

Carleton University Physics Department
PHYS 3308 – Electromagnetism (Fall 2022)
Course Outline

Instructor:

Prof. Heather Logan (she/her) (email: logan@physics.carleton.ca).
Please call me “Dr. Logan” or “Professor”. My office is Herzberg 2470.

Required Textbook:

Griffiths, David J., “Introduction to Electrodynamics,” Fourth Edition (Cambridge University Press, 2017). This is the same book that was used for PHYS 2305 last Winter. Available directly from Cambridge University Press (\$82.95, shipping to Ottawa is about \$10 and takes about a week). It should also be available at Haven Books and the Carleton Bookstore.

Course web page:

The webpage for this course will be hosted in Brightspace, at <https://brightspace.carleton.ca/> (you may be redirected to log in using your MyCarletonOne name and password). The Brightspace page will be used for homework assignment submission. Time-sensitive announcements will also be sent out by email.

Lecture times:

Tuesdays and Thursdays, 11:35am–12:55pm, in University Centre 279. The first lecture is on Thursday September 8 and the last one is on Thursday December 8. There are no lectures on October 25 or 27 because that week is Fall Break.

Office hours (dedicated times for you to ask me questions about homework problems or course material):

Tuesdays 2:30–3:00pm in Herzberg 2470 and Wednesdays 12:00–12:30pm on Zoom (the Zoom link will be posted in Brightspace). If you need to talk to me and are unable to attend the scheduled office hours, you can email me to arrange a time to talk to me on Zoom.

Lecture, assignment, and exam format:

Lectures will be fully in-person (modulo future pandemic restrictions). Lecture attendance is encouraged but not required. To reduce the spread of COVID-19, Carleton continues to strongly encourage wearing a mask when indoors; please wear a mask in class. If you get sick, please stay home; I will provide you (upon request) with scans of my lecture notes and/or last year’s HyFlex lecture video recordings to help you catch up on any missed material. If I get sick, I will do my best to continue delivering lectures on schedule using Zoom and also record the Zoom sessions to post on the Brightspace page; if I’m unable to lecture, I’ll provide last year’s HyFlex lecture recordings to fill in the missed lectures.

Homework assignments are to be done outside of class time. The question papers will be distributed by email and/or 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 below. The *midterm and final exams* will be held in-person (modulo future pandemic restrictions). The midterm exam will be held in our usual classroom during one 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 (final exam dates and times are normally announced by mid-October). To reduce the spread of COVID-19, please wear a mask during the exams. If you get sick, please stay home, and make arrangements (directly with me for the midterm; through the university for the final) for a deferred exam to be written when you are recovered. More details below.

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.

Prerequisite(s): PHYS 2202, PHYS 2604, 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 focus on electrostatics and magnetostatics in the presence of matter. We will also explore some more sophisticated mathematical techniques involving electrostatic potentials and the magnetic vector potential, as well as going 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).

Assignments, exams, and grade distribution

Homework assignments (45%; lowest assignment mark will be dropped):

Homework will be assigned approximately every week. The complete schedule of due dates will be provided in Brightspace. Each assignment will be distributed by email and/or posted in Brightspace, and your solutions must be scanned to a **single pdf file** and uploaded into Brightspace by the assignment's due date. **Late assignments will not be accepted** except for legitimate reasons such as illness – once the due date passes, Brightspace will simply not let you upload your assignment. Requests for extensions due to illness should be sent to me by email and must include (1) an estimate of when you will be able to submit the work and (2) a completed illness self-declaration form, which can be downloaded from <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

Working the assigned problems is an essential part of developing a deep understanding of electromagnetism 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. **You are encouraged to discuss the problems with other students in the course and with me; however, the work you hand in must be your own original work. Posting the assigned homework problems to third-party sites is forbidden and will be considered an academic offence. Likewise, searching for or viewing solutions to equivalent problems online is forbidden and will be considered an academic offence.** If you are having difficulties with the material, please come to my office hours for individualized help.

Midterm exam (20%):

There will be one in-person 80-minute midterm exam in the regular classroom during the regular lecture time (11:35am–12:55pm) on **Tuesday November 1**. (If future pandemic restrictions force us to shift the midterm on-line, it will still take place during the same time period and connection to e-proctoring will be mandatory – see <https://carleton.ca/ses/e-proctoring/>). The midterm 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 in advance so you can see what will be on it). If you have to miss the midterm exam due to illness or some other emergency, please let me know by email as soon as possible (attaching a completed illness self-declaration form) so that I can arrange a time with you to write a deferred exam. I plan to have the midterm exam marked and returned to you no later than November 15, which is the last day to withdraw from a course (this is new – the last day to withdraw used to be the last day of classes).

Final exam (35%):

The final exam will be 3 hours long and will be held in-person during the final exam period in December (Exam Services has said that they will publish the final exam schedule on October 7). (If future pandemic restrictions force us to shift the final exam on-line, it will still take place during the scheduled 3-hour time period and connection to e-proctoring will be mandatory – see <https://carleton.ca/ses/e-proctoring/>). 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) are handled centrally by Exam Services.

