Carleton University Physics Department
PHYS 3308 A – Electromagnetism (Fall 2026)

This course was prepared, and will be delivered, on the traditional and unceded territory of the Algonquin Anishinaabeg people. As an immigrant to Canada, I grapple with the contradiction that the government that granted me citizenship did so without the consent of the nation on whose land I live.

Course Delivery Information

Instructor:
Prof. Heather Logan (she/her) (please call me "Dr. Logan" or "Professor")
Email: [redacted]

Teaching Assistant (TA):
[redacted]
Email: [redacted]

Required Textbook:
Griffiths, David J., *Introduction to Electrodynamics,* 5th, 4th, or 3rd Edition. This is the same book that was used for PHYS 2305 last Winter. Available from the Carleton Bookstore ($79.95 physical book or $66.95 for a 180-day subscription to the e-book) or directly from Cambridge University Press ($79.95 hardcover [+ shipping] or USD$69.99 e-book). A second-hand copy is fine.

Course web page:
Hosted in Brightspace, at `https://brightspace.carleton.ca/`. I will use this site to distribute readings and homework assignments and to host information about the exams. You will use it to upload your completed homework assignments and to view your grades and marked assignments. I will send out any time-sensitive announcements by email.

Lecture times:
Tuesdays and Thursdays, 1:05–2:25pm, in [redacted]. The first lecture is on Thursday September 10 and the last one is on Thursday December 10. There are no lectures on October 27 or 29 because that week is Fall Break.

Where to get personalized help with assignments & course material:
Instructor's office hours: Mondays, 4:00–5:00pm, in [redacted].
TA's office hours: To be announced on Brightspace.
Physics Drop-In Centre: Hours to be announced; in Herzberg 3349.

Lecture, assignment, and exam format:
Lectures will be held in-person. You are expected to attend every lecture unless you are sick or have a domestic emergency. Please read the assigned textbook sections either before or after the corresponding lecture. I will also post scans of my lecture notes in Brightspace. To help assess your preparation for the course, a few *in-class mini-quizzes* (to be hand-written on paper) will be given at the end of some of the lectures during the first few weeks of the course.
Homework assignments are to be done outside of class time. The question papers will be made available on the Brightspace page. Your solutions for each assignment should be submitted by scanning them to a single pdf file which you will upload to the Brightspace page. More details on page 3.
Two midterms and the final exam (to be hand-written on paper) will be held in-person. The two midterm exams will be held in our usual classroom during two of the normal lecture periods. The final exam will be held during the December final exam period at a time and location to be assigned by the university. More details on page 3.

Course Description

PHYS 3308 [0.5 credit]
Electromagnetism
Electrostatic field and magnetostatics in the presence of matter. Solving Laplace's and Poisson's equations. Multipole expansions. Vector potential. Faraday's laws of induction; Maxwell's equations in matter. Waves in vacuum and dielectric media, guided waves.
Precludes additional credit for ELEC 3909.
Prerequisites: PHYS 2305, MATH 2004 or MATH 2008, and MATH 3705, or permission of the Department.
Lectures three hours a week.

Electromagnetism is in some sense a simple theory—Maxwell's equations fit easily on a t-shirt—but it gives rise to diverse and profoundly useful phenomena. The goal of this course is to consolidate and deepen your understanding of these phenomena, aided by the advanced mathematical techniques necessary for their clear description. In this course we will cover electrostatics and magnetostatics in the presence of matter, explore some more sophisticated mathematical techniques involving electrostatic potentials and the magnetic vector potential, and go deeper into Faraday's laws of induction and the physics of electromagnetic waves.

1. Electrostatic boundary value problems: Solutions of Laplace's and Poisson's equations; method of images; separation of variables; multipole expansion. [Griffiths Chapter 3]
2. Electrostatics in materials: polarization; dielectric materials. [Chap. 4]
3. Magnetic vector potential; multipole expansion. [Chap. 5]
4. Magnetic fields in materials: magnetization; magnetic materials. [Chap. 6]
5. Faraday's laws of induction; Maxwell's equations in matter. [Chap. 7]
6. Waves in vacuum and dielectric materials; guided waves. [Chap. 9]
7. The potential formulation and gauge transformations [Chap. 10.1]; relativistic electrodynamics [Chap. 12.3] (if time allows).

