ELEC4123
Design Proficiency

Course Outline – Semester 1, 2018

Australia's Global University | Faculty of Engineering | School of Electrical Engineering and Telecommunications

Course Staff

Course Convener: Prof. David Taubman, Hilmer Building Room 748
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Consultations: The primary consultation time for this course is 2pm to 4pm Mondays, starting from Week 2. The default location for consultations is the Course Convener's office, listed above. However, you should check the course web-site (see below) for any changes in these arrangement, before coming for consultation.

Additionally, the Course Convener will usually be available during the laboratory sessions, and he will also usually be available after the weekly lecture, 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: All materials for this course will be made available via http://subjects.ee.unsw.edu.au/~elec4123. You may also receive emails and/or announcements during the labs or the scheduled lectures or tutorials that are relevant to this course. You should read your email and visit the above-mentioned web-site regularly, since you will be deemed to be abreast of course materials and information provided therein.

Course Summary

Contact Hours

This course consists of a 4 hour weekly laboratory and 1 weekly lecture or tutorial, as detailed below. Attendance at laboratories is mandatory, since these are the primary assessed components of the course. From Week 2, all laboratories will be assessment opportunities.

NB: There is a **preliminary lab session in Week 1**, not assessed, which is important. Unless you have emailed the lecturer to explain that you cannot attend, **it is expected that you come to this lab session.**

	Day	Time	Location
Lectures	Mondays W1-W10	5pm-6pm	Colombo Theatre A
Tutorials	Mondays W11-13	5pm-6pm	Various; TBA
Labs	Thursdays W2-W13	9am-1pm	EEG13, EEG14, EE214
Pre-Lab	Thursday W1	9am-1pm	EEG14, EE214

Introduction 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 based on weekly 4 hour laboratories, supplemented by a weekly lecture which becomes an elective-specific tutorial in the last 3 weeks. The course is organized around 4 proficiency topics, each lasting 3 weeks, starting from Week 2. The purpose of lectures is to keep the course on

track and to help to correct weaknesses in your understanding. Each topic will be introduced in the preceding week's lecture, but apart from this, 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 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 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 11-13 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.

Course schedule

Wk	Begins	Lecture (Mon 5-6pm)	Laboratories (Thu 9am-1pm)
1	26 Feb	**Intro and guide to Topic-1**	Pre-lab: attendance required
2	5 Mar	Interactive lecture	Topic-1: Electronic Circuits
3	12 Mar	Interactive lecture	Topic-1: Electronic Circuits
4	19 Mar	Interactive lecture + **Intro to Topic-2**	Topic-1: Electronic Circuits
5	26 Mar	Interactive lecture	Topic-2: Signal Processing
Mid Session Recess			
6	9 Apr	No lecture	Topic-2: Signal Processing
7	16 Apr	Interactive lecture + **Intro to Topic-3**	Topic-2: Signal Processing
8	23 Apr	Interactive lecture	Topic-3: Control Systems
9	30 Apr	Interactive lecture + **Intro to Electives**	Topic-3: Control Systems
10	7 May	Interactive lecture	Topic-3: Control Systems
11	14 May	Elective-specific tutorials **(partly assessed)**	Elective Topic: no assessment
12	21 May	Elective-specific tutorials **(partly assessed)**	Elective Topic: no assessment
13	28 May	Elective-specific tutorials **(partly assessed)**	Elective Topic: **assessment**

Deadlines

1. Elective topic selection (with optional team formation preference): Friday, May 4th, 5pm
2. Elective topic report due: Wednesday, June 6th, 5pm

Assessment

The marks for this course will be assigned as follows:

Assessment Component	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 and the expected average workload is 10–12 hours per week throughout the semester. Note, however, that since this course has no final examination, the workload of the course is compacted into just 13 weeks, so you should adjust your effort accordingly.

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

Upon successful completion of this course, the student should:

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.
    - *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.
    - *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.
    - *The assessment methodology in laboratories deliberately reinforce and assess 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 four competency components, as follows:

- Electronic Circuit Design: Devices, amplifiers, tuned circuits, opamp 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.
- Power System Design: Transformer, motor, power electronic converter, power factor, harmonics, etc.

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

Teaching Strategies

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 weeks in the laboratory timetable. The core design topics are: 1) Electronic Circuits; 2) Signal Processing; and 3) Control Systems. The elective topics are: 4a) Telecommunications; 4b) Data Networks; and 4c) Energy Systems.

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 9, 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. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to be assessed for your laboratory work, 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.

Assessment for the elective design topic

The elective design topic is a group activity, for which all assessment will take place in Week 13. 40% of the overall course assessment is related to the elective topic, but only 15% is awarded by the lab demonstrators in Week 13. 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 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 13. 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 14.

Relationship of Assessment Methods to Learning Outcomes

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

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

Design tasks and other materials for this course will be made available via the course web-page at http://subjects.ee.unsw.edu.au/~elec4123.

Mailing list

Announcements concerning course information will be made via the course web-page, in lectures, tutorials, laboratories and/or via email. You should note that any course related email will be sent exclusively to your UNSW 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 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 **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*. Since this course has no final examination, you should plan to spend more time during the session itself. 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 laboratories, lectures and tutorials 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 Assessment

Each laboratory session is an opportunity for assessment in this course. You are expected to attend all laboratory sessions. Special consideration will be shown to students suffering from illness or misadventure, which can generally be accommodated with the 3 weekly cycle associated with each proficiency topic. You should seek assistance early if you suffer illness or misadventure which affects your progress with the design topics or ability to be assessed, especially where this interferes with your ability to be assessed by the final week of each proficiency topic. All applications for special consideration must be **lodged online through myUNSW within 3 working days of the affected assessment**, not to course or school staff. For more detail, consult https://student.unsw.edu.au/special-consideration.

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 "myExperience" 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 and UNSW policies:
https://student.unsw.edu.au/guide
https://www.engineering.unsw.edu.au/electrical-engineering/resources

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 through the laboratory program and the associated design tasks, as assessed in the lab.
- Developing ethical practitioners who are collaborative and effective team workers, through group activities and tutorials.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.

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	✓