


Electricity, Magnetism and Waves

Physics 1004A Fall 2024

Course Instructor: Dr. Andrew Robinson  [Hear my name](#) **Office Location:** Herzberg Building HP3368

How to address me: Dr. Robinson or Andrew

[Click here for visual directions.](#)

Gender Pronouns: (he/him/his) ([learn more](#))

Class Location:

Email: andrew.robinson@Carleton.ca

[Click here for visual directions.](#)

Note: If you have a question or would like to talk with me, you can send an email, visit me during student hours (see below), or approach me after lecture.

Class Times: Wed and Fri, 4.05 pm – 5.25 pm

Prerequisites: See this outline

Phone: (613) 520-2600 ext. 8922

Prerequisites: BIT 1003 (no longer offered), BIT 1007, BIT 1204, PHYS 1002, PHYS 1008

Student Hours: To be determined

Department/Unit Physics

What are 'Student Hours'?

Student hours are dedicated times through the week for the course instructor and TAs to meet with YOU. Pop in to introduce yourself, ask questions about the course, or discuss content from the course.

Physics PHYS 1004 Laboratory, Fall 2024

Location:

Lab Supervisor: Kurtis Bauer

Email: KurtisBauer@cunet.carleton.ca

Note: If these times don't work for you, email me and we can arrange an alternate time to meet.

Welcome to Physics 1004A

Introduction

This calculus-based course introduces electricity and magnetism with an emphasis on mastering the physics concepts required by students in the engineering programs. This includes electric and magnetic fields and associated forces, potential and potential energy, magnets, electromagnetic induction, alternative current, electric circuits and electromagnetic waves. The associated laboratory and tutorial sessions alternate each week and provide an essential complement to the lectures. Student evaluations are based on labs, tutorial tests and quizzes, as well as the final exam. Students are required to obtain a satisfactory grade in the laboratory component to pass this course.

Inclusive Teaching

I am committed to fostering an environment for learning that is inclusive for everyone regardless of gender identity, gender expression, sex, sexual orientation, race, ethnicity, ability, age, class, etc. Please email me if you have any comments or concerns.

Land Acknowledgement

We recognize the Algonquin peoples as the traditional custodians of the land in which the campus is located, and where the class is taught. We give respect to the host nation, the *Kitchissippi Omàmiwinini Anishinabeg* (Algonquin peoples of the big river, in the Algonquin language).

Prerequisites

Prerequisite(s): [MATH 1004](#), [ECOR 1101](#) or [ECOR 1053](#) or ([ECOR 1045](#) and [ECOR 1048](#)) (the ECOR courses may be taken concurrently) or [PHYS 1001](#) or [PHYS 1003](#) or [PHYS 1007](#) (a grade of at least B- is required for [PHYS 1007](#)), or permission of the Department.

Students **must** check with Dr Robinson and obtain permission from the Physics Department to remain in the course if they do not fulfil these prerequisites.

Assistance for Students

Career Services: <https://carleton.ca/career/>

Writing Services: <https://carleton.ca/csas/support/>

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

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

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

Community Guidelines

The following values are fundamental to academic integrity and are adapted from the International Center for Academic Integrity*. In our course, we will seek to behave with these values in mind:

	As students, we will...	As a teaching team, we will...
Honesty	<ul style="list-style-type: none"> Honestly demonstrate our knowledge and abilities on assignments and exams Communicate openly without using deception, including citing appropriate sources 	<ul style="list-style-type: none"> Give you honest feedback on your demonstration of knowledge and abilities on assignments and exams Communicate openly and honestly about the expectations and standards of the course through the syllabus, and with respect to assignments and exams
Responsibility	<ul style="list-style-type: none"> Complete assignments on time and in full preparation for class Show up to class on time, and be mentally/physically present Participate fully and contribute to team learning and activities 	<ul style="list-style-type: none"> Give you timely feedback on your assignments and exams Show up to class on time, and be mentally & physically present Create relevant assessments and class activities
Respect	<ul style="list-style-type: none"> Speak openly with one another, while respecting diverse viewpoints and perspectives Provide sufficient space for others to voice their ideas 	<ul style="list-style-type: none"> Respect your perspectives even while we challenge you to think more deeply and critically Help facilitate respectful exchange of ideas
Fairness	<ul style="list-style-type: none"> Contribute fully and equally to collaborative work, so that we are not freeloading off of others Not seek unfair advantage over fellow students in the course 	<ul style="list-style-type: none"> Create fair assignments and exams, and grade them in a fair, and timely manner Treat all students equitably
Trust	<ul style="list-style-type: none"> Not engage in personal affairs while on class time Be open and transparent about what we are doing in class Not distribute course materials to others without authorization 	<ul style="list-style-type: none"> Be available to all students when we say we will be Follow through on our promises Not modify the expectations or standards without communicating with everyone in the course
Courage	<ul style="list-style-type: none"> Say or do something when we see actions that undermine any of the above values Accept a lower or failing grade or other consequences of upholding and protecting the above values 	<ul style="list-style-type: none"> Say or do something when we see actions that undermine any of the above values Accept the consequences (e.g., lower teaching evaluations) of upholding and protecting the above values

