PHYS 1002 - Winter 2025

Electricity and Magnetism

We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

Course Instructor: Sangeeta Murugkar

How to address me: Professor M

Gender Pronouns: (she/her/hers)

Email: Sangeeta.murugkar@Carleton.ca

Note: If you have or 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.

Best Ways to be in Touch: in class, via email, or during student hours

Student Hours: To be posted on Brightspace

Office Location: Room 2414, Herzberg Building

Class Location: Please check Carleton Central for the room location.

Class Times: Wednesday, Friday (8:30 – 10 am)

Prerequisites: MATH 1004 or MATH 1002

And PHYS 1001/ PHYS 1003/ PHYS 1007

Department/Unit: Physics

Course TA:
Ishan Vyas (he/him/his)
(IshanVyas@cmail.carleton.ca)

Welcome to PHYS 1002 !

PHYS 1002 is an introduction to Electricity and Magnetism for physics students, including discussion of applications in everyday life. The course will be delivered in person. It is obligatory for students to participate with in-person classroom attendance.

Topics Covered

		Lectures			Labs & Tutorials & HW	
		Wednesday		**Friday**		**Mon (A1), Wed (A3), Thu (A2)**
January	**8**	Course introduction Chapter 21: Electric Charge and Coulomb's Law	**10**	Chapter 22.1-22.3: Electric field lines Motion of a particle in the E-field		Introductory Tutorial Post HW #1 (due Jan 17)
	15	Chapter 22.4 – 22.5: Electric Field due to a Continuous charge distribution	**17**	Chapter 26: Current and Resistance Chapter 27: (27.1 – 27.3) Direct Current Circuits		Tutorial # 1 Post HW #2 (due Jan 24)
	22	Chapter 23.1 - 23.3: Electric Flux and Gauss's Law	**24**	Chapter 23.4 – 23.6: Application of Gauss's Law		Lab 1: DC Circuits Post HW #3 (due Jan 31)
February	**29**	Chapter 24.1-24.4: -Electric Potential -Potential difference -Electric Potential Energy	**31**	Chapter 24.5-24.8: -Field from the electric potential -Electric Potential due to Continuous charge distribution -Conductors-electrostatic equilibrium		Tutorial # 2 Post HW #4 (due Feb 7)
	5	Chapter 25 (25.1) & Ch. 27 (27.4) Capacitance and RC Circuits	**7**	Chapter 25 (25-2 to 25-7): Capacitors and Dielectrics		Lab 2: RC Time constant Post HW #5 (due Feb 14)
	12	Review Problems Midterm Preparation	**14**	*Mid-term Test*		Lab 3: Oscilloscope
	Week of February 17-21, 2025 - Winter Break: no lectures or laboratories.					

March	**26**	Chapter 28: Magnetic Fields 28.1-28.4: Magnetic forces on moving charges, Hall Effect	**28**	28.6: Magnetic force on a current-carrying wire 28.7: Torque on a current loop Chapter 29: Magnetic fields due to currents		Tutorial # 3 Post HW #6 (due March 7)
	5	29.2: Mag Force between conductors 29.3: Ampere's Law	**7**	29.4: Mag field of a Solenoid Chapter 30.1: Faraday's Law, Lenz's law		Lab 4: Magnetic Balance Post HW #7 (due March 14)
	12	30.2-30.4: Motional emf, Inductance 30.5: Self-induction	**14**	Chapter 30.6: RL circuits 30.7-30.9: Energy in magnetic field		Tutorial # 4 Post HW #8 (due March 21)
	19	Chapter 31.1 - 31.6: LC oscillations, RLC circuit oscillations	**21**	Chapter 31.4-31.6: Alternating Current Circuits (single element in AC circuit), Power in AC circuits		Tutorial # 5 Post HW #9 (due March 28)
	26	Chapter 32.1-32.2: Gauss's law for magnetic fields, Displacement current, Maxwell's equations	**28**	Chapter 32.4 – 32.8: Magnetism in Matter		Lab 5: RLC circuits Post HW #10 (due April 4)
April	**2**	Chapter 33: EM Waves	**4**	Final Review		Review Tutorial
	Exam period: April 11-26, 2025					

Course level learning outcomes:

Upon completion of this course,

1. At an introductory level, students will be able to recall and utilize foundational knowledge in calculus-based electricity and magnetism, including electric field, electric potential, DC and RC circuits, motional EMF, inductance and circuit oscillation.
2. Students will have developed basic problem-solving skills in calculus-based electricity and magnetism, and be able to use appropriately the tools of physics, calculus, and algebra. In the lab, students will be able to generate justifiable uncertainty estimates for experimental results.
3. Students will have developed basic written communication skills for reporting lab work and their analysis of solved problems.

