Course Outline: PHYS 1004 A/B/C, Winter 2026
Introductory Electromagnetism and Wave Motion

Course description and prerequisites

This calculus-based course introduces electricity and magnetism with emphasis on mastering the physics concepts required by students in the engineering programs. It covers electric and magnetic fields and associated forces, potential and potential energy, magnets, electromagnetic induction, alternative current, electric circuits and electromagnetic waves. References to many applications and real-world examples are used frequently. The associated laboratory and tutorial sessions alternate each week and provide an essential complement to the lectures. Student evaluations are based on labs, tutorials and quizzes, in addition to a final exam which is formally scheduled. Students are required to obtain a satisfactory grade in the laboratory component, as well as overall to pass this course.

This course is intended for students who have already taken MATH 1004, ECOR 1101 or ECOR 1053, or ECOR 1045 and ECOR 1046 (which may be taken concurrently), or PHYS 1001 or PHYS 1003 or PHYS 1007 (with the additional requirement of having obtained at least B- in PHYS 1007), or *with explicit permission from the Physics Department*

Note: *Lectures are three hours per week, and laboratory or tutorial sessions are an additional three hours per week. Students are also* ***expected*** *to* ***read selected chapters*** *in the* ***textbook*** *and exercise, including by* ***solving*** *the* ***suggested problems*** *in the textbook and the required* ***weekly quizzes****.*

Instructors and contact information

Razvan Gornea	PHYS 1004 section A instructor	razvangornea@cunet.carleton.ca
Dag Gillberg	PHYS 1004 section B instructor	daggillberg@cunet.carleton.ca
Razvan Gornea	PHYS 1004 section C instructor	razvangornea@cunet.carleton.ca
Jesse Lock	Lab & tutorial groups coordinator	jesselock@cunet.carleton.ca

Material for the lectures, labs and tutorials is available on the course Brightspace page. It is very important that ***each student identifies his or her lab & tutorial group***. Student hours are posted on Brightspace. The Brightspace websites should be consulted carefully and frequently.

Email communications must be done using your Carleton University account. Email early about any possible issues. Please keep copies of all exchanges until the end of the term.

Textbook

Fundamentals of Physics, *12th Edition*, ***Halliday, Resnick & Walker***, John Wiley & Sons Canada Ltd.

The textbook can be bought (or rented) at the Carleton bookstore, publisher and Amazon.ca for about 115 CAD or less in electronic form.

Course philosophy and objectives

Physics provides an ideal opportunity to learn the art of quantitative thinking, i.e. learning how to successfully turn an abstract concept into a concrete calculation or measurement. To solve a problem, you often must critically examine the information available in a given situation and then determine an effective method to obtain the solution and examine the final answer. These skills will serve you throughout your future career. This course is a good step towards that end. The goal of physics is to understand the physical universe and be able to accurately describe and predict what is observed. Physics is based on critical thinking and hence helps to develop independence and free thinking. The understanding of physics helps you perceive the world around you in a more comprehensible, enjoyable, and fascinating way.

Learning physics is not a spectator sport. To learn physics, you must do work outside of class thinking about, and interacting with, the course material. ***No one ever learns physics by simply reading about it or listening to someone talk about it. You learn by making the effort to understand the course material and by solving problems using the principles learned.*** *The standard at university is that you spend one hour working outside of class for every hour in class.*

Course delivery

This course is delivered in person as a mixture of lectures, tutorials, labs and student hours, as well as asynchronous activities (quizzes, recordings and slides). The specific dates and activities are described below. The asynchronous activities are intended to provide flexibility to students. Students are expected to remain up to date with the deadlines and due dates as provided by the instructors. In practice, this course requires Internet access and a computer. ***Please note this is not a remote virtual course and in-person attendance for labs and tutorials is mandatory.***

Also, please note that course materials and recordings are protected by copyright. These are for your own educational use, but you are not permitted to publish to third party sites, e.g. social media sites or any course material websites. ***All solutions and answers to any quiz, lab, or exam in this course must be your own work.***

Lectures

This course is divided into 26 lectures. Each lecture is an in-person 80-minute traditional lecture. Each instructor posts on Brightspace the lecture material and announces in-class guidelines specific to a given lecture section. In addition, each instructor has their own student hour according to the schedule of the respective section, as detailed on Brightspace. Below is the list of the topics that will be covered within each week, as well as the corresponding textbook sections recommended for reading. The table below also details the concepts of the lectures and clearly identifies the subject matters of each bi-weekly tutorial test.

