



**ELECTRICAL AND COMPUTER ENGINEERING  
FACULTY OF ENGINEERING  
UNDERGRADUATE SAFETY MANUAL FOR  
ELECTRONICS LABORATORIES**



# Laboratory Information Sheet

## *Electrical and Computer Engineering*

### Electronics Labs

#### Hazards Present in this Lab

None

#### Protective Equipment

Closed Toe Shoes

#### Contact List

	Name	Extension	After Hours
<b>Supervisor</b>	Supervising TA	Present in Lab	
<b>Supervisor</b>	See course outline	See course outline	"88"
<b>Staff</b>	Steve Spencer	24103	or
<b>Staff</b>	Tyler Ackland	24448	905.522.4135
<b>Departmental Office</b>	Shelby Gaudrault	24826	

#### Emergency Contacts

- ▶ **Emergency assistance (e.g. security, medical): "88" or 905.522.4135**
- ▶ **First Aid: Stephan Olaizola, ITB 146, ext. 24965**
- ▶ **First Aid: Robert Li, ITB 242, ext. 23445**
- ▶ **Safety Information: EOHSS, ext. 24352**

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## ***Acknowledgement***

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Parts of this manual have been extracted from the “McMaster University Laboratory Manual 2019” to maintain consistent wording when referring to the Occupational Health and Safety Act (OHSA).

## ***Introduction***

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Safety standards at McMaster University are designed to eliminate the risks inherent in the use of dangerous materials and potentially dangerous procedures or practices. All laboratories can be inherently dangerous places and the attitudes and actions of those who work in the laboratory determine their own safety and that of their colleagues and ultimately that of the community.

Different safety procedures and training are set for different levels of risk. High levels of risk require more stringent procedures than lower levels of risks. Changes are therefore made in setting safety procedures and training so as not to impede student learning while keeping risks of those involved to a safe minimum. Laboratory equipment and design has become more sophisticated and safer, but safe operation still depends on properly trained and genuinely concerned personnel, who are safety conscious at all times.

This Lab Safety Manual is intended to provide basic rules for safe work practices in a laboratory, along with specifics of a particular room or group of rooms. This manual is by no means all-encompassing, and any omission is not an excuse for unsafe practices. If you have questions about how to undertake a task or project safely, contact your TA or the professor/instructor of the course. In all cases the individual professor/instructor is ultimately responsible for teaching safe work practices and standard operating procedures and must insist upon the use of such proper procedures to eliminate unnecessary hazards.

## ***Purpose of this document***

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- To define health & safety responsibilities and accountabilities within the University Community
- To outline specific procedures and programs, where applicable
- To explain basic emergency procedures
- To provide information and standards in the form of established Safety Guidelines in laboratories

## ***Responsibilities and Rights***

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Under the Occupational Health and Safety Act (OHSA) and Regulations, professors together with their teaching assistants must make their students aware of dangerous or potential hazards. Students have a responsibility to report to their TAs or professor the existence of hazardous conditions which are contrary to good health and safety practices, or which contravene any requirements of the Act or applicable Regulations. It is the professor's responsibility, together with ECE technical staff, to ensure that corrective action is taken at once.

It is the unconditional right of all members of the University to bring without prejudice, health and safety concerns to their supervisors, or to Environmental and Occupational Health Support Services (EOHSS) (Human Resources), Faculty of Health Science (FHS.) Safety Office, or to Joint Health and Safety Committees (JHSCs). If possible, the supervisor, in every case, must be informed of a concern before a complaint is taken elsewhere.

It is the responsibility of each member of the McMaster Community to know all emergency procedures, location and use of safety equipment and exit routes in case of an emergency. Consult your supervisor for more information.

### ***Summary of Responsibilities***

The following is a summary of responsibilities according to the Occupational Health and Safety Act. Please refer to the OHSA for specific wording.

