School of Electrical Engineering and Telecommunications

Term 3, 2022
Electrical Technical Stream - Lab Program

DESN1000
Introduction to Engineering Design and Innovation

Electrical Technical Stream Lab Program

The motivation behind these laboratory exercises is to expose you to some of the technical concepts and ideas that will be useful for you in designing the electronics in the ROV, R2R and SCC projects.

Due to time and space limitations, we cannot provide more than an introduction and brief explanation of these concepts, and our aim here is more to expose you to some basic features of electronics. For more detailed explanation you are encouraged to consult textbooks and websites on this material.

Your most important resource in the labs is lab tutors. You're wasting a valuable and important resource if you are not regularly asking these tutors questions and for explanations.

The second point to emphasize is to take accurate notes when you work through these exercises. Many of the ideas you see here will be useful in your design project, and you want to make sure you can accurately repeat what you do here in your design development work. A journal recording of your circuits, settings, and measurement results will be a valuable asset to you later on and is something that should become a habit whenever you do experimental work in the laboratory.

Electrical Technical Stream Lectures

The electrical technical stream has recorded lectures. These are released on the Tuesday before your lab session. You **must** watch these recorded lectures sometime before your technical laboratory session on the Thursday. Not watching these recorded lectures will mean you may not understand the content in the laboratory session which may negatively affect your technical stream mark.

Table 1: Electrical Stream Lectures.

Week	Lab content relates to	Content covered
3	Lab 1	Introduction to voltage, current, resistance, power and energy and resistors
3	Lab 1	Important circuit equations, useful simple circuits, and voltage sources
4	Lab 2	Introduction to diodes, LEDs, photodiodes, phototransistors
4	Lab 3	Introduction to transistors
5	-	Introduction to DC motors and electric drive circuits

Assessment Guidelines

The breakdown of the electrical technical stream assessment items is shown in Table 2.

Table 2: Electrical technical stream assessment breakdown

Assessment Item	Percentage of Final Course Grade
Laboratory Work	20%

Laboratory Work (20%)

Checkpoints are listed throughout the four laboratory task sheets. There are four checkpoints in labs 1-3. This means that there are 12 checkpoints in total.
You will achieve 1.82% for each checkpoint, which means that you will need to do 11 checkpoints to get the full 20% of the technical stream assessment.

Each checkpoint will have a task that you need to complete. This generally involves designing a circuit and demonstrating correct functionality. You should show your functioning circuits to a lab demonstrator to be signed and noted as having completed that checkpoint. It is recommended that students **work in pairs** in Labs 1-3, to gain basic familiarity with the lab equipment and lab environment (unless you are familiar with the equipment through a course like ELEC1111 or you have a remote partner).

The labs and the associated content covered is shown in Table 3. Note that the final Laboratory Work marks will be totaled at 5pm Thursday Week 7.

Table 3: List of laboratory programs for the electrical technical stream.

Lab. No.	Week No.	Content Covered
1	3-4	Resistors, breadboards, important lab equipment, Circuits on TinkerCAD, introduction to component ratings
2	5	Voltage/current divider circuits, batteries LEDs, IR LEDs, phototransistors
1-2	6	Optional open lab session
3	7	Temperature sensors, force sensors, transistors, transistor motor drive circuits

Note: Lab 4 task sheet is provided but is completely optional.

General Guidelines for Electronics

Your breadboard and the various electronic components you use are quite delicate, so be careful and make sure that each connection is firm.

Particularly when you begin to work on larger, more complex circuits, there are many things that can go wrong. It is unrealistic to expect to connect all the components together and expect them to immediately work. It is important that you incrementally test every component and connection as you build your circuit.

Only if every unit works can you expect the entire circuit to function properly. When debugging a circuit bear this in mind, and progressively check each component to verify that it is working as expected and that they are connected in the correct orientation. As a last resort, ask a demonstrator for assistance.

Tasks in red must be completed in the laboratory. The tasks in blue can be completed online and just marked in the laboratory, it is highly recommended that you complete theses tasks online before attending the labs to make the most efficient use of your time in the labs

Laboratory Safety

You should complete the **Electrical Engineering OH&S Module** (Enrolment key = elecmood) on Moodle and **submit your certificate prior to being admitted to the laboratory in Week 3**. However, it is always worth emphasizing the importance of safe practices in an electrical engineering laboratory.

To begin with, please note that use of the EE&T laboratory facilities is conditional on adhering to the following rules:

- You may not smoke, eat or drink in the laboratories.
- Covered footwear must be always worn.
- Bags and loose clothing must be stored under the benches. The most common form of accident in laboratories is tripping, so this rule is much more important than you may think.
- You may not, under any circumstances, wire your own project directly to the mains. For this subject, all designs are to be powered either by batteries or from the power supplies provided in the labs.
- Please report any equipment failures or unsafe mains cords to laboratory technical staff or to one of the laboratory demonstrators.
- You must wear a facemask and maintain social distancing of 1.5 m where possible.

In addition to the above safety guidelines, you should remember that the School's laboratories are a shared resource, to be treated with care and respect. Before leaving the laboratory, please

- turn off and unwire any equipment you have used;
- put all equipment, leads and components away; and
- store all lab stools under the benches.

Electronic Components

The lab demonstrators will be able to give you the special components as you need them*.

Lab 01	Breadboard (Bring to the lab)
Lab 02 Provided	Battery attachments (for 9V)
	9V batteries (normal)
	CSLR-N502TG4-A0R Standard Green LED
	L-53F3C IR LED
	Toggle switch
	L-53P3C IR phototransistor
	10 Ω 10 W power resistor
	LM7805 voltage regulator
Lab 03 Provided	BC-549 NPN transistor
	BD139 transistor
	3V High torque DC motor (MM28 – Element 14 - 599128)

* Note: the model may varies depending on the components in stock.

The components should be returned to the lab demos after the completion of the laboratory session.