Carleton University Department of Electronics

Winter 2025

ELEC 3605: Electrical Engineering

Introduction

This course covers the fundamentals of Electrical Engineering. Topics covered include:

- DC circuits: elements, sources, analysis.
- Single phase AC circuits: phasors, RLC circuits, real and reactive power, impedance, network analysis, three phase systems.
- Power transformers.
- DC motors: operation and characteristics.
- AC motors: single phase and three phase.

Course Description and Requirements

DC circuits: elements, sources, analysis. Single phase AC circuits: phasors, RLC circuits, real and reactive power, impedance, network analysis, three phase systems. Power transformers. DC motors: operation and characteristics. AC motors: single phase and three phase.

Prerequisite(s): MATH 1005 and (PHYS 1004 or PHYS 1002), and second-year status in Engineering.
Lectures: 3 hours per week
Laboratory and problem analysis: 1.5 hours per week.

Instructor

Shichao Liu, Associate Professor, Room MC 7142
Email: shichaoliu@cunet.carleton.ca
Course site: on Brightspace
Office hour: 10:15-11:30 AM on Thursdays

Textbook and Learning Materials

1) Lecture notes are provided on Brightspace

2) Textbook (either hardcover copy (CAD 235.00) or electric-Textbook (CAD 77.99)): *Electrical Engineering: Principles and Applications*, Allan R. Hambley, 7th Ed., Pearson (2018). Problems will be assigned from the text, so it is required.

3) A course pack, *ELEC3605, Electrical Engineering*, by Carl Kropp, Fall 2015 (edited by Prof. Calvin Plett and Prof. Steele) will be provided on Brightspace (in chapters).

There are some open textbooks that will have relevant information and could be very helpful. These will be useful secondary resources.

DC Electrical Circuit Analysis: A Practical Approach, James M. Fiore, Version 1.0.3, 08 June 2020, ISBN13: 978-1654515478,
AC Electrical Circuit Analysis: A Practical Approach, James M. Fiore, Version 1.0.1, 22 April 2020, ISBN13: 979-8605022282

See http://www.dissidents.com/books.htm

Course Contents

The following topics will be covered during the course lectures delivered in-class.

1. Fundamental physical considerations
2. Fundamentals of circuit theory
3. Resistive circuits
4. Inductance and Capacitance
5. Transients
6. Steady State Sinusoidal Analysis
7. Magnetic circuits, transformer
8. DC Machines (Motors)
9. AC Machines (Motors)
10. Electrical safety

Laboratory and Problem Analysis Sessions

1.5 hours PA per week.

Notes for PA Sessions

PA sessions will start after the first week.

Problem analysis sessions with TAs will be delivered in-class at the scheduled times and will give an opportunity for students to work on problems sets. During these times, TAs can help with clarifying any issues with the questions or with course material.

Several problems will be assigned each week as homework to help understand the lecture material, prepare for the midterm exams and final exam. To learn the course material, **IT IS ESSENTIAL THAT YOU ATTEMPT SOLUTIONS FOR THESE PROBLEMS BEFORE THE PA SESSION**. Solutions to these problems will be reviewed in the PA sessions.

Self-Declaration form and 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 submitting a self-declaration form no later than three (3) days after the date/deadline of term work including test/midterm, labs/PAs, assignments. Any alternate arrangements made with the instructor for submission of term work should be made as soon as possible but within 3 days of the missed due date. If this is not possible after discussion with the instructor, alternate arrangements must be made before the last day of classes in the term as published in the academic schedule.

Evaluation and Grading Scheme

The final grade will be determined using the following weighting:

Assignments	20 %
Tests (closed-book, in-person)	30%
Final Exam (closed-book, in-person)	50%

To complete the course, there must be attempts at all assessments, unless there are extenuating reasons, for example health reasons. There will be three (3) tests in-class during the lecture period at regular points during the term. The final exam will be a three hour in-person officially scheduled exam. Late assignment submission will usually incur a penalty.

All tests and the examination are **in-person, closed book**. You will be provided with **equation sheets** and all other information required for their completion, which will be available on the website prior to the test or exam. Any communication, including electronic communication, with others during a test or examination is expressly not permitted.

Final Exam: **Final exams are for evaluation purpose and will not be returned to students.**

Programmable calculators will not be allowed in the midterm or final exam. A “programmable calculator” is defined as a calculator that can store program steps or text at any level of sophistication and the rule applies irrespective of whether or not there appears to be anything stored. If you have any doubts about the eligibility of your calculator, please see me well before the exam.

Learning Outcomes

At the end of the course, a student should be able to:

- Demonstrate knowledge about fundamental electric parameters and laws such as current and voltage, power and Kirchhoff’s voltage and current laws.
- Demonstrate knowledge and of basic electrical components such as resistors, capacitors, and inductors and their characteristics.
- Read and draw basic circuit diagrams, and be able to simplify circuits, with components in series and parallel.
- Be able to analyze and make accurate calculations of DC, transient and AC (sinusoidal) circuits involving resistors, capacitors, and inductors. Analysis will be done through different methods, such as (but not limited to) Nodal and Mesh analysis and Thevenin and Norton’s theorem, phasors and finding equivalent circuits.
- Demonstrate how a three-phase AC system works.
- Explain how DC can be produced from an AC signal.
- Demonstrate knowledge of magnetic circuits and magnetic parameters.
- Demonstrate how a transformer works and make related calculations.
- Explain the principles of AC and DC motors and make basic calculations.
- Explain basic safety relating to electricity and electrical systems.

Graduate Attributes

The Canadian Engineering Accreditation Board requires graduates of undergraduate engineering programs to possess 12 attributes: Graduate-Attributes.pdf (engineerscanada.ca) or GA’s. 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 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. Accreditation metrics are based on courses common to all students in a program.

This following list provides the GAs that will be measured in this course (ELEC 3605), along with the indicators that are intended to develop and assess these attributes.

Graduate Attribute		Indicators
GA-1 Knowledge base for Engineering Level I	DoE-1 Analog Circuits DoE-6 Electromagnetics DoE-7 Electronics DoE-8 Energy Conversion and Transmission	Dedicated exam questions.

Academic Integrity and Plagiarism

a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: https://carleton.ca/engineering-design/current-students/fed-academic-integrity. Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that the work you submit is your own. As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

- Any submission prepared in whole or in part, by someone else;
- Using another's data or research findings without appropriate acknowledgment;
- Submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own;
- Failing to acknowledge sources of information through the use of proper citations when using another's work and/or failing to use quotations marks; and
- Unless explicitly permitted by the instructor in a specific course, the use of generative AI and similar tools to produce assessed content (such as text, code, equations, images, summaries, videos, etc.).

Academic Accommodations

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: Contact us 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 accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form (click here).

Religious obligation: Contact us 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 click here.

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 us 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). After requesting accommodation from PMC, contact us, if needed, to ensure that accommodation arrangements are made.

You should request your academic accommodations in the Ventus Student Portal, for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm.

Please consult the PMC website for the deadline to request accommodations for formally-scheduled exams (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/equity/sexual-assault-support-services

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 will be provided to students who compete or perform at the national or international level. Contact us 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: https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

Use of Course Materials