ELEC 3605, Electrical Engineering

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Description: ELEC3605 Electrical Engineering

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.

Precludes additional credit for ELEC 2501.

Prerequisite(s): MATH 1005 and (PHYS 1004 or PHYS 1002), and second-year status in Engineering.

Lectures three hours a week, problem analysis 1.5 hours a week.

Regular Class Schedule

Class	4:05 pm - 5:25 pm	Monday & Wednesday	Jan 10, 2022 - Apr 12, 2022
PA1	11:35 am - 12:55 pm	Monday	Jan 10, 2022 - Apr 12, 2022
PA2	4:05 pm - 5:25 pm	Thursday	Jan 10, 2022 - Apr 12, 2022
PA3	4:05 pm - 5:25 pm	Tuesday	Jan 10, 2022 - Apr 12, 2022
PA4	1:05 pm - 2:25 pm	Friday	Jan 10, 2022 - Apr 12, 2022
PA5	11:35 am - 12:55 pm	Friday	Jan 10, 2022 - Apr 12, 2022
PA6	4:05 pm - 5:25 pm	Friday	Jan 10, 2022 - Apr 12, 2022
PA7	8:35 am - 9:55 pm	Friday	Jan 10, 2022 - Apr 12, 2022

Course Website

The course will make use of BrightSpace. As this will be an online offering of the course all information will be passed through the course's BrightSpace area.

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 simplifying 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 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

This course will be delivered online through BrightSpace in winter term 2022. Because of the size of the class the course will be delivered in a blended form, with selected reading from the main course text, videos and audio recordings to provide additional material and guidance. During the scheduled class time the course instructor will provide online classes (through Zoom) and these sessions will be recorded for viewing. Problem analysis sessions with TAs will be at the scheduled time and that will give an opportunity for students to work on problems set. TAs 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 be assessments and your individual access to the site monitored to ensure you are progressing.

Instructors and TAs can be contacted by email. We ask that when sending emails the course code 'ELEC3605' be included in the subject line.

Printed resources are listed below and include a course text bought which is *required* to be purchased. This is available as a printed book, eText book, or a custom eText specifically for the course. A course pack will be available (chapters will likely be released regularly, rather than a full pack) and two open text books (free) have been located that provide a supplemental resource whilst studying the material, although they do not cover all material.

Because of the online nature of the course, we recommend students engage with the recommended texts, the course website and its resources. The instructors and TAs will be available to help you 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 instructors or TAs.

Prof Steele will have scheduled office hours from **11am to noon on Thursdays**. If that time does not work for you please email your instructor or TA for a mutually convenient time to meet.

Text Book 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. 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 in chapters on BrightSpace.
- There are some open text books 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

Assessment Scheme

Tests	30%	Regularly set across the term
Assignments	20%	Two will be assigned
Final Examination	50%	

There must be attempts at each type of assessment, unless there are extenuating reasons, for example health reasons. There will be 3 tests at regular points along the course and the average mark from the best 2 will be taken towards the final grade.

All tests and the examination are open book and this means only the recommended texts (Hambley and Fiore), the course pack and your notes can be used during those assessments. Any communication, including electronic communication, with others during a test or examination is expressly not permitted.

A scientific calculator will be needed and is allowed in tests and exams.

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/

Key Term Dates

Selected dates and activities from https://carleton.ca/registrar/registration/dates-and-deadlines/ provided here for your convenience. Please check the link above incase there are any changes.

10 Jan. 2022	Winter term classes begin
24 Jan. 2022	Last day of registration for fall term and fall/winter courses.
31 Jan. 2022	Last day to withdraw from winter term courses.
21 Feb. 2022	Statutory holiday. University closed.
22-25 Feb. 2022	Winter break. Classes suspended.
16 Mar. 2022	Last day to request formal exam accommodations for April examinations to the Paul Menton Centre for Students with Disabilities.
29 Mar. 2022	Last day for summative tests or examinations, or formative tests or examinations totalling more than 15% of the final grade, in winter term or fall/winter courses before the official examination period (see Examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar).
12 Apr. 2022	Winter term ends. Last day of fall term classes. Classes follow a Friday schedule. Last day for academic withdrawal from fall term courses. Last day for handing in term work and the last day that can be specified by a course instructor as a due date for term work for fall term courses.
14-28 Apr. 2022	Final examinations in winter term and fall/winter courses may be held. Examinations are normally held all seven days of the week.

15 Apr. 2022	Statutory holiday. University closed.

Academic Accommodation

Details on academic accommodation, for a range of reasons, can be found at

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

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 managementinto the practice of engineering and to understand their limitations.

12.*Life-long learning*: An ability to identify and to address their own educational needsin 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.