* This class statement of values is adapted from Tricia Bertram Gallant, Ph.D.

Online Community Expectations for Social Platforms

With the growing use of social platforms (e.g., Discord) on campuses, it is important to keep in mind that university codes of conduct still apply to the behaviours of students online. Please be considerate and respectful while engaging with peers and remember that we are all humans, and that your words matter. If any student witnesses or experiences harassment, I encourage you to reach out to me. Alternatively, you can contact [Ombuds Services](#) or [Carleton Equity and Inclusive Communities](#).

Online communities can be highly beneficial to students and can help to facilitate learning within the course. I encourage people to ask questions, learn from one another, and have open discussions about class material. That said, any acts of academic misconduct (i.e., cheating) will not be tolerated and will result in serious consequences ranging from a grade reduction to expulsion (*see [academic integrity violations](#)*).

- Examples of appropriate peer-to-peer sharing/learning vary from course to course. In this course appropriate peer-to-peer sharing includes: identifying the proper formula to use, identifying an incorrect or missing step in a person's work, brainstorming potential reasons behind a concept, suggesting helpful sites and videos for learning a concept, posting your own work showing only a specific step or process for illustrative purposes (note: this is very different from posting your work and solution for others to simply copy)
- Examples of unacceptable peer-to-peer sharing: Posting or sharing the answers, indicating which answers are correct on assignments, sharing links to solutions, posting your own complete work for a question/solution

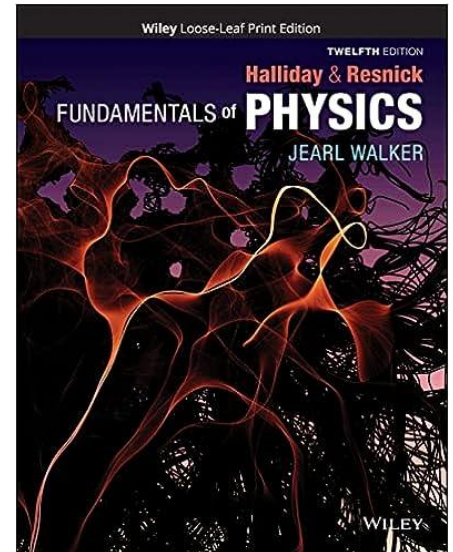
Learning Materials

Textbooks

Fundamentals of Physics, 12th edition by Halliday, Resnick and Walker. If you can find a second-hand copy, of either the 9th, 10th or 11th editions, then this will do for this course.

This textbook is available at the University Bookstore. The ISBN number: 978-1119801146

An electronic version of the textbook is also available for download, is much cheaper than the print copy, and is perfectly acceptable.



Intellectual Property

Classroom teaching and learning activities, including lectures, discussions, presentations, quiz questions and solutions etc., by both instructors and students, are copyright 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).

i.e. Please don't upload notes, quiz questions or solutions to Chegg or other external sites

Technology Checklist:

- An internet-enabled computer (laptop/desktop)
- Zoom software installed on computer (can also install on phone as backup!)
- Access to reliable internet
- Webcam
- Headset with microphone

Note: these facilities are available in the library on campus, and if you need to purchase them, then financial aid is available.

