

**ELEC ENG 2CI5**  
**Introduction to Electrical Engineering**

COURSE OUTLINE

Please refer to course website for updated information.

**COURSE DESCRIPTION**

Current, potential difference; Kirchhoff's laws; Ohm's Law; circuit elements; mesh/nodal analysis of electrical circuits; first and second order circuits; complex arithmetic; phasors, impedance and admittance; AC power.

**PRE-REQUISITES AND ANTI-REQUISITES**

Prerequisite(s): Registration in a Computer Engineering or Electrical Engineering program  
 Antirequisite(s): ELEC ENG 2CI4

**SCHEDULE**

<b>Lectures:</b>	C01: Mondays/Thursdays 9:30am, Tuesdays 10:30am	Online (live)
	C02: Mondays/Thursdays 9:30am, Tuesdays 10:30am	Online (live)
<b>Tutorials:</b>	TO1: Mondays 11:30am-12:20pm	Online (live)
	TO2: Mondays 1:30-2:20pm	Online (live)

**Laboratories:** L01 Mondays 2:30 - 5:30pm  
 L02 Tuesdays 2:30 - 5:30 pm  
 L03 Wednesdays 2:30 - 5:30 pm  
 L04 Thursdays 2:30 - 5:30 pm  
 L05 Fridays 2:30 - 5:30 pm

All labs sessions are virtual and require the use of the AD2 board

**INSTRUCTORS**

**Dr. Mohamed Bakr**  
 Email: [mbakr@mcmaster.ca](mailto:mbakr@mcmaster.ca)  
 Office: ITB-A219  
 Phone: 905-525-9140 ext. 24079  
 Office Hours: Mon.-Thurs. 2:30pm – 3:20pm  
 (online)

**Dr. Michael Noseworthy**  
 Email: [nosewor@mcmaster.ca](mailto:nosewor@mcmaster.ca)  
 Office: SJH-F130A  
 Phone: (905) 522-1155 ext.35218  
 Office Hours: Wed. & Fri. 8am-10am  
 (online)

### TEACHING ASSISTANTS

Mohamed Bagheri  
Mistry Jigar,  
Ayman Negm  
Mohamed Abdelmagid  
Mohamed Ibrahim,  
Shima Faramarzi  
Ziqi Dou  
Maksud Md. Alam  
Diego Valencia Garcia  
Mina Naguib  
Jiaqi Yuan,  
Yangyi Liu

All contact information will be shared on Avenue to Learn.

### COURSE WEBSITE/S

Avenue to Learn (<http://avenue.mcmaster.ca/>)

### COURSE OBJECTIVES

By the end of this course, students should be able to:

- Analyze circuit systems using nodal analysis and/or mesh analysis.
- Be able to interpret analytical results and assign properly powers, currents and voltages to circuit elements.
- Explain the characteristics of resistors, capacitors and inductors.
- Compute time response of first-order RC and RL circuits.
- Analyze RLC circuits using phasor techniques and interpret analytical results and assign properly powers, currents and voltages to circuit elements.
- Work in a group in an effective and efficient manner in order to achieve goals of assigned laboratory work.
- Clearly communicate engineering design work in both written and oral formats.
- Understand sustainability aspect and its relation to power engineering systems.

### ASSUMED KNOWLEDGE

Linear algebra, basic complex algebra, first-order differential equations

**COURSE MATERIALS**

Required Texts:

Basic Engineering Circuit Analysis (11th Ed.) by J. David Irwin and R. Mark Nelms, Wiley.  
Analog Discovery 2 Laboratory Experiments Courseware

Calculator:

Only the Casio FX-991 MS or MS Plus Calculator will be permitted in tests and examinations.

Other

Analog Discovery 2 Board, Available at the McMaster Bookstore

Videos are available via

1). Dr. Bakr's YouTube Channel:

[http://www.youtube.com/channel/UCFQ\\_5eallhvHplhf9pdsVsw](http://www.youtube.com/channel/UCFQ_5eallhvHplhf9pdsVsw)

2). Dr. Noseworthy's YouTube Channel:

[https://www.youtube.com/channel/UCS7Q-0\\_OhuCPw4GVR1Y0LLw](https://www.youtube.com/channel/UCS7Q-0_OhuCPw4GVR1Y0LLw)

**COURSE OVERVIEW**

Weeks	Topics	Textbook
1	Charge, current and voltage. Voltage and current sources.	Chapter 1
2-3	Resistive circuits, Ohm's law, parallel and series circuits, voltage and current dividers, wye and delta circuits.	Chapter 2
4-5	Nodal and loop analysis techniques, Kirchhoff's laws.	Chapter 3
6-7	Superposition techniques in linear circuits. Thevenin and Norton equivalent circuits. Power transfer.	Chapter 5
8-9	Capacitance and inductance, energy storage, integrator and differentiator circuits	Chapter 6
10	Transient circuit analysis	Chapter 7
11-12	AC steady-state analysis, phasors, power relationships.	Chapter 8

A more detailed timeline is available on Avenue to Learn.