#### ***Employer (McMaster)***

- OHSA, Section 25, 26
- the equipment, materials and protective devices provided by the employer are in good condition
- provide information, instruction and supervision to a worker (student) to protect the health and safety of the worker (student)
- appoint a competent supervisor (professor)
- acquaint a worker (student) or a person in authority over a worker (student, such as a teaching assistant, with any hazard in the workplace
- take every reasonable precaution in the circumstances to protect the worker (student)
- prepare and review a written health and safety policy at least annually and post this in the workplace

### ***Supervisors (Professor)***

- OHSA, Section 27
- ensures a worker works in a manner required by the Act and Regulations and with the proper protective devices
- ensures a worker uses or wears the equipment, protective devices or clothing required
- advise the worker of any potential or actual danger to the health and safety of the worker
- provide the worker with written instructions (standard operating procedures) about measures and procedures for protection
- take every reasonable precaution in the circumstances to protect the worker

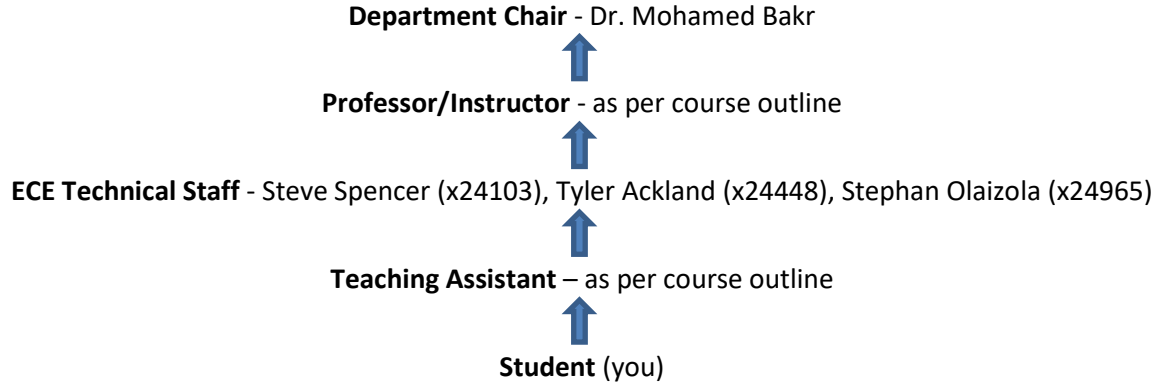
### ***Workers (Students)***

- OHSA, Section 28
- work in compliance of the Act and applicable Regulations
- wear any equipment, protective devices or clothing that the employer requires
- report any defect in protective gear that may endanger him/herself or someone else
- report any contravention of this Act, applicable Regulations or any hazards
- shall not remove or alter any protective device
- operate or use any equipment in such a manner as to endanger him/herself or someone else
- shall not engage in any prank, contest, feat of strength, unnecessary running or rough and boisterous conduct

### ***Chain of reporting for incidents relating to safety in the lab***

You will be provided with a health and safety lecture at the beginning of the first lab for each course. You are responsible for ensuring that you understand this safety information. The ECE technical staff members are responsible for ensuring that all equipment is in good working order. In the event of an emergency, notify your Teaching Assistant (TA) or one of the ECE technical staff members if a TA is not available. They are responsible for calling medical aid if needed. If they are unavailable, or the incident occurs after regular working hours, dial 88.

You must report any hazardous situation of concern to one level up according to the chart below. In case this person is not available, either contact the person delegated in their absence or the person positioned at the next level up. You are expected to know this chain of reporting:



## ***Hazardous Chemicals or Materials***

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ECE technical staff intentionally do not place any hazardous chemicals or materials inside any of our undergraduate instructional laboratories. There are also no Designated Substances (as identified by the Ontario Government) placed intentionally in our labs.

Students are not allowed to bring any such chemicals or materials into an ECE undergraduate lab. There are no chemical storage facilities in any of the ECE undergraduate labs.