Assessment in this Course

Research about learning strongly suggests that the most important factor in learning is doing the work of reading, writing, recalling, practicing, synthesizing, and analyzing. Learning happens best when people actively engage material on a consistent basis, and that is why we have high standards in this course. We are confident that, with appropriate effort, you **all** can meet those standards.

We also make an effort to reduce unintentional bias in grading by using methods such as grading assignments one question at a time (i.e., grading all of question 1 before grading any of question 2), grading anonymously, and using rubrics.

Course Organisation

Lectures

The lectures are on Wednesdays and Fridays. Attendance is not mandatory but is strongly recommended. Educational research shows that performance in university is strongly correlated with attendance in class. Lectures will be recorded, so you will have the opportunity to review the material. However, the recordings are a pale shadow of the full theatrical experience! We will be using the Wooclap interactive response system to respond to questions. You can log into this system using a web browser on a phone, tablet or laptop, or there is an App which you can download.

Weekly Online Quizzes

There are 11 weekly online quizzes in the course to be completed on Brightspace. You will have two attempts. Questions are randomized from a question bank pool, so they will be different in each attempt. The best attempt is used for the course grade calculation, and the lowest two of your scores will be dropped. The due dates will be in the Brightspace calendar. It is my custom to allow flexibility on the due date for these quizzes. If you require an extension to complete one, please email me. It is best to stick to the schedule, but sometimes things happen.

Laboratory

The laboratory sessions will be held in the Herzberg Building, room HP4130. If you are unable to attend your designated laboratory, please contact the laboratory supervisor. We do offer make-up labs at the end of the semester. If you have taken the course before and got a satisfactory score on the laboratory component, then you may be eligible for a laboratory exemption, so that you do not need to repeat the lab component again. This is not applied automatically; you must contact the lab supervisor to apply for it.

Lab Section	Day	Time
A1	Tuesday	1305-1555
A2	Wednesday	1305-1555

Tutorial Tests

Tutorials are held on alternate weeks from the laboratory sessions, at the same time and in the same room (HP4130).

The first tutorial session will be a lab introduction, and review of important mathematical concepts used in both the lectures and lab parts of the course. Attendance is mandatory. There will be five tests which are taken during tutorial sessions. These take the place of midterm exams in this course. These are 60-minute tests at the **end** of the tutorial session. They are closed book, but the official formula sheet may be used. University exam conditions are in effect, and you may not communicate with other students during this test. Students with PMC accommodations for extra time will sit this test in the McIntyre Centre.

The lowest score of the five tests will be dropped, and the mean value of the other four tests will be used to calculate your final grade. The tutorial tests are worth 20% of your final grade.

Grade Breakdown

This course marking scheme will be used to evaluate the performance of all students. Requests to deviate from this scheme will be denied, unless there are special circumstances, such as illness. Requests to increase the weighting on the final exam to compensate for poor performance on work during the term will be denied unless there are exceptional circumstances.

You will not be allowed to pass the course unless you write the final exam. If you do not attend the exam, then you will be given a maximum of 49% for your final grade, regardless of your score on the other components. There is no minimum grade requirement in the final exam. If you are unable to write the final exam, then you must follow the university procedure and apply for a deferred exam.

You must also obtain a passing grade (50%) in the laboratory work to pass the course. If you do not, then you will automatically receive a failing grade, F, regardless of your performance in the other course components.

Component	Grade Value
Weekly Online Quizzes (drop lowest two)	20%
Tutorial Tests (drop lowest grade)	20%
LABORATORY	35% (must pass with minimum 50% to pass course)
Final Exam	25% (must take the final exam to pass the course)

Final Exams

The final exam will be in-person and will be held during the final examination period. Final exams are scheduled centrally, and I have no control over the date. Please do not book any travel arrangements before the schedule is announced. The exam will be a three-hour closed book exam, with a formula sheet supplied.

Other Assistance

The Physics department runs a Physics Drop-In Centre, staffed by experienced tutors for all first-year students. Details of this will be announced at the start of the semester.

The Faculty of Engineering also runs the Elsie MacGill Learning Centre, which provides similar services for all engineering students.