At certain points in the course it may make good sense to modify the schedule. The instructors may modify elements of the course and will notify students accordingly (in class, on Avenue).

**LABORATORY OVERVIEW**

Week	Topic
4	Laboratory Safety: Each student in the course is required to pass the lab safety quiz prior to attempting any of the laboratories. The video and quiz will be on Avenue to Learn.

5	Introduction to AD2 board (Sets 1 -3)
6	Nodal Analysis (Set 4)
7	Mesh Analysis (Set 5)
8	Thevenin and Norton Equivalentents (Set 6)
9	RLC circuits (Set 9)
10	AC Analysis (Set 10)
11	Maximum Power Transfer (Set 11)
12	Make-up lab (requires permission from instructor)

**LABORATORY OPERATION**

- At the beginning of every term, every undergraduate student using an ECE Lab is required to complete the ECE Lab Safety Quiz (one completed quiz covers every course that term). This is required even if you are doing labs at home.
- The labs for this course will be held at your home, in your assigned lab times, with an online presence of a TA dedicated to each lab.
- Each lab will involve a significant amount of pre-lab work. You may submit one pre-lab report per group.
- The pre-lab work will be assessed at the beginning of the lab.

**ASSESSMENT**

Component	Weight
Laboratories	20%
Two Midterm Tests (15% each)	30%
Quizzes/Attendance	20%
Final Examination (cumulative)	30%
Total	100%

Students are expected to attend all lectures and tutorials, as well as their assigned laboratory section. Students will be responsible for all material covered in these venues.

**ACADEMIC INTEGRITY**

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation

reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/>

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

#### **AUTHENTICITY / PLAGIARISM DETECTION**

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster’s use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

#### **COURSES WITH AN ON-LINE ELEMENT**

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

#### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online. It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

### **ACADEMIC ACCOMMODATIONS**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC WORK**

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

**EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

**ACCREDITATION LEARNING OUTCOMES**

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: <http://www.engineerscanada.ca> .

<b>Outcomes</b>	<b>Indicators</b>	<b>Measurement Methods(s)</b>
Use mathematics, circuit laws and network theorems to analyze and solve problems in simple and complex D.C. circuits.	1.1, 2.2	Exams
Describe the principles of inductance and capacitance and explain their effects on circuit performance.		Exams
Solve problems in determining charge magnitude, timing and transient response in both inductive and capacitive circuits.	3.1	Exams
Safely use test equipment commonly found in industry for the measurement of electrical circuit parameters.	11.2	Labs
Use theoretical basis to propose simple circuit design and test the performance in the laboratory setting	7.3, 9.3	Labs

[www.eng.mcmaster.ca/ece](http://www.eng.mcmaster.ca/ece)

## Information for Laboratory Safety and Important Contacts

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory and online <https://hr.mcmaster.ca/app/uploads/2019/07/2019-McMaster-Lab-Manual.pdf>

## General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following whether conducting lab work at school or at home:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.
9. Personal ergonomics should be practiced when conducting lab work. <https://bit.ly/3fOE71E>
10. Current University health and safety issues, and protocol should be known. <https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/>

## Location of Safety Equipment

### Fire Extinguisher

On walls in halls outside of labs

### Telephone

On the wall of every lab near the door

### First Aid Kit

ITB A111, or dial "88" after 4:30 p.m.

### Fire Alarm Pulls

Near all building exit doors on all floors

## Who to Contact

**Emergency Medical / Security:** On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.

**Non-Emergency Accident or Incident:** Immediately inform the TA on duty or Course Instructor.

**University Security (Enquiries / Non-Emergency):** Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.

**See TA or Instructor:** For problems with heat, ventilation, fire extinguishers, or immediate repairs

**Environmental & Occupational Health Support Services (EOHSS):** For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.

**ECE Specific Instructional Laboratory Concerns:** For non-emergency questions specific to the ECE laboratories, please contact 24103.

## In Case of a Fire (On Campus Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. 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.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

## Clothing on Fire

**Do not use a fire extinguisher on people**

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

## Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

1. Immediately discontinue use of the equipment.
2. In power labs, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

## Protocol For Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

## Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	<a href="mailto:steve@mail.ece.mcmaster.ca">steve@mail.ece.mcmaster.ca</a>
ECE Chair	Tim Davidson- ITB A111	<a href="mailto:davidson@mcmaster.ca">davidson@mcmaster.ca</a>
ECE Administrator	Kerri Hastings- ITB A111	<a href="mailto:hastings@mcmaster.ca">hastings@mcmaster.ca</a>
ECE Course Instructor	Please contact your specific course instructor directly	