Week	Subject	Textbook chapter	Quiz due
1	Electrostatics (*week of Jan 5*) Electric field due to discrete charges	**Chap 3:** Vectors (review) **Chap 21:** Coulomb's Law **Chap 22:** Electric fields (part I)	Jan 12
2	Electric field due to continuous charge distributions (*week of Jan 12*)	**Chap 22:** Electric fields (part II)	Jan 19
3	Gauss' law (*week of Jan 19*)	**Chap 23:** Gauss' Law	Jan 26
4	Work and energy (*week of Jan 26*)	**Chap 7:** Kinetic energy and work **Chap 8:** Potential energy and conservation of energy **Chap 24:** Electric potential energy	Feb 2
5	Potential energy (*week of Feb 2*)	**Chap 24:** Electric potential energy	Feb 9
6	Capacitance (*week of Feb 9*)	**Chap 25:** Capacitance	Feb 23
Reading week			
7	Magnetic fields (*week of Feb 23*)	**Chap 28:** Magnetic fields	Mar 2
8	Magnetic fields (*week of Mar 2*)	**Chap 29:** Magnetic fields due to currents	Mar 9
9	Induction (*week of Mar 9*)	**Chap 30:** Induction and Inductance	Mar 16
10	AC circuits (*week of Mar 16*)	**Chap 31:** EM oscillations and alternating current	Mar 23
11	Maxwell's equations (*week of Mar 23*)	**Chap 32:** Maxwell's equations	Mar 30
12	Electromagnetic waves (*week of Mar 30*)	**Chap 33:** Electromagnetic waves	Apr 6
13	Good Friday missed lecture (*week Apr 6*)		

Weekly quizzes

Each week, there is a quiz administered through Brightspace. These are due at the beginning of the week (Mondays at midnight). You have at most three attempts to complete each quiz, and plenty of time to complete each attempt (two hours).

The best 10 of 12 quizzes will count towards your final mark.

If there is any discrepancy between the marks posted on Brightspace and your calculated values, notify the instructor immediately.

Numerical answers

When answering the assignment questions requires a calculation, enter the answer when appropriate in scientific notation with three **significant figures**, e.g. 1.60×10^{-19}. You are allowed a 5% deviation between your answer and the exact one calculated within Brightspace to account for rounding errors. If the question explicitly asks for a different number of significant figures or demands an answer with a certain number of digits of precision, then please follow those specific instructions. If the significance or the accuracy of the answer deviates from the stated ranges, the question or problem will be marked as incorrect.

Ensure to always take careful note of the units of your answer. Typically, it is expected that the answer will follow SI units (e.g. m, s, J), however there are occasions in which non-standard units will be required. Such instances will be noted in the question itself, e.g. “Express your answer in km”. Units are not to be entered with the numerical answer for these assignments.

Labs and tutorials

All labs and tutorials will be held in person. No online alternatives will be offered.

Labs and tutorials start the week of **January 5, 2026,** with an introduction and calculus review.

It is imperative that all students attend the first lab session*!* You must attend only the section that you are registered in.

If you have completed the labs in this course before, you may be eligible for a lab exemption. All possible exemptions must be arranged with the Lab Coordinator, Mr. Jesse Lock at the start of term. Lab exemptions will only be considered for students that have previously taken the course and completed all the labs. You are not automatically given a lab exemption - you must apply for it no later than **January 23rd**. To apply for a lab exemption, please contact the Lab Coordinator, Mr. Jesse Lock (jesselock@cunet.carleton.ca). Lab exemptions will be considered on a case-by-case basis at the discretion of the Lab Coordinator.

The grade for each lab will be based on an in-class lab write-up. All lab work (write-ups) counts towards your total lab grade for the course. ***No lab grade will be dropped.*** All lab write-ups must be completed

and submitted by the end of each lab session. ***No lab work will be accepted for grading outside of the lab. If you miss a lab, contact Mr. Jesse Lock (or your lab supervisor) immediately.***

Week		Lab section A/C	Lab section B/D
1	Jan 5th – 9th	**Tutorial 0:** Introduction (for all sections)	
2	Jan 12th – 16th	**Lab 1:** Electrostatics	Tutorial 1
3	Jan 19th – 23rd	Tutorial 1	**Lab 1:** Electrostatics
4	Jan 26th – Jan 30th	**Lab 2:** DC Circuit	Tutorial 2
5	Feb 2nd – 6th	Tutorial 2	**Lab 2:** DC Circuit
6	Feb 9th – 13th	**Lab 3:** Magnetic Balance	Tutorial 3
7	Feb 16th – 20th	***WINTER BREAK***	
8	Feb 23rd – Feb 27th	Tutorial 3	**Lab 3:** Magnetic Balance
9	Mar 2nd – 6th	**Lab 4:** Oscilloscope	Tutorial 4
10	Mar 9th – 13th	Tutorial 4	**Lab 4:** Oscilloscope
11	Mar 16th – 20th	**Lab 5:** RLC Circuits	Tutorial 5
12	Mar 23rd – 27th	Tutorial 5	**Lab 5:** RLC Circuits
13	Mar 30th – April 3rd	**MAKE-UP LABS**	

There will be a tutorial on each alternating week with the labs. A formula sheet will be provided. The formula sheet will be identical to the one posted on Brightspace. The structure of the tutorials is as follows.