Learning Outcomes

After successfully completing this course, you will be able to:

- Identify the most tractable method(s) to solve any particular electromagnetism problem by evaluating the symmetries and/or the known and unknown quantities involved;
- Set up a mathematical representation of the physical problem using the principles of electromagnetism and perform the mathematical operations needed to obtain the desired solution;
- Apply a variety of advanced techniques to solve electromagnetism problems involving boundaries or interfaces between materials;
- Solve electromagnetism problems involving polarizable, magnetizable, or conducting materials; and
- Solve problems involving electromagnetic waves in the presence of waveguides or dielectrics.

Assignments, exams, and grade distribution

Homework assignments (25%; lowest 2 assignment marks will be dropped):

Homework will be assigned approximately every week, with due dates generally on Tuesdays (the complete schedule will be posted in Brightspace). The questions for each assignment will be posted in Brightspace, and your solutions must be scanned to a single pdf file and uploaded into Brightspace by the assignment's due date.

Independently working the assigned problems is the most important thing you can do to develop a deep understanding of the material, and is the best way to prepare for the exams. This material is quite mathematical, and builds on the math and physics that you learned in PHYS 2305 and the MATH prerequisite courses. You are encouraged to form study groups and to discuss the homework problems with other students, the TA, and me; however, **the work you hand in must be your own original work.** Use of online homework-help sites or generative AI, or searching for solutions to equivalent problems online, is strictly forbidden and will not prepare you for the exams. If you are having difficulties with the material, please attend office hours for individualized help.

Late or missed assignment policy: Assignments will be accepted through Brightspace upload up to 48 hours (two days) after the due date without penalty, no questions asked. To accommodate illnesses/emergencies longer than 2 days, you may miss up to two assignments without penalty (i.e., your two lowest assignment scores will be dropped).

Two midterm exams (20% each):

There will be two in-person 80-minute midterm exams in the regular classroom during the regular lecture time (1:05–2:25pm) on **Thursday October 15** and **Thursday November 19**. The midterms will be closed-book and closed-notes; a detailed formula sheet will be provided. I will post a draft of the formula sheet on Brightspace several days in advance so you can see what will be on it. I plan to have the first midterm exam marked and returned to you well before the last day to withdraw from a course, which is November 15.

Missed midterm exam policy: If you must miss a midterm exam due to illness or other emergency, please email me as soon as possible (and no more than 2 days after the missed exam) so that I can schedule you for a deferred midterm. **Deferred midterms will take place outside of the normal lecture time, and may be scheduled on Friday evenings or weekends.** Midterm exams will not be waived. Missed deferrals cannot be deferred again and will be assigned a grade of zero.

Final exam (35%):

The final exam will be 3 hours long and will be held in-person during the **final exam period, December 12–23** (Exam Services has said that they will publish the final exam schedule on October 9, though they are sometimes a few days late). The final exam will be closed-book and closed-notes and a detailed formula sheet will be provided (I will post this in Brightspace in advance).

Deferrals of final exams, due to illness or other emergency, are handled centrally by Exam Services; for more information and a link to the deferral application, see `https://carleton.ca/registrar/deferral/`. A self-declaration is allowed instead of a doctor's note, but see the link for more information about required documentation and submission deadlines.

Four in-class mini-quizzes (1% extra credit each):

A short written quiz will be held at the end of class during four lecture periods in the first $\sim$3 weeks of the course. These quizzes are designed to assess your preparation for the course material. For each quiz score of at least 80%, you will receive one extra-credit mark. Missed quizzes cannot be deferred.

