Carleton University
Department of Electronics
Engineering ELEC 3605 – Electrical Engineering
Course Outline ---------- Fall 2024

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.

Instructor

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Learning Objectives

This course is for BEng students who are not in an electrical engineering or related program. The course will introduce students to fundamental electrical engineering principles, circuit analysis techniques, passive electrical components (resistors, capacitors, and inductors) and their response in DC and AC circuits. As well as magnetics, transformers, and basic principles of motors. This knowledge will allow informed consultation with electrical engineers to resolve problems, as well as allow the student to recognize the limits of their electrical engineering competence and the need to consult.

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.

Course Content

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 and transformers
8. DC Machines (Motors)
9. AC Machines (Motors)
10. Electrical safety

Teaching Modality

The lectures for this course will be delivered in-class during the Fall 2023 term. Problem analysis sessions with the TA will be delivered in-class at the scheduled times and will give an opportunity for students to work on problems sets. During these times the TA can help with clarifying any issues with the questions or with course material.

The course Brightspace website should be checked regularly as this will be the main route for information. Resources will be posted there as will assessments and your individual access to the site will be monitored to ensure you are progressing.

Printed resources are listed below and include a course text bought which is ***required*** to be purchased. This is available as a printed book or eText book. A course pack will be distributed in electronic form during the term and two open textbooks (free) have been located that provide a supplemental resource whilst studying the material, although they do not cover all material.

We recommend students engage with the recommended texts, the course website and its resources. The instructor and TA will be available with help and guidance. It is expected you will check the Brightspace website at least once a week (probably more often would be better) and please pay attention to any emails that are sent to you from the course instructor or TA.

Textbook and Other Resources

The main course text is:

> *Electrical Engineering: Principles and Applications*, Allan R. Hambley, 7th Ed., Pearson (2018) (This is available through the Carleton Bookstore, including for rental and eText, as well as from Pearson direct. Links will be provided in cuLearn. Problems will be assigned from the text, so it is required.)

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 Grade

The final grade will be determined using the following weighting:

Assignments	20 %
Tests	30 %
Final exam	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.

Tests & Final Exam
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.

Calculator Policy
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.

Website Mark Listings
Marks will be available on the course website. Please check your marks online and report any discrepancies immediately. *Please note*: Near the end of the term, information will be posted on the course website concerning the final opportunity for mark argument/correction. After that time, the term marks will be closed and there will be no further opportunity for correction or argument. Please monitor the course website for the final deadline.

Academic Integrity
As with other courses it is assumed that work done by you for the course will be done with academic integrity. As potential future engineers it is expected that you will pursue your profession with integrity. The Universities academic integrity policy webpage can be found at:
https://carleton.ca/registrar/academic-integrity/
Note that the use of generative AI tools (such as ChatGPT) in course work is prohibited unless explicitly authorized by the course instructor for specific elements of the course and such use is considered an academic integrity violation.

Use of Course Materials

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).
Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Graduate Attributes
An institution must demonstrate that graduates of its programs possess the attributes described below. In addition, the institution must implement and employ processes to demonstrate that program outcomes are being assessed in the context of these attributes, and that the results of such assessments will be applied to the further development of programs. The graduate attributes are:

1. *A knowledge base for engineering*: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

2. *Problem analysis*: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

3. *Investigation*: An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

4. *Design*: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

5. *Use of engineering tools*: An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

6. *Individual and teamwork*: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

7. *Communication skills*: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking, and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

8. *Professionalism*: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.

9. *Impact of engineering on society and the environment*: An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions, and the concepts of sustainable design and development and environmental stewardship.

10.*Ethics and equity*: An ability to apply professional ethics, accountability, and equity.

11. Economics and project management: An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

12.*Life-long learning*: An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

This course (ELEC 3605) will score attribute 1 a *knowledge base for engineering*. They are scored through the responses provided in assignments, quizzes, pre-lab and lab reports, presentations, final exams. The graduate attribute scores may in some cases be derived from graded material, however the graduate attribute scores are not used in determination of the final grade for the course.

Key Term Dates

Key dates and activities are given at https://calendar.carleton.ca/academicyear/. Since changes may occur, particularly during the current circumstances, please check this link for up-to-date information.

Academic Accommodation

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

Pregnancy obligation: write to me 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 visit the Equity Services website: http://www.carleton.ca/equity/

Religious obligation: write to me 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 visit the Equity Services website: http://www.carleton.ca/equity/

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*). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (*if applicable*) at http://www.carleton.ca/pmc/

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/ and https://students.carleton.ca/course-outline/.