A set of tutorial problems will be posted on the lab/tutorial Brightspace website at least a week before the tutorial session. Students should attempt to solve all these problems to prepare for the tutorial test. At the start of the tutorial session the instructor will go through a new problem that you have not seen before on the board. Then, the TAs will demonstrate solving the practice problems and answer questions about the tutorial problem set. **The last hour of the tutorial will be a close-book test consisting of two multiple choice problems and one long-answer problem (*i.e.* the tutorial test has a 1-hour duration).**

The grade for the tutorial test long answer questions and the multiple-choice will be combined to provide the final Tutorial Test grade for each of the 5 tutorial sessions this semester.

The four highest test grades will be used to determine the final Tutorial Test score. There will be no make-up tutorial tests and there will be no differed tutorial tests.

Students must only attend the tutorial/lab section to which they registered in.

Final exam

There is no mid-term examination in this course. We regard the five tutorial tests, the suggested problems in the textbook and the weekly quizzes, as the main avenues for providing performance feedback and guidance to the students in this course. ***If you do not perform to your own satisfaction, it is imperative to discuss this with your instructors during student hours or by email. Do not leave this consultation until the end of the course.*** Effective assistance is best obtained sooner than later.

The final examination will be formally scheduled during the regular April final exam period and announced toward the end of the term. ***It is the responsibility of the students to be present during the final exam period; in particular, holiday travel arrangements must not be made before the final exam date is known. The final exam may include questions related to the material contained within the lab portion of the course. Please note that attending the final exam is mandatory.***

Grade distribution

Weekly quizzes (best 10 out of 12)	15%
Tutorials (best 4 out of 5)	25%
Labs (all 5 count)	35%
Final examination	25%
TOTAL	**100%**

Attending all labs and tutorials is mandatory. Also, students must obtain at least 50% of the lab component, as well as at least 50% on the theory component (weekly quizzes, tutorials and final exam), to pass this course.

Mental Health

If you are struggling, please do not hesitate to reach out. I am happy to listen, and/or direct you to resources that might help. In terms of class, if you need extra help or missed a lesson, don't stress! Email me and we will set a time to meet. I'll work with you, I promise. Remember that Carleton also offers an array of mental health and well-being resources, which can be found here.

University Policies

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	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52

F = <50

WDN = Withdrawn from the course

DEF = Deferred

Academic Accommodations, Regulations, Plagiarism, Etc.

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/)

- **Deferred/missed term work for short-term accommodation (5 days or less)**: Email your instructor.
- **Deferred/missed term work for longer term incapacitation (5 days or longer):** If you require accommodations for this course that are longer than the 5-day (short-term) period, please email your instructor to discuss how/whether accommodation needs could be met for this course.
- **Paul Menton Centre for Students**: The Paul Menton Centre (PMC) is the designated department at Carleton University coordinating disability services on campus. https://carleton.ca/pmc/

Statement on Chat GPT/Generative AI usage

AI Use in this course: Students may use AI tools for basic word processing and formatting functions, including:

- Grammar and spell checking (e.g., Grammarly, Microsoft Word Editor)
- Basic formatting and design suggestions (e.g., Microsoft Word's formatting tools, PowerPoint Design editor)

Documenting AI Use: It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that isn't listed above, please consult your instructor.

Why have I adopted this policy? This policy ensures that student voices and ideas are prioritized and authentically represented, maintaining the integrity of the work produced by students while allowing basic support to enhance clarity, correctness, layout, and flow of ideas. The goal of adopting a limited use of AI is to help students develop foundational skills in writing and critical thinking by practicing substantive content creation without the support of AI.

Academic Integrity

Academic Integrity is upholding the values of honesty, trust, respect, fairness, responsibility, and courage that are fundamental to the educational experience. Carleton University provides supports such as academic integrity workshops to ensure, as far as possible, that all students understand the norms and standards of academic integrity that we expect you to uphold. Your teaching team has a responsibility to ensure that their application of the Academic Integrity Policy upholds the university's collective commitments to fairness, equity, and integrity.

(Adapted from Carleton University's Academic Integrity Policy, 2021).

Examples of actions that do not adhere to Carleton's Academic Integrity Policy include:

- Plagiarism
- Accessing unauthorized sites for assignments or tests
- Unauthorized collaboration on assignment and exams
- Using artificial intelligence tools such as ChatGPT when your assessment instructions say that it is not permitted

Please review the checklist linked here to ensure you understand your responsibilities as a student with respect to academic integrity and this course.

Sanctions for Not Abiding by Carleton's Academic Integrity Policy

A student who has not upheld their responsibilities under Carleton's Academic Integrity Policy may be subject to one of several sanctions. A list of standard sanctions in science can be found here.

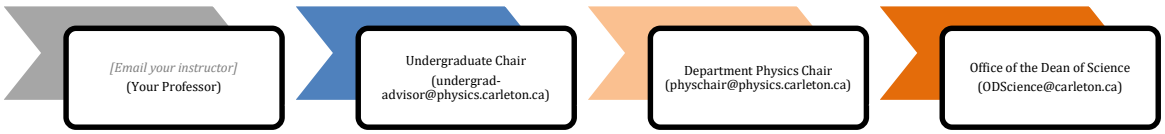
Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):



Note: You can also bring your concerns to Ombuds services.