Policy on Generative Artificial Intelligence (AI) use:

Use of generative AI systems such as ChatGPT, Gemini, Claude, Copilot, Grok, etc. for any purpose related to this course is strictly prohibited. The rationale for this policy is that use of generative AI has been demonstrated to reduce achievement of learning outcomes while falsely inflating students' perception of their mastery of the material, and may also cause broader cognitive decline while damaging student mental health. For a recent summary of the many ethical problems of generative AI, see also `https://blog.johanneslink.net/2025/11/04/to-gen-or-not-to-gen/`.

No generative AI was used in the preparation or delivery of this course.

Academic accommodations and human rights

Carleton University is committed to promoting academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems, and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. Academic accommodation does not undermine or compromise the established learning objectives of the course. For more information, see: `https://students.carleton.ca/course-outline/`

University rules regarding registration, withdrawal, appealing marks, etc. are here: `https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/`

Human rights and non-discrimination:

Carleton University and all members of the Carleton 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, pregnancy, or sexual orientation, please contact the Department of Equity and Inclusive Communities (`https://carleton.ca/equity`) at `equity@carleton.ca`.

You can also contact me to address any concerns related to the course or classroom environment. I am a member of the Carleton Physics Department's Equity, Diversity, and Inclusion committee.

Academic accommodations for students with disabilities/Disabled students:

If you have a documented disability requiring academic accommodations in this course, please access the Paul Menton Centre for Students with Disabilities (PMC)'s centralized accommodation-handling web portal called Ventus at `https://ventus.carleton.ca/student/` . PMC can also be reached at 613-520-6608 or `pmc@carleton.ca`. **You have to log in to Ventus each semester to select which courses you want your accommodations to apply to.** This has to be done no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). For more details, visit the Paul Menton Centre website (`https://carleton.ca/pmc`).

If your learning experience could be improved by me adjusting aspects of this course, please don't hesitate to let me know (by email or in person). I will take your requests seriously.

Religious, pregnancy-related, or caregiving (family status) obligations:

Please email me during the first two weeks of class with any requests for accommodations, or as soon as possible after you find out that you will need such an accommodation. For more details, please review the Student Guide to Academic Accommodation via the links at `https://students.carleton.ca/course-outline/`.

For survivors of sexual violence:

Carleton 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 in accordance with 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/focus/sexual-violence-prevention-survivor-support/`

For extracurricular student activities:

Carleton recognizes the benefits of participation in activities beyond the classroom experience. Reasonable accommodation will be provided to students who compete or perform at the national or international level and who attend student research conferences (e.g. CUPC). Please contact me during the first two weeks of class with any requests for academic accommodation, or as soon as possible after the need for accommodation is known to exist. For details, see the Senate Policy on Accommodation for Student Activities via the Student Activities section of `https://students.carleton.ca/course-outline/` .

Some resources for peer support, academic help, and skill development:
Carleton Undergraduate Physics Society: `https://physsoc.physics.carleton.ca/`
Carleton Science Student Society: `https://www.sciencesociety.ca/`
Science Student Success Centre: `https://sssc.carleton.ca/`
Math Tutorial Centre: `https://carleton.ca/math/math-tutorial-centre/`
Centre for Student Academic Support: `https://carleton.ca/csas/`

Academic integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using Generative Artificial Intelligence (GenAI) systems when course policy or assessment instructions indicate that such use is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy, available at
`https://carleton.ca/registrar/academic-integrity/`.
Students are expected to read, understand, and abide by this policy.

A list of standard sanctions in the Faculty of Science and additional details about this process can be found on the Faculty of Science Academic Integrity website,
`https://science.carleton.ca/academic-integrity/`.

Student rights and responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the Student Rights and Responsibilities Policy at `https://carleton.ca/studentaffairs/student-rights-and-responsibilities/` for details regarding the expectations of non-academic behaviour of students.

Concerns?

Contact me first. If your concern is not resolved, proceed as follows: → Physics Undergrad Advisor (Thomas Gregoire) → Physics Dept Chair (Kevin Graham) → Office of the Dean of Science.