COURSE OUTLINE

(VERSION 1)

ECOR1043: CIRCUITS – WINTER 2023

DEPARTMENT OF ELECTRONICS

CARLETON UNIVERSITY

1 INSTRUCTOR INFORMATION AND OFFICE HOURS

Tashfeen Karamat
tashfeen.karamat@carleton.ca
Office: 4526 EDC

2 HEAD TA INFORMATION:

Name: Qingyang Li
Email: QINGYANGLI@cmail.carleton.ca

3 COURSE MODE OF DELIVERY

Course will be delivered In-Person, which includes all the lectures, labs, quizzes, and exams.

4 CALENDAR INFORMATION

ECOR1043
Circuits

Basic electrical quantities (Voltage, Charge, Current, Power) and Ohm's law. Elementary circuit theory for passive elements including Loop and Nodal analysis. Thévenin's, Norton's, Source Transformation and Superposition theorems. Basics of frequency response, capacitors and inductors. Fundamentals of passive filters (low-pass, high-pass and band-pass). Circuit design and simulation.

Precludes additional credit for ECOR 1052.

Prerequisites: This course may not be taken concurrently with ESLA 1300 or ESLA 1500.

Students who have not satisfied the prerequisites for this course must either withdraw from the course or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

5 COURSE OBJECTIVES

This course will introduce students to various engineering subjects such as:

- An introduction to electrical system design & simulation
- Applications for theoretical knowledge such as voltage dividers, max power transfer
- Electrical engineering hardware
- Electrical specifications
- Cooperative group work
- Engineering Documentation and technical writing

6 LEARNING OUTCOMES

By the end of this course, students should:

1) Learn to analyze electrical circuits using techniques such as loop and nodal analysis, Norton and Thevenin analysis and superposition.
2) Learn the basics of capacitors and inductors
3) Learn to analyze and design lowpass, highpass and bandpass filters
4) Gain experience performing electrical circuit simulation
5) Familiarize themselves with electrical laboratory hardware such as function generators and oscilloscopes
6) Learn to work in a group environment.

7 REFERENCE MATERIAL

Lecture Notes: Lectures notes will be provided which will be sufficient for this course.

Reference Book: **NOT REQUIRED** but may prove useful: Engineering circuit analysis. Irwin, J. and Nelms, R. Wiley. 11^{th}/12^{th} Edition.

8 REQUIRED SOFTWARE

Multisim Live Free software (from National Instruments NI) will be used for the labs. This is an online circuit simulator for which no installation is required. NI Multisim (for desktop) is already installed on the lab workstation computers.

9 EVALUATION AND GRADING SCHEME

The overall grade will be calculated as follows:

Component	Weight
Pre-labs	10%
Lab Reports	25%
Final Exam	65%

In order to pass the course, students must achieve satisfactory performance during the term as well as in the final exam.

Satisfactory performance during the term is completion of the lab experiments (including checking out of each lab) with a combined average grade of >40% on all term work (All grades excluding the final exam).

Students who fail the final exam (an exam grade of less than 50%) will receive a course grade of F, regardless of their marks in the other components. For students who pass the final exam, a numeric mark out of 100 will be calculated by weighting the course components as shown in the table above.

The table below describes the numerical grade ranges for each letter grade (Received final grade represented by X):

Letter Grade	Numerical Grade Range
F	$X < 50$
D-	$50 \leq X < 53$
D	$53 \leq X < 57$
D+	$57 \leq X < 60$
C-	$60 \leq X < 63$
C	$63 \leq X < 67$
C+	$67 \leq X < 70$
B-	$70 \leq X < 73$
B	$73 \leq X < 77$
B+	$77 \leq X < 80$
A-	$80 \leq X < 85$
A	$85 \leq X < 90$
A+	$90 \leq X$

10 BREAKDOWN OF COURSE REQUIREMENTS

10.1 PRE-LABS

The pre-labs will be evaluated prior to the start of each lab in order to ensure students understand the requisite knowledge prior to performing each experiment. The prelab will be required to be completed prior to starting each lab (in the form an online quiz).

10.2 LAB REPORTS

The lab reports will be evaluated in order to ensure students performed and understood the experiment as required and recorded or calculated all necessary values.

As current circumstances do not allow for makeup labs to be offered: Should a student miss a single lab due to any reason the weight of that report will be moved to the remaining three reports. Therefore, your lab report grade will take the best 3 of the 4 total reports. Lab attendance is a mandatory requirement of the course (to be eligible for a grade for that lab), which will be ensured during lab "Check-out". A grade of '0' in lab Check-out means you will get '0' in your lab report irrespective of your lab report grade.