## ***Administrative Controls – Laboratory Operations***

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- Always be prepared and informed. Know the safety rules, emergency procedures and standard operating procedures. Be familiar with your emergency exit route.
- According to the Ontario Fire Code all laboratory doors are fire doors and must be kept closed at all times.
- Never prop open doors or block emergency exits, emergency equipment or electrical panels.
- Eating and drinking is not allowed in any ECE undergraduate laboratory.
- The Electrical Safety Code prohibits the use of extension cords in laboratories as a permanent source of power.
- Know the location of emergency equipment in your area and how to use it.
- Wear the appropriate personal protective equipment for the level of hazard. Open toed shoes are not permitted, and long pants should be worn in the lab. Long hair, loose clothing and dangling jewelry should be constrained.
- Working alone especially at off hours is discouraged; always check with your professor if specific procedures require a buddy system. Check the standard operating procedures in your department

regarding "working alone" during off hours. Consult Risk Management Manual (RMM) # 304: Persons Working Alone Program

- Practice good housekeeping - promptly dismantle equipment when no longer needed. All lab benches should be kept clear of clutter. Dispose of any waste appropriately.
- No rough-housing or pranks in laboratories. Always report unsafe conditions and accidents promptly to your professor.
- Hallways and stairwells are to be clear and with unobstructed egress in case of fire. These areas are not at any time to be used for storage.

## ***Emergencies – Accidents & Spills***

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### ***Medical Emergency***

On McMaster University campus, call Security at 88 from any campus phone or dial 905-522-4135 on your cell phone for assistance or if medical aid is required. Report all incidents to your supervisor and to EOHSS as quickly as possible. Completed Injury/Incident Reports must be submitted to EOHSS and where applicable to FHS. Safety Office within 24 hours of its occurrence.

### ***Fire Emergency***

The RMM# 1201: Fire Safety Plan provides instruction and direction during a fire emergency for all persons working, studying, or visiting campus buildings – familiarize yourself with this policy.

#### **In Case of a Fire:**

- Immediately vacate the building VIA the nearest Exit Route. DO NOT USE ELEVATORS
- Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
- The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself.
- In the event of a fire in your work area shout "FIRE" and pull the nearest fire alarm.
- Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner, utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire.

Most labs are equipped with Class A, B and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.

- Do not attempt to fight a major fire on your own.



- If possible, make sure the room is evacuated, close but do not lock the door and exit the building using the stairs.

Main Campus: Using a campus phone dial 88 or from a cell phone, dial 905-522-3135. Give the location and details of the fire.

Report all incidents to your supervisor. Completed Injury/Incident Reports must be submitted to EOHSS and where applicable to FHS Safety Office within 24 hours of its occurrence.

### **Clothing on Fire**

Roll on the floor and scream for help OR smother the flames with material made from non-flammable fiber. Do not wrap a standing person, rather, lay the victim down to extinguish the fire. The material should be removed once the fire is out to disperse the heat. DO NOT use a fire extinguisher on people.

## ***General guidelines***

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- Conduct yourself in a responsible manner at all times in the laboratory.
- Know what to do if there is a fire drill during a laboratory period; turn off any electrical equipment in the event of a fire drill.
- Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ASK YOUR TA or ECE TECHNICAL STAFF MEMBER BEFORE PROCEEDING WITH THE ACTIVITY.
- Perform only those experiments indicated by the lab manual or your TA. Carefully follow all instructions, both written and oral. Unauthorized experiments are not allowed.
- Carry out the experiments in such a way that nobody will be injured or hurt.  
Carry out the experiments in such a way that the equipment will not be damaged or destroyed.
- Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory.
- Observe good housekeeping practices. Work areas should be kept clean and tidy at all times. Keep backpacks and overcoats out of traffic areas.
- Be alert and proceed with caution at all times in the laboratory. Notify the TA or lab technician immediately of any unsafe conditions you observe.
- Labels and equipment instructions must be read carefully. Set up and use the equipment as directed by your lab manual.
- Experiments must be personally monitored at all times. Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.
- Dress appropriately for each laboratory activity as outlined by the lab supervisor and door signage for each lab.

