School of Electrical Engineering and Telecommunications

Term 3, 2019
Electrical Engineering Technical Stream Outline

ENGG1000
Engineering Design and Innovation

Technical Stream STAFF

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Introduction
ENGG1000 is a single course coordinated by the Faculty of Engineering. This document outlines details of the technical stream offered within ENGG1000 by the School of Electrical Engineering and Telecommunications (EE&T). It is intended to be read in conjunction with the faculty-wide course outline, which you should have already consulted on the course website through learning and teaching platforms Moodle (https://moodle.telt.unsw.edu.au/login/index.php).

Consultations
You are encouraged to ask questions on the course material, after the lecture class times and during laboratory time in the first instance, rather than via email. For consultations outside of these times, please email for an appointment. ALL email enquiries should be made from your student email address with "ENGG1000 Elec tech stream" in the subject line; otherwise it could result in a lengthy delay in response or no response at all.

Keeping Informed
Announcements will be made via Moodle. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Laboratory Demonstrators
Several experienced demonstrators will staff each laboratory. You may consider these demonstrators as technical consultants and mentors for your project – they will be an excellent source of ideas and experience to successfully complete your project.

COURSE SUMMARY

Contact Hours

The Electrical Stream nominally occupies the **Thursday 2-4pm** slot, from **Weeks 3 to 8 inclusive**, as indicated in the Faculty Course Outline (please refer to the faculty-wide schedule in the Faculty ENGG1000 Course Outline). It will consist of **five lectures**, **2 hours each**. Laboratories are scheduled outside this timeslot from **Weeks 3 to 8 inclusive**.

Lectures

The Electrical Stream lectures will take place in **K-G17-G23 - ElecEng** (map), starting **Thursday, 3 Oct 2019, from 2.00pm to 4.00pm** (**Week 3**). The lecture program will be as follows:

Week No	Day	Time	Lecture Topic
Week 3, 3 Oct	Thursday	2:00pm – 4:00pm	Introduction to Electronics
Week 4, 10 Oct			Resistors & Diodes
Week 5, 17 Oct			Power Sources & DC Motor Circuits

Week No	Day	Time	Lecture Topic
Week 6, 24 Oct			Capacitors, Op-Amps, & Filters
Week 8, 7 Nov			Interfacing & A/D conversion

A comprehensive set of **video lectures** will be provided on Moodle. Due to the limited class time, and the preference to favour laboratory time over lecture time, these video lectures are important to provide the background for the topics discussed. These video lectures can be watched at any time.

The intention is that students should **watch the video lectures before coming to each lecture**, to obtain the necessary background. The lectures will be more focused on circuit design and analysis, and will assume the basic background concepts as covered in the video lectures. Students who have a solid background in Electronics, for instance through ELEC1111, may find that they are already comfortable with the material covered in the video lectures.

Laboratories
Students planning on undertaking the lab assessment will need to **enrol in a lab session**. The Electrical Stream Laboratories (Electrical Engineering Building (G17)) are open for **3 different sessions** and they start in **Week 3**. Here are the time slots and lab rooms:

- **Thursday:**
  - **10am – 12pm, Lab room K-G17-G14 (Ground Floor)**
  - **11am – 1pm, Lab room K-G17-214**
- **Friday:**
  - **12pm – 2pm, Lab room K-G17-G14 (Ground Floor)**

Enrolment will be performed on Moodle. While the labs in principle will be open, preference will be given to those enrolled for that session. Students not enrolled for that session may have to wait until 10 minutes after the start of session to be given bench space. Note also that students that have booked lab space for that session will forfeit this if they are more than 10 minutes late for that lab.

Open Labs
During week 7, the above lab rooms in these timeslots will be available to you for a catchup. At all of these times the laboratory will be staffed by experienced demonstrators. If more open labs were needed as per students' request close to the project deadline or close to Practical Lab Exam due date, arrangements would be made outside of the normal scheduled lab times mentioned above. The times will be announced accordingly on Moodle.

Context and Aims of the Electrical Stream
The main aims of ENGG1000 are clearly explained in the Faculty Course Outline. The Electrical Stream aims to provide you with helpful background knowledge and insight to help you make appropriate design decisions for your project. To achieve this end, the stream aims:

- To convey some basic details of the principles of electrical devices, construction of electronic circuits and analysis techniques, in order to design, build and test simple circuits.
- To familiarize you with the test equipment available in the electronics laboratories, in order to evaluate your design effectively.
- To motivate the learning you will undertake in future courses, both in science and engineering, through a practical design problem.

Perhaps unlike some other technical streams in ENGG1000, many students may not begin the course with much experience in building circuits or measuring electrical quantities. This course provides a fairly gentle (and hopefully fun!) introduction to electronic circuits, while keeping the emphasis on engineering design.