Assessments

Grade Breakdown

COMPONENT	GRADE VALUE
TUTORIAL QUIZ	10 %
ASSIGNMENTS	20% (Top 8 out of 10 assignments)
MIDTERM EXAM	15 %
FINAL EXAM	30 %
LAB	25 % (Details in the 'Lab Policy' page on Brightspace)
EXTRA CREDIT	5 % (in-class engagement)

Tutorials - There are seven tutorials: one introductory tutorial, five regular tutorials and one review tutorial at end of term. The first 30-40 minutes, a teaching assistant will solve key problems on the board – it will serve as a review of the material seen in class. The next 30-40 minutes will be for students to work on problems where students will have the opportunity to ask questions in an informal setting (discussion in groups is encouraged). The regular tutorial concludes with a 60-minute quiz evaluation which you do on your own and hand in for marking. The evaluation will consist of a new problem. There is no evaluation in the introductory and review tutorials. Prepare for the tutorials in advance by reviewing your notes and attempting problems in the text. A list of suggested problems will be posted.

TUTORIAL EVALUATION MAKEUPS: if you miss a tutorial and its evaluation, immediately contact Dr. Ivanovic and explain why. If the reason is illness, a medical note is required. Students with valid reasons will be given written permission to write a makeup at the end of term.

Assignments:

There will be a total of 10 weekly assignments; a problem set will be assigned every Friday and will be due by midnight **(11:59 pm)** on the following **Friday.** However, if you need an extension on this deadline, please email and ask for one. You should include an estimate of when you can get the homework done by.
The detailed method and steps involved in solving the problem (i.e. not only the final result) should be provided in your solution. Complete the analysis yourself, as the work you turn in must be your own.

Assignment solutions should be submitted electronically in a '.pdf' document. Note the assignment may be typed up or handwritten and scanned in. Photos taken with a cell phone are not admissible, as the lighting and contrast are usually bad, and resolution poor.

You are encouraged to discuss the problems on assignments with other students in this course; however, the work you turn in must be your own.

Midterm Exam

There will be an 90-minute mid-term exam held during the lecture time on Friday, February 14, 2025. It will cover material discussed in Chapters 21 – 27. It will be an in-person closed-book exam. You will be allowed a pen/pencil, an eraser, a ruler and a non-programmable calculator. The exam will have 3 long problems with sub-parts and a formula sheet will be provided. Be sure to have your student ID card with you.

Final Exam

The 180-minute final exam will take place during the final exam period in April and will cover the entire course (Chapters 22 – 33). It will be an in-person closed book exam. You will be allowed a pen/pencil, an eraser, a ruler and a non-programmable calculator. The exam will have 6 long problems with sub-parts and a formula sheet will be provided. Be sure to have your student ID card with you for the final exam.

Deferred Final Exam

This will replace only the Final Exam portion of the marks. Deferred Exams for the 2025 Winter term will be held during the Summer term. Students with inadequate term work on the theory part of the course will not be permitted a Deferred Exam. Term work will be considered inadequate if less than 10 out of the possible 45 marks on Theory component of the course have been earned during the term.

Late and Missed Work Policies

Late Work

one day late	*5 marks deducted (10% of 50)*
two days late	*10 marks deducted*
three days late	*15 marks deducted*

Missed Work

Short-term (5 days or less): Accommodations for missed work due to unexpected, temporary situations such as sickness, injury, or extraordinary circumstances outside of a

student's control, must be requested via a written email to me along with an academic considerations form.

Long-term (> 5 days): Students experiencing chronic, ongoing challenges which necessitate a broader solution are encouraged to reach out to the Paul Menton Centre and/or the Care Support team. (More information here: longer-term accommodation) .

Learning Materials

Fundamentals of Physics, 12th Edition (volume 2)
Halliday, Resnick and Walker
ISBN: 9781119801269

Available from the Carleton Bookstore or elsewhere

$49.12 to $116.95

If you bought the multi-volume text for PHYS 1001/1002 in the fall term then you already have the material for PHYS 1002 in the second volume. The content that will be covered in PHYS 1002 is "Electricity and Magnetism". For a hardcopy, a small number of textbooks have been ordered by the Bookstore for students who do not have the multi-volume text already. Look at the Bookstore, or it might be possible to find a used text.

For the laboratories, the laboratory manual and all of the documents for each experiment are available on *Brightspace* associated with your lab section.

Academic Accommodations and Regulations

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/).

Statement on Chat GPT/Generative AI usage (See the *Sample Syllabus Statements for AI use in Courses* document for examples)

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Statement on 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 artificial intelligence tools such as ChatGPT when your assessment instructions say it 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. A list of standard sanctions in the Faculty of 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 abide by Carleton University's Academic Integrity Policy.

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.