- Report any accident (breakage, etc.) or injury (cut, burn, etc.) to the TA or ECE technical staff member immediately.
- Cell phones and use of music headphones should be avoided while working in the lab. They can be distracting and thereby increase the potential for an accident to occur.
- Soldering is not allowed in ECE undergraduate labs due to the lack of smoke filtration and potential damage and injury. All soldering operations can be done in the IEEE Student branch room where soldering facilities have been set up. Contact the IEEE Student Branch regarding rules of access.
- Fire extinguishers in ITB are in the hallways, not in individual rooms.

## ***Lab-specific safety information for Electronics Laboratories***

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### ***Undergraduate Electronics Laboratory Safety Specifics***

Switch off the supply if you make changes to the experiment even when the voltage is low.

Do not connect power to a circuit until the circuit is finished and you have carefully checked your work.

After the lab session, switch off every supply, disconnect and dismantle the experiments.

If you discover a damaged AC power cord, discontinue use of the equipment, and inform your teaching assistant, instructor, or technical staff member.

Malfunctioning integrated circuits can get hot enough to burn skin. Diagnosing faults through touch is discouraged. If attempted, start with a quick tap followed by increasingly longer touches.

Similarly, resistors of improper ratings can heat up and burn out due to excessive current through the device. Dispose of resistors that appear to be blackened and turn off electrical power at the first sign of overheating or visible smoke from any part of a circuit.

The wire cutters in the lab are only intended for cutting soft copper wire. Cutting harder materials may produce injurious projectiles or damage the cutters.

Cut wire ends, component and IC leads are pointy enough to cause a puncture injury. Take care when handling these items.

PRO TIP: Strip only enough insulation to fully insert the bare wire into a breadboard. Usually, this is about 6 to 8 mm or bare wire. Hold wires and component leads 1 cm from their end and insert perpendicularly into the breadboard. Very little, if any, bare wire on jumper wires should be visible after insertion. This will help you avoid mangled leads and short circuits.

## ***Handling of Semiconductor Components***

Sensitive electronic circuits and electronic components have to be handled with great care. The inappropriate handling of electronic component can damage or destroy the devices. The devices can be destroyed by driving to high currents through the device, by overheating the device, by mixing up the polarity, or by electrostatic discharge (ESD).

Therefore, always handle the electronic devices as indicated by the handout, the data sheet or other documentation.

An ESD event is a rapid transfer of charge from one object to another in an attempt to become electrically neutral. Electrostatic charge is most commonly created by the contact and separation of two electrically nonconductive materials.

The amount and type of charge (positive or negative) depends on the materials involved. The following common materials, often found in business and laboratory environments, are all sources of static electricity:

- common plastic bags
- common packing tape
- paperwork
- common untreated plastic materials
- styrofoam parts

## ***Controlling Electrostatic Discharge***

The basics of ESD control are simple, built on the following principles:

### **Grounding**

Grounding is a means of draining the static charges present on your body, by use of a personal grounding device or a wrist strap.

### **Isolation**

Isolation involves the packing of components and assemblies during storage and transportation.

### **Prevention**

Prevention is the area where you can make the biggest difference. A number of common-sense rules can be applied. These rules do not require additional materials but are extremely effective in preventing static damage:

- Always keep your workbench clean and clear of unnecessary material, particularly common plastics.
- Return ESD-sensitive items to their ESD-protective containers when not actively working with the items.
- Do not hold ESD-sensitive items like semiconductor device (diodes, transistors, integrated circuits) against your clothing.
- Don't touch sensitive items (e.g., metal oxide semiconductor field effect transistors (MOSFETs), Operational Amplifiers, Logic gate).