For detailed instructions about Pre-Lab and Labs, see "Pre-Lab and Lab Instructions" in "Lab Experiments" section of your main Brightspace course page.

10.3 FINAL EXAM

The final exam will evaluate student understanding of all course concepts. Final exam will take place outside of class time (which can include Friday evening, Saturday or Sunday).

The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

11 GRADUATE ATTRIBUTES (GA'S)

The Canadian Engineering Accreditation Board requires graduates of undergraduate engineering programs to possess 12 attributes.[1] Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all

[1] Criterion 3.1, *2018 Accreditation Criteria and Procedures*, Canadian Engineering Accreditation Board, November 2018.

[2] The instructional level of course content related to graduate attributes is classified by the content-level codes I (Introduced), D (Developed) and A (Applied). These codes are defined in A Guide to Outcomes-Based Criteria, Version 1.25, Canadian Engineering Accreditation Board, 1 March 2015.

sections of a course during an academic year) is used for accreditation purposes and to guide improvements to our programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate.

This table lists the GAs that will be measured in this course, along with the learning outcomes that are intended to develop abilities related to these attributes.

Graduate Attributes	**Instructional Level[2]**	**Learning outcomes (listed in the previous section)**
1.3 - Fundamental engineering concepts	I	1-3
2.3 - Use of assumptions	I	1
2.4 - Interpreting the solution - validity of results	I	1 - 3
5.3 - Tools for design, experimentation, simulation, visualization or analysis.	I	1, 2 & 4
5.5 - Limitations of such tools and the assumptions inherent in their use	I	1, 2 & 4

12 General Regulations

12.1 Copyright on Course Materials

The materials created for this course (including the course outline and any slides, notes, program source code, labs, projects, assignments, quizzes, exams and solutions) are intended for personal use and may not be reproduced or redistributed or posted on any website without prior written permission from the author(s).

12.2 Attendance

Students are expected to attend all lectures and lab periods In-Person. Lab attendance is a mandatory requirement of the course. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 1.2, Course Selection and Registration and Section 1.5, Deregistration.*

12.3 Health and Safety

Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: http://sce.carleton.ca/courses/health-and-safety.pdf

12.4 Deferred Term Work:

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.6, Deferred Term Work.* In an eventuality of course being going online, the students are required to have a stable and reliable internet connection, a poor internet connection will not be considered a sufficient reason to defer an online exam.

12.5 Appeal of Grades

The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 2.7, Informal Appeal of Grade and Section 2.8, Formal Appeal of Grade.*

12.6 Academic Integrity

Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

12.6.1 Plagiarism

Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

12.7 Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals. You can obtain detailed information on academic accommodation at https://students.carleton.ca/course-outline/#accommodation-for-student-activities.

13 Information for Pandemic Measures

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are a number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

13.1 Feeling sick?

Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

13.2 Masks

Carleton has paused the COVID-19 Mask Policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

13.3 Vaccines

Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the University's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.

14 Week-by-Week breakdown

Following is a breakdown of the topics that will be covered each week. There may be a slight variation in their order to adjust for any unforeseen circumstances.

Week	Topics	Description
1	Introduction, Ohm's Law, KVL, KCL.	Charge, current, energy, voltage, power, circuit elements, Resistance, Ohm's law, KCL, KVL
2	Single-loop and Single-node circuits.	Single-loop analysis, voltage division, multi-source, multi-resistance networks, resistors in

		series. Single-node analysis, current division, multi-source/ multi-resistance networks.
3	Multi-node analysis, Multi-loop analysis.	Analysis of multi-node, multi-loop and multi-source circuits.
4	Additional Analysis Techniques. Source transformation and Superposition	Thevenin's and Norton's theorems, Maximum power transfer. Introduction to the concept of Source transformation and its use to simplify circuit analysis. Basics of Superposition and its use to simplify the analysis of the circuits with multiple sources.
5	Introduction to AC Basics of Frequency response,	Introduction to AC signals, sinusoids, complex numbers, concept of impedance, basics of capacitors, inductors and their impedance. Basics of frequency response, transfer function, decibels. Concepts of creating Bode plots and introduction to various passive filters.
6	Passive high-pass and band-pass filters, superposition, and source transformation.	Utilizing the frequency response of inductors and capacitors to create passive first-order high-pass, low-pass and band-pass filters. Examples of how to create Bode plots for various passive filters.