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. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University. More information can be found at:

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

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, 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.

If you feel comfortable doing so, you can also contact me to address any concerns related to the course or classroom environment.

Academic accommodations for students with disabilities/Disabled students:

If you have a documented disability requiring academic accommodations in this course, please consult the Paul Menton Centre for Students with Disabilities (PMC)'s new 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 must make arrangements with the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, get in touch with me as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website (<https://carleton.ca/pmc>).

Regardless of documentation, if your learning experience could be improved by me adjusting the way I do things in this course, please don't hesitate to let me know and I will do what I can to address it.

Religious obligations:

Please contact me during the first two weeks of class with any requests for religious accommodations, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf> (2.1 MB pdf)).

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/sexual-violence-support/>

If you miss academic work due to illness (in place of doctor's notes):

Carleton recognizes that the COVID-19 pandemic has placed unprecedented strain on the health-care system and that health-care resources should not be diverted to produce doctor's notes for missed academic work. For this reason, Carleton is currently using a self-declaration form for students to self-declare illness, self-isolation, or other emergencies that cause you to miss course-work or exams. The form can be found at: <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

For pregnancy:

Please contact 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, please review the Student Guide to Academic Accommodation (<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf> (2.1 MB pdf)).

For extracurricular student activities:

Carleton 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 must be provided to students who compete or perform at the national or international level (this also includes things like CUPC). Please contact 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, see the Senate Policy on Accommodation for Student Activities (<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf> (25 kB pdf)).

Note about COVID-19 and mental health:

The global pandemic has led to extra stress and uncertainty for everyone, but this affects each person in a unique way. If you need extra help with course material or have missed something, don't panic—email me and we can set a time to talk. If you're freaking out about stuff in general, I'm here to listen and will try to help to the extent that I'm able. Carleton also offers an array of mental health and well-being resources, which can be found at <https://carleton.ca/wellness/>.

Some resources for academic help and skill-development:

Science Student Success Centre: <https://sssc.carleton.ca/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Academic and Career Development Services: <http://carleton.ca/sacds/>

Writing Services: <http://www.carleton.ca/csas/writing-services/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>

Carleton's letter grade scheme

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90–100 B+ = 77–79.99 C+ = 67–69.99 D+ = 57–59.99 F = below 50

A = 85–89.99 B = 73–76.99 C = 63–66.99 D = 53–56.99

A– = 80–84.99 B– = 70–72.99 C– = 60–62.99 D– = 50–52.99

WDN = Withdrawn from the course (deadline to withdraw from Fall 2022 courses is November 15)

ABS = Student absent from final exam

DEF = Deferred

FND = (Failed, no Deferred) = student could not pass even with 100% on final exam

Academic integrity and how to avoid cheating (this is important)

Examples of actions that violate Carleton's Academic Integrity Policy include:

- Plagiarism (e.g., passing off another person's words, equations, problem-solving strategies, or thoughts as your own, without citing the source);
- Accessing unauthorized sites for assignments or tests (e.g., posting the assigned questions on Chegg or searching the internet for solutions to similar problems);
- Unauthorized collaboration on assignments or exams (e.g., communicating with another student during an exam).

For details of what constitutes plagiarism, please see the Faculty of Science Academic Integrity website (<https://science.carleton.ca/academic-integrity/>). Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (<https://carleton.ca/registrar/academic-integrity/>). The Policy is strictly enforced and is binding on all students. To further understand Academic Integrity, consider attending the Learning Support Academic Integrity Workshop (<https://carleton.ca/csas/learning-support-2/learning-support-workshops/>).

Standard penalties for violating Carleton's Academic Integrity Policy:

- **First offence, first-year students (< 4.0 credits completed):** No credit for assessment(s) in question, or a final grade reduction of one full letter grade (e.g., A- becomes B-), whichever is a greater reduction.
- **First offence (anyone else):** Grade of F in the course.
- **Second offence (anyone):** Grade of F in the course and a one-term suspension from studies.
- **Third offence:** Expulsion from the University.

While these are the standard penalties, more severe penalties may be applied when warranted.

Process of an Academic Misconduct Investigation:

Step 1: The instructor believes misconduct has occurred and submits documentation to the Dean of the Faculty of Science.

Step 2: The Dean reviews documentation and can proceed with or dismiss the allegation.

Step 3: If sufficient evidence, the student receives an allegation statement by email. Ombuds services is copied on the email.

Step 4: The student provides a written response to the evidence provided.

Step 5: Either party may request a meeting between student, Dean, and the ombudsperson.

Step 6: Dean informs the student of the decision.

Appeal: Student has the right to appeal the decision.

Additional details about this process can be found on the Faculty of Science Academic Integrity website (<https://science.carleton.ca/academic-integrity/>).