours each.

The core design topics are:
1) Electronic Circuits;
2) Signal Processing; and
3) Control Systems.

The elective topics are:
4a) Energy Systems;
4b) Data Networks; and
4c) Telecommunications.

Each of the core topics consists of a sequence of design tasks, with progressively higher complexity. Design tasks for the core topics must be completed individually, although you are encouraged to discuss the topics with your fellow students **outside the formal laboratory hours**.

The elective design is performed in groups of at most 4 students; you must nominate which of the elective topics you intend to pursue by the end of Week 6, at which point you will also have an opportunity to propose a design team. If you are not part of a proposed team, or if unavoidable circumstances require it, you will be assigned to a team at the Course Convener's discretion. You will be provided with further instructions on how to submit elective topic and team nominations. Unlike the first three design topics, the elective design is assessed only in the final week.

Individual Learning

Preparation for labs is essential to success in this course. You should find yourself revising material from previous courses, discussing problems with your peers, raising questions in lectures, and perhaps struggling to find and solve problems you encounter with your design or implementation in the laboratory. All of these are outstanding learning opportunities.

Group Learning

You are strongly encouraged to discuss the design tasks with your class mates outside the laboratory sessions – laboratories themselves, however, are not the place for helping your friends or discussing design solutions, except during the elective topic.

The elective topic is a team effort, having larger scope and less incremental objectives than the first three design topics. To succeed in this topic, you will need to work effectively as a team member or leader. Moreover, each team is required to submit a report describing the design principles, implementation, outcomes and final reflections. The report will also need to be a team effort.

Laboratory Exemption

There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course must take the labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, you will need to **seek permission from the course convener** to be assessed in a subsequent week.

ASSESSMENT

Assessment of core design tasks

All completed tasks for the three core design topics are to be assessed during the laboratory sessions by one of the laboratory demonstrators. Once you have completed a task, you should add your name to a list maintained by the demonstrators in your laboratory, so that you can be assessed as quickly as possible. You cannot expect to be assessed for all of the tasks you have completed during the final laboratory session of the topic, since this can place an unacceptable burden on the demonstrators' time.

Of the 20% of the overall course assessment that is associated with each core design topic, 12% is awarded based on actual outcomes. You cannot expect to obtain any of these marks for a solution which does not actually work or achieve the task objectives to some extent. The remaining 8% is awarded for your understanding of the design problem and your own design. To obtain these marks, you will need to convince the marker (one of the demonstrators) that you thoroughly understand your design and why you have selected it.

Assessment is individual. You may not present a group design or implementation for assessment within the core design topics. It is recommended 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.

Assessment of the elective design tasks

The elective design topic is a group activity, for which all assessment will take place in Week 10. 40% of the overall course assessment is related to the elective topic, but only 15% is awarded by the lab demonstrators in Week 10. 5% is awarded based on an individual interview of each team member, to determine their level of understanding of both the overall design and their contribution to it. The other 10% is awarded based on objective performance of the final design, a component of which will be competitive, meaning that teams will be ranked within each topic, based on the objective performance of their designs.

Tutorials are important and compulsory for the elective design topics. There will typically be several teams within a single tutorial. Your tutor will ask each team to work by themselves within the tutorial room, circulating between teams to observe their interaction and thought processes, and to offer suggestions where appropriate. Your tutor will especially be interested in the way in which you approach the design problem, how you ensure that you focus on the most challenging parts of the problem first, how you reach an overall design that is likely to work, and how your team manages the resources at its disposal. Your tutor will also observe how individuals contribute to the team's deliberations, design and interaction. Based on these observations, the tutor will award team and individual marks, each worth 5% of the overall assessment for the course.

Your team's final report for the elective topic is an essential part of the reflective process. You will be expected to have a preliminary version of the report available during the laboratory assessment exercise in Week 10. However, the report should be finalized afterwards, including a reflection on the design process that you followed, in light of your design's performance. The report is due on Wednesday of Week 11 (01 April 2019).

Relationship of Assessment Methods to Learning Outcomes

Assessment	Learning outcomes		
	1	**2**	**3**
Core design tasks	✓	-	✓
Elective design topic	✓	✓	✓
Elective design group report	✓	✓	✓

Mid-Semester Exam and Final Exam

There is no Mid-Semester exam or Final exam in this course.

COURSE RESOURCES

Textbooks

There are no specific texts for this course, but you should consider your lecture notes and text books from earlier classes in Electronics, Signal Processing, Control, Telecommunications, Data Networks and/or Energy Systems to be useful resources.

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

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

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 https://student.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://student.unsw.edu.au/guide), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 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. As of Term 1 2019, assessment of applications for Special Consideration will be managed centrally and the University has introduced a "fit to sit/submit" rule. You will no longer be required to take your original documentation to The Nucleus for verification. Instead, UNSW will conduct source checks on documentation for verification purposes. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application prior to the start of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. If you sit an exam or submit an assignment, you are declaring yourself well enough to do so.

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 online student survey myExperience. 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.

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:
https://student.unsw.edu.au/guide
https://www.engineering.unsw.edu.au/electrical-engineering/resources

APPENDICES

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 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 ethical practitioners who are collaborative and effective team workers, through group activities, seminars and tutorials.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
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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	✓

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