[Elsie MacGill Learning Centre - Academic Support for Engineering Students | Faculty of Engineering and Design \(carleton.ca\)](#)

Extra Credit

We will be participating in a survey being undertaken by science education researchers at Carleton University and the University of British Columbia. This will involve completing two online surveys (hosted on Brightspace). These are anonymous and nobody can associate your name with your responses. We will offer 0.5% extra credit for each of the surveys you participate in. You can opt to not allow your responses to be used in the overall study, without losing your extra credit for participation.

Student Hours

I will be available for student hours sessions every week when there are classes. We will determine the times during the first lectures, as this needs to be based on student schedules. These will be online Zoom sessions. I will also be available by email but note that I do not monitor my Carleton email continuously. I try to respond within one business day. I am also happy to chat after lectures.

Feeling Sick?

If you feel very sick (e.g., fever, chills, stomach upset) do not come to class or campus. All lectures are recorded, so you can review them later. Please contact the **lab supervisor** if you are unable to attend a tutorial or laboratory session. We will offer makeup labs at the end of the semester, and we drop the lowest tutorial test, to allow for such eventualities.

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 (students.carleton.ca/course-outline)

- **Deferred/missed term work for short-term accommodation (5 days or less):**
Send me an email.
- **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 me to discuss how/whether accommodation needs could be met for this course.

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 Large Language Models (LLMs) which go under the general “AI” umbrella do not understand mathematics and numbers and cannot be relied upon to generate correct answers. Once you understand the basic principles, and can do them yourself, you will be able to correctly identify suitable use-cases for LLMs and be able to spot when they are incorrect. We are at the “understand the basic principles” part of the educational process.

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](#).

Important University Dates and Deadlines

Please familiarise yourself with the Academic Calendar here:

[The Academic Year \(Graduate and Undergraduate Studies\) < Carleton University](#)

Course Schedule

Week Beginning	Lecture	Lecture Date	Topic	Tutorial	Labs
Monday 2nd Sept	1	Wed 4th Sept	Introduction/Electrostatics	No labs or tutorials	
	2	Friday 6th Sept	Coulomb Force		
Monday 9th Sept	3	Wed 11th Sept	Electric Fields	Tutorial 0 (Intro/Review)	
	4	Fri 13th Sept	Electric Fields and Calculus		
Monday 16th Sept	5	Wed 18th Sept	Lines of Charge		Lab 1 (Electrostatics)
	6	Fri 20th Sept	Gauss's Law 1		
Monday 23rd Sept	7	Wed 25th Sept	Gauss's Law 2	Test 1 (Lectures 1 to 5)	
	8	Fri 27th Sept	Work and Energy		
Monday 30th Sept	9	Wed 2nd Oct	Potential		Lab 2 (Oscilloscope)
	10	Fr 4th Oct	Potential of Charge Distributions		
Mon 7th Oct	11	Wed 9th Oct	E-V conversion and Potential Energy	Test 2 (Lectures 6 to 10)	
	12	Fri 11th Oct	Capacitance		
Monday 14th Oct	13	Wed 16th Oct	Capacitance and Dielectrics		Lab 3 (Magnetic Balance)
Thanksgiving on Monday	14	Fri 18th Oct	Magnetic Fields 1		
Monday 21st Oct	Fall Break				
Monday 28th Oct	15	Wed 30th Oct	Magnetic Fields 2	Test 3 (Lectures 11 to 14)	
	16	Fri 1st Nov	Magnetic Field due to Current		
Monday 4th Nov	17	Wed 6th Nov	Ampere's Law		Lab 4 (RC and RLC Circuits)
	18	Fri 8th Nov	Induction 1		
Monday 11th Nov	19	We 13th Nov	Induction 2	Test 4 (lectures 15 to 18)	
	20	Fri 15th Nov	LC and RLC Circuits		
Monday 18th Nov	21	Wed 20th Nov	Phasors and Transformers		Lab 5 (Malus' and Snell's Laws)
	22	Fri 22nd Nov	Maxwell's Equations		
Monday 25th Nov	23	Wed 27th Nov	Solutions of Maxwell's Equations	Test 5 (lectures 19 to 22)	
	24	Fri 29th Nov	Refraction and Reflection		
Monday 2nd Dec	25	Wed 4th Nov	Exam Review		Make Up Labs
		No class (Monday Schedule)			
Exam Period 9th Dec - 21st Dec					