

FALL 2024, ELEC 3909

ELECTROMAGNETIC WAVES

DEPARTMENT OF ELECTRONICS (DOE)

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TA name(s)

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Course Description and requirements

1) Course description

Maxwell's equations and EM wave solutions. Polarization. Poynting vector. EM waves in dielectrics and conductors; skin depth. Reflection and refraction. Standing waves. Fresnel relations, Brewster angle. Transmission lines. Line termination, basic impedance matching and transformation. Smith charts. Introduction to guided waves; slab waveguide.

2) Precluded courses none

3) Prerequisites (and recommended knowledge) ELEC 3105 or permission of the Department

5) Accreditation Units:

Accreditation units (AU's) are used by the Canadian Engineering Accreditation Board (CEAB) to determine if an Engineering program meets a minimum number of class hours required for accreditation in each of 5 components: math, natural science, engineering science, engineering design, and complementary studies. Accreditation metrics are based on courses common to all students in a program.

Math	Natural Science	Complementary Studies	Engineering Science	Engineering Design
-	35%	-	40%	25%

5) Learning outcomes / Graduate Attributes

The Canadian Engineering Accreditation Board requires graduates of undergraduate engineering programs to possess 12 attributes. 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.

This following list provides 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: 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 team work:** 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:** 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 3909) will score attributes 1.6.E - Knowledge base: Discipline-specific concept DOE-3: Electromagnetics, 2.1 - Problem analysis: Problem definition, 2.2 - Problem analysis: Approach to the problem, 2.3 - Problem analysis: Use of assumptions, 2.4 - Problem analysis: Interpreting the solution - validity of results, 4.1 - Design: Clear design goals, 4.2 - Design: Detailed design specifications and requirements, 4.4 - Design: Design solution(s), 4.5 - Design: Design implementation / task(s) definition, 4.6 - Design: Alternate solution(s) definition, 4.7 - Design: Evaluation based on engineering principles. 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.

6) Texts

There are no official textbook for this course. However, some suggested textbooks covering the course contents are:

13. M. Sadiku, "Elements of Electromagnetics", 6th or latest edition (recommended)
14. Branislav M. Notaros, "Electromagnetics," (Prentice Hall, 2011).
15. David J. Griffith, "Introduction to Electrodynamics", Pearson.

I will be using slides in classes. Additional material will be used to reinforce the understanding. Several good textbooks covers Electromagnetics and studying from them outside lecture hours is strongly recommended: If you were to attempt to study and pass the final exam by using only the lecture slides, you would likely fail the course. The lecture slides will be available to you after every lecture, however. **If there are any important changes, they will be communicated to you, well in advance.**

7) Course Schedule

There is total 6 Problem Analysis (PA)/Lab sessions.

Note 1: All sessions are mandatory, and attendance will be taken. Zero will be assigned for the corresponding lab reports in case of absence.

Note 2: All HFSS/lecture related questions **must be posted on Brightspace forum only**, to avoid repetitions and so that everyone benefits. In certain cases, questions can be emailed to me or the TAs.

8) Evaluation and Marking Scheme

1 Final exam (During normal exam period): weight 50% but you need to pass the final exam with at least 50% to pass the course.

- The Final exam will be scheduled during examination period at the end of the Fall term. Rules for a missed final exam are covered in Carleton's undergraduate calendar.
- The final exam will be traditional 3 hour closed book format and in-person in campus.
- The final exam is exclusively for the purpose of evaluating student performance and will not be returned.
- Students who miss the final exam may be granted permission to write a deferred examination. See the Undergraduate Calendar for regulations on deferred examinations.

1 Midterm: 20% weight of the final grade (1 x 20%)

- Midterm will occur during the course lecture and will be in-person on November 6th, 2024.
- Missing a Midterm without a valid reason (medical certificate) will result in a mark of zero. If you know in advance that you cannot attend the Midterm, and can support it with a valid reason, then we can possibly arrange for an accommodation.
- Midterm is open book format. You are free to bring whatever textbook material you think will help you in answering your questions.
- No discussions between students allowed. Any evidence of discussions, cheating, or something similar, during both the final exams or Midterm, will have serious consequences.
- Students registered in their own lab sessions only will be allowed to attend the Midterm. No switching allowed.

6 Labs: 30% weight of the final grade (30%)

- All labs will be in MC6030 Computer Lab in Minto building. No Section switching is allowed.
- All lab reports must be prepared using **Latex only using the templates provided and submitted as a pdf file**, with suggested section headings and specified page limits. Latex template will be provided in advance.
- The prepared document must be electronically submitted on **Brightspace within 2 weeks**.
- Reports must be named according to the following format:

Lastname_Firstname_ELEC_3909_Fall_2024_Lab_#.pdf,

Satisfactory performance to pass the course:

1- Minimum term course grade of 50% AND

2- Minimum grade of 50% in final exam.

Students must review their assignment and quiz grades as soon as they are given back to them. Any marking concerns, and clarifications must first be directly addressed to the TA. In case, TA's clarifications are not sufficient, or students are not satisfied with their markings, they must bring this to my attention as soon as possible. I will treat such instances as an informal appeal and will review/re-mark the quizzes/assignments in question. All such cases must be brought to me before **December 13th, 2024**.

9) Deferred Final Examinations

Students who are unable to write the final examination because of a serious illness/emergency or other circumstance beyond their control may apply for accommodation by contact the Registrar's office. Consult the Section 4.3 of the University Calendar

(<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/>)

10) Self-Declaration form and Deferred Term work

Calendar language (Section 4.4

<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/#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) 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.

Instructors can require (or not) the student to submit the self-declaration form. Include the following statement if you require the student to submit a completed self-declaration form:

Consult with the instructor no later than 3 days after any missed course work or midterm examination.

or

Contact the instructor with the completed self-declaration form no later than 3 days after the date/deadline of term work including test/midterm, labs, assignments.

Copyright

The materials (including the course outline and any slides, posted notes, videos, labs, project, assignments, quizzes, exams and solutions) created for this course and posted on this web site are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s).

Advising and Counselling services

a) Engineering Academic Advising

The Engineering Academic Support Service : <https://carleton.ca/engineering-design/current-students/undergrad-academic-support/> assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation.

Academic Advisors Contact : <https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/>

b) Student Mental Health Service

As a University student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. Carleton's Wellness Services Navigator <https://wellness.carleton.ca/navigator/> is designed to help students connect with mental health and wellness resources. If you need to talk to someone, please reach out for assistance: <https://carleton.ca/health/emergencies-and-crisis/>.

Learning and Working Environment

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone's personal beliefs, choices, and opinions.

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 acknowledgement;
 - submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
 - failing to acknowledge sources of information through the use of proper citations when using another’s work and/or failing to use quotations marks.
- c) Generative Artificial Intelligence (AI): 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. Submission of AI generated work without authorization may lead to an academic integrity investigation.

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 accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form ([click here](#)).

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 [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 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).

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. 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. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

Covid Protocols

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are a number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

Masks: Carleton has paused the COVID-19 Mask Policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the University's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.