Learning outcomes
Additionally to the faculty learning outcomes, on successful completion you should be able to:

- Appreciate some of the design challenges faced by electrical, telecommunications and photonics engineers, and what kinds of skills and knowledge are needed to tackle them.
- Give examples of design trade-offs typically experienced during electrical design.
- Explain the types of applications of simple electronic circuits, and suggest circuit designs for simple problems.
- Understand basic electrical quantities, in particular voltage and current, from a practical perspective: how to measure them and what values to expect for a given circuit design or application.
- Suggest approaches for debugging simple design problems.

Teaching strategies
This technical stream consists of video lectures, lectures and labs. The video lectures will provide some basic electrical engineering principles to act as a starting point for addressing the design brief. The lectures then focus on specific circuit designs based on these principles. Note that it is absolutely **not** the intention of the lectures, and the technical stream in general, to directly teach you how to solve your design problem – you must determine how to do this yourself. The aim here is to strengthen your knowledge base and skills to help you successfully complete the project. The labs are intended to provide guidance on your self-directed path of discovering the relevant information and skills needed to successfully complete the project.

Assessment Specific to the Electrical Stream
As explained in the Faculty Course Outline, **20% of your assessment for ENGG1000 is to be taken from Technical Streams**. To this end, the Electrical Stream offers **three assessment** tasks worth **10% each**. You can choose to take all three assessments and keep the best two marks.

1. **Circuit Theory Quiz**

   This assessment will consist of a **30-minute Multiple Choice Quiz on Moodle** (**20 questions**). The Quiz questions will be based on ELEC Stream lectures content and will assess your understanding of simple circuit analysis and design. Marks will be assigned based on the correctness of your answers. This assessment task will be held on **Thursday, 7-Nov-2019, 3:20-4:00pm** (**Week 8**), in **K-G17-G23 – ElecEng**. To be eligible to sit for this Quiz, **students must enrol** on Moodle, ELEC Stream section, **one full week prior** to this exam, by **Thursday, 31-Oct-2019, 11.55pm** (**Week 7**) – failure to do so will mean the student will not be permitted to undertake this assessment task.

   Note! The students are required to **bring an electronic device** (preferably, a laptop or tablet) to access the Quiz on Moodle.

2. **Practical Lab Exam**

   The laboratory practical exam will assess and test your skills and familiarity with basic circuit construction, circuit analysis, and laboratory equipment, gained while completing the introductory labs, and will give you feedback on your understanding. Marks will be assigned by Lab demonstrators according to pre-determined criteria. This assessment task will be held during **lab time in Week 8**. To be eligible to sit for this laboratory exam, **students must enroll** on Moodle, ELEC Stream section, **one full week prior** to this exam, by **Friday, 1-Nov-2019, 11.55pm** (**Week 7**) – failure to do so will mean the student will not be permitted to undertake this assessment task.

3. **Lab Book Assessment**

   The Electrical Stream lab program features four optional labs. However, for assessment purposes a student may complete **either** Lab 2, 3, or 4 to achieve **10% of their final mark**. This **requires the student to have 4 checkpoints marked off** by a Lab demonstrator. You **must complete** this assessment before your last lab during **Week 8**.

Lab Operation
The optional lab exercises are important in this course as the primary activity in which your group will gain the required knowledge and practical experience in electronics to be able to successfully complete the project. The lab program consists of a series of exercises in which you construct a variety of useful circuits with relevance to the project. Completion of these exercises should provide the group with the background to successfully implement the design choices it makes. However, these exercises are optional.

In case enrolment numbers are larger than expected for the stream, students should book a lab time through Moodle as explained before – note that if a student has booked a lab time but has not attended 10 minutes after the start of the lab the bench will be allocated to another student. Outside of these allocations and for any laboratory sessions that do not fill up, the Laboratories can be considered 'come as you are' – there is no formal allocation or timetable. The labs will be open and staffed at the above times and no attendance will be recorded. Note, however, the Lab Skills Test and the Lab Book assessments – it is your responsibility as adults to attend the labs as often as you need to pass the course and complete your prototype.

