COURSE OUTLINE

(VERSION 3.00)

ECOR1043: CIRCUITS – WINTER 2022

DEPARTMENT OF ELECTRONICS

CARLETON UNIVERSITY

1 INSTRUCTOR INFORMATION AND OFFICE HOURS

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2 HEAD TA INFORMATION:

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3 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.

4 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 tranfer
- Electrical engineering hardware
- Electrical specifications
- Cooperative group work
- Engineering Documentation and technical writing

5 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.

6 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 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.

[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.

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

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. Part of Lab 4 may need NI Multisim (for desktop) which is already installed on the lab workstation computers that you can access remotely.

9 EVALUATION AND GRADING SCHEME

The overall grade will be calculated as follows:

Component	Weight
Pre-labs	15%
Lab Reports	30%
Final Exam	55%

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 above.

Final grades are not rounded, 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

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).

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".

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

Final Exam - The final exam will evaluate student understanding of all course concepts.

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.

In order to pass the course, students must achieve satisfactory performance during the term. 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).

11 GENERAL REGULATIONS

Online Requirements: Due to content currently being provided in an online capacity, **students are required** to have a stable and reliable internet connection. It will not be possible to accommodate missed labs, or other deliverables due to a dropped internet connection. To reduce the chances of this impacting you it is recommended students use a wired internet connection where possible. Additionally, it is **highly recommended** students test the simulation software on their local computer prior to their first lab session to ensure proper functionality.

Attendance: Students are expected to attend all lectures and lab periods virtually. 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.*

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

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.* Since 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.**

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.*

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.

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

Academic Accommodation: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/ For an accommodation request, the processes are as follows:

- **Pregnancy or Religious obligation**: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity

Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your ***Letter of Accommodation*** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). **Requests made within two weeks will be reviewed on a case-by-case basis**. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (*if applicable*).

- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/.
- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

12 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. Capacitance and inductance.	Thevenin's and Norton's theorems, Maximum power transfer. Capacitors & inductors, current, power and energy, series and parallel combinations, Complex numbers, decibel, sinusoids, impedance of passive elements.
5	Basics of Frequency response, Passive low-pass filters	Introduction to frequency response using AC signals with capacitors, inductors, and resistors. Utilizing the frequency response of various circuit elements to create low-pass filters.
6	Passive high-pass and band-pass filters, superposition, and source transformation.	Utilizing the frequency response of various circuit elements to create high-pass and band-pass filters. Introduction to superposition theorem. Source transformation.