



Instructor

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Online Office Hours: By appointment

Textbook: M. Sadiku, “Elements of Electromagnetics”, 7th edition, ISBN 978-0-19-932138-4
Additionally, course notes will be provided online through Brightspace.

Prerequisites: The course precludes additional credit for ELEC 2601 or ELEC 3504. Pre-requisites are MATH 2004 and (PHYS 1004 or PHYS 1002).

Course Outline:

- Vector calculus: gradient, divergence, curl, coordinate systems
- Basic Electrostatics: Coulomb’s force law, electric field, electric field lines and flux, Gauss’ law and divergence, electrostatic potential, Poisson’s equation and Laplace’s equation, gradient of electric field, method of images; numerical solution of Laplace’s equation
- Electric Fields in Matter: polarization and dielectrics, the displacement field, the pn junction depletion region, the solar cell, electrostatic problems with dielectrics, current flow: resistivity and conductivity
- Magnetostatics: Lorentz force law, Hall effect, Ampere’s law, curl of a vector field, the magnetic vector potential, the Biôt-Savart Law, applications of the Biôt-Savart Law: current ring, solenoid, energy stored in magnetostatic field
- Magnetic Fields in Matter: magnetic dipoles, types of magnetic materials, hysteresis, magnetic circuits
- Faraday’s Law and Time-Varying Fields: Faraday’s law and induced EMF, Lenz’s law, eddy currents, displacement current, Maxwell’s Equations

Evaluation Scheme:

4 Labs + Lab 0	20%
4 Assignments	20%
Learning Objective Project	10%
Midterms (Best 2 of 3)	20%
Final Exam	30%

A grade of at least 50% on the final exam is required to be eligible to pass the course. Students must complete all labs to be eligible to pass otherwise a grade of F can be assigned.

Lab and PA Schedule:

Lab and PA sessions are 3 hours in duration. Individual Labs and PAs will be held according to the schedule which will be posted on Brightspace. You must attend the Lab and PA session which you are registered in.

You must complete all Labs and Assignments. There will also be a mandatory Lab 0 that is designed to familiarize yourself with Carleton's VPN and remote login that is needed to use ANSYS (Labs 1 and 2). Retain records of your graded lab reports and Assignments until the end of term in case they are needed to confirm your grades.

Laboratories:

This offering of ELEC3105 is being delivered in a completely online format and will include a laboratory component. There will be 4 labs scheduled over the term. Each student is required to independently complete and submit all laboratory reports. Submitted reports will be held to the same standard as the in person labs on Carleton campus and should be high quality documents. Lab reports should convey all data, calculations, graphs etc. and contain the necessary conclusions and discussions. All submitted reports must be in PDF file format. Students have the choice of software and materials to prepare their reports but reports must be neat, legible and coherent. Discretionary deductions may be applied to illegible and sloppy reports.

The first 2 labs are simulation based and you will be given approx 2 weeks to complete each lab before submission on a scheduled due date. For Labs 3 and Lab 4, you must attend your scheduled lab section as this will determine when you can remotely access the lab computers. Labs 3 and 4 are to be submitted within 24 hours from the end of the lab period. In the event of a documented absence, you may attend an alternate lab section with instructor or TA consent. Lab exemptions are not granted under any circumstances for accreditation purposes.

Assignments and PA Sessions:

You are expected to solve and understand all the problems in the Assignments. You are allowed and encouraged to work with other classmates on the problem sets, this is for the benefit of understanding the material. PA sessions will be held remotely with your assigned TA using Big Blue Button or a similar web conferencing service. All questions on the assignments will be covered and you will be required to submit your assignment on a due date before your PA session. In your assignment submission I ask that you credit your collaborators if there are any. You must attend your scheduled PA section. You may attend an alternate lab section with instructor or TA consent.

Learning Objective Project:

Every student will be required to complete a learning objective project. Students will need to choose a learning objective from a list and design a 5-7 minute presentation and teach the objective to the class. The presentations will take place during the last PA session of the term. The schedule for the teaching presentations will be made by your TA and distributed in advance. The breakdown of this project is 5% of your final grade will be awarded based on participation only. The remaining 5% will be awarded based on your ability to convey the learning objective. You have the option to upload a separate video of your presentation to be graded on your communication ability. This will allow you to redo your presentation if necessary. If you feel uncomfortable with the in class presentation, please contact me and we can discuss alternative options for this portion of the course.

Course materials, such as textbooks, notes, etc. are permitted during labs and PA sessions. Please note: it is strongly recommended you review this material BEFORE coming to the lab. Please come prepared!

Midterms:

There will be 3 midterms during the term. **They will be held during class time with dates TBD.** The best of 2 of 3 midterms will be considered to account for 20% of your final grade. Please make sure you attend the midterm during the scheduled time. Midterms will be **Open Book.**

Final Exam:

The format of the final exam is TBD. Full exam conditions will be in effect. There will be no collaborations of any sort permitted on the exam and this will be flagged as plagiarism subject to University regulations.

Plagiarism:

Plagiarism is a serious instructional offense that will not be tolerated. All written lab reports need to represent your independent work. Please note, that copying another's work, or even your own, is cheating! Please refer to the section on instructional offenses in the Undergraduate Calendar for

additional information.

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: 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/new-and-current-students/dates-and-deadlines/>. 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/>

Graduate Attributes:

The Canadian Engineering Accreditation Board (CEAB) has established that an institution must demonstrate that graduates of its programs possess certain defined attributes. The institution must also 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 relevant to this course 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.

This course (ELEC 3105) will score attributes 1 (Knowledge Base) and 2 (Problem Analysis). They are scored through the responses provided in assignments, quizzes, and final exams. The graduate attribute scores will be derived from graded material, however they are for internal use only.

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).