Preparation for Laboratories

You are advised to do the following in preparation for your first electronics laboratory:

- Prior to being admitted to the Electronics Labs you are required to complete an **Occupational Health and Safety Course**. This course is available on Moodle. Please log in to Moodle to find how to enrol in the course.
- Wear **covered shoes**. Without these you will be refused entry to all Electrical Engineering labs.
- Obtain a prototyping board (**breadboard**) before the first lab. If you do not own one, you can purchase one from the **Electrical Engineering Workshop** located in **room G15** of the Electrical Engineering Building or you can borrow it (in case of **borrowing**, you **must return it back** at the end of the semester **to have your final mark released**).
- You may also find it helpful to have a small pair of pliers and a set of small screwdrivers.
- Under no circumstances is mains voltage (230V) to be used at any stage during this course.
- Get a lab notebook if you don't already have one, and bring it to every lab (and every mentor meeting and team project meeting).
- Read the laboratory exercises in advance of the lab (when attempting the suggested introductory labs).
- Read the related lecture notes in advance of lab 2-4, and bring them to the lab.
- If you expect to do soldering (more likely in the later labs), bring safety goggles or purchase them from the Electrical Engineering Workshop.
- There are **laboratory equipment video guides** available online on **UNSW eLearning YouTube Channel** (Click Here). It is highly recommended to watch these videos during the first week of labs (Week 3) to better familiarize yourself on how to work with Electrical Engineering laboratory equipment.

Resources

Wondering where or how to get started? Here are some suggestions, from various sources:

The recommended text book for ENGG1000:

- Dym, C.L. and Little, P., Engineering Design: A Project-Based Introduction, 3rd Edition, John Wiley & Sons, 2009

Another good one for introductory engineering design is:

- Voland, G., Engineering By Design, 2nd Edition, Pearson/Prentice Hall, 2004
- Horenstein, M. N., Design Concepts for Engineers, Pearson/Prentice Hall, 2006 (this is an excellent text on engineering design that is better than Voland in various respects. It is written by a large team of authors, has great examples and has a fresher, more up-to-date feel than Voland)

More specifically for **electrical engineering design** there is:

- Wilcox, A. D., Engineering Design for Electrical Engineers, Pearson/Prentice-Hall, 1989 (this interprets design perhaps more closely to EE&T than the others, and in various sections discusses aspects of specific relevance to Electrical Engineering)
- J.E. Salt and R Rothery, Design For Electrical and Computer Engineers, John Wiley & Sons 2002.
- Stadtmiller, D. J., Applied Electronic Design, Prentice-Hall, NJ, 2003.

More technical books that may help (most helpful in bold) include:

- Brindley, K., Starting Electronics, Elsevier, Burlington, MA, 2005. (very clearly written, this is an excellent introduction to electronics for anyone new to the subject) – in UNSW library
- Kybett, H., and Boysen, E., All new electronics self-teaching guide, Wiley, Indianapolis, IN, 2008. (another great book for getting started on electronics principles, includes revision exercises) – available online from UNSW library

- Scherz, P., Practical Electronics for Inventors, McGraw-Hill, 2000 (this is a very helpful book on introductory electronics, and includes example circuits and practical design tips) – in UNSW library
- Slone, G. R., Tab Electronics Guide to Understanding Electricity and Electronics, McGraw-Hill, 2000. – Google books
- Mims, F. M., Getting Started in Electronics, Master Publishing Inc, 2003. (practical set of notes at a very introductory level, still mainly theory)
- Radio Society of Great Britain, Radio and Electronics Cookbook, Newnes, Woburn, MA, 2001 (maybe some useful circuit ideas) – Google books
- Carlson, A. B., and Gisser, D. G., Electrical Engineering: Concepts and Applications (this is not a design text, but is written at about the right level to provide a useful resource for circuit analysis)

Also:

- The Electrical Stream section on Moodle will be updated as the semester unfolds. Please check it regularly for new info. The dates shown in the Outline are a guide only. You should consult the Moodle site, which is the ultimate source of truth.
- Kerzner, H., Project Management: A Systems Approach to Planning, Scheduling and Controlling, Wiley, 2007
- D. A. Norman, The Design of Everyday Things, Currency-Doubleday, 1990. (a general text on design by a design guru)
- Selinger, C., Stuff you don't learn in engineering school: Skills for success in the real world, Wiley, 2004 (how to work in a team, etc. Read it for interest, or before you do your industrial training)
- P. Horowitz and W. Hill, The Art of Electronics, Cambridge University Press, 1989 (this is not an introductory book, but is full of insightful design tips).

Circuit example web sites, for example:
https://www.arduino.cc/
http://www.aldinc.com/ald_circuitideas.htm
http://www.discovercircuits.com/list.htm
http://www.allaboutcircuits.com/
http://www.opencircuits.com/Basic_Circuits_and_Circuit_Building_Blocks
http://www.kpsec.freeuk.com/trancirc.htm
http://www.eleinmec.com/index.asp
http://hobby_elec.piclist.com/e_pic.htm (PIC microcontrollers)

Occupational Health and Safety
Prior to attending the first laboratory session you must enroll and complete the "Electrical Engineering OH&S" course, which is available through Moodle (http://moodle.telt.unsw.edu.au). You can find this course by searching for courses on Moodle.
Completion of this course is a requirement to attending the Electrical Engineering Labs.