

## **PHYS 2202 Wave Motion and Optics**

**Lectures:** Wednesday and Friday, 1:05 PM – 2:25 PM

**Lecturer:** Avery Berman                      E-mail:                      Avery.Berman@carleton.ca  
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Office:    Herzberg 2420  
You can address me as                      Student hours:                      To be posted on Brightspace  
Dr. Berman

**Course schedule:** The first lecture will be Wed, Jan 10 and the final lecture will be Wed, Apr 10.

**Important dates and deadlines:** January 19 is the last day to withdraw from courses with a full fee adjustment and March 15 is the final day for academic withdrawal. Other important dates can be found at <https://calendar.carleton.ca/academicyear/>.

Assignments and announcements will be posted to the course Brightspace page.

**Prerequisites:** PHYS 1001 and PHYS 1002, or PHYS 1003 and PHYS 1004 (PHYS 1007 and PHYS 1008 are also acceptable provided a minimum average grade of B- is presented); plus MATH 1004 and MATH 1104, or MATH 1002 and MATH 1102, or permission of the Physics Department

**Labs: Lab supervisor:**  
Maria Paula Rozo Martinez ([prmartin@physics.carleton.ca](mailto:prmartin@physics.carleton.ca))  
Labs begin the week of January 8<sup>th</sup>, 2023. The schedule, lab policy, and other details will be provided by the lab supervisor.

**Course content:** Geometrical optics (Ch. 2):  
Fermat's principle, reflection and refraction from curved surfaces, lenses

Optical instrumentation (Ch. 3):  
the human eye, cameras, microscopes, telescopes, prisms

Waves (Ch. 4): harmonic waves, plane waves, spherical waves, electromagnetic (EM) waves, light polarization

Superposition of waves (Ch. 5):  
standing waves, beats, phase, and group velocity

Lasers (Ch. 6): black body radiation, EM radiation, Einstein's theory of light-matter interactions, laser elements and characteristics

Interference of light (Ch. 7):  
two-beam interference, Young's double-slit experiment, thin films, Stokes relations, multiple beam interference

Optical interferometry (Ch. 8):  
Michelson interferometer, Fabry-Perot interf., applications

Fraunhofer diffraction (Ch. 11)  
diffraction from a single slit, circular apertures, resolution, double-slit diffraction

Diffraction grating (Ch. 12):  
grating equation, spectral range, dispersion, resolution, blazed and interference

gratings

Optical Coherence (Ch. 9):  
Fourier analysis, temporal and spatial coherence

Fibre optics (Ch. 10):  
Communications systems, bandwidth and propagation, modes,  
attenuation, distortion

} Time permitting

**Textbook:** Pedrotti, Pedrotti, and Pedrotti, “Introduction to Optics”, Cambridge, 3<sup>rd</sup> edition (2017, ISBN = 9781108552493) or newer. [Note: 3<sup>rd</sup> edition by Pearson prior to 2018 will do as well]

**Other references:** E. Hecht, “Optics”, Pearson, 5th edition. Or Addison Wesley Longman Inc., 4<sup>th</sup> edition.

**Problem assignments:** Expect about 8–9 assignments, due weekly.  
Late assignments will not be accepted.  
Clarity, rigour, and organization are important parts of your solutions.

**Midterm & final exam:**

1. There will be a 75-minute closed book mid-term exam during the lecture period (likely Fri, Mar 1).
2. There will be a 3-hr in-person closed book final exam during the exam period.

**Grading scheme:**

| Component   | Weight |
|-------------|--------|
| Assignments | 20%    |
| Midterm     | 20%    |
| Final Exam  | 30%    |
| Labs        | 30%    |

**Land acknowledgement:** We acknowledge that the land on which we gather to learn is on the traditional, unceded territories of the Algonquin nation. Carleton acknowledges it has a responsibility to the Algonquin people and a responsibility to adhere to Algonquin cultural protocols. [You are invited to learn more here.](#)

**Course delivery**

The course will consist of synchronous meetings that will follow an **in-person** model where we will gather in our classroom. I will lead a discussion of the course material in a lecture style following the ‘chalk-and-talk’. Students are encouraged to ask questions and engage with the material during the lecture. These sessions are intended to be the primary method of course delivery and it is highly recommended that you attend these sessions except in the case of an illness or emergency.

**Assignments**

Expect about 8–9 assignments, typically one every week. Each assignment will be due one week later and submitted as handwritten or printed in class. Late assignments will not be accepted. Students are permitted and encouraged to discuss concepts related to the assignments, however, you must submit your own work. Clarity, rigour, and organization are important parts of your solutions—be sure to explain your steps.

The use of generative AI is highly discouraged since, a) depending on how it is used, it could deprive you of the work of grappling with challenging concepts—an often necessary component of learning— b) you will not have the opportunity to use one on the midterm and final exam, and c) it could

potentially be considered plagiarism, which is a violation of the Carleton Academic Integrity Policy (see later).

### **Exam deferrals**

No deferred exam will be set for the midterm exam. Instead, the weight of the midterm will be assigned to the final exam. A deferred exam will be scheduled only for the final exam. If your term mark on the assignments, labs, and mid-term is below 20 out of 70, and you were unable to write the scheduled final exam, and you want to request a deferred final exam, please consider the fact that you will be unable to pass the course, even if you score 100% on the final. However, every student is entitled to write the final exam, and you may find it an educational experience, regardless of your standing in the course.

### **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

ABS = Student absent from final exam

DEF = Deferred

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

### **Academic Accommodations, Regulations, Plagiarism, Etc.**

Carleton University is committed to providing access to the educational experience in order to promote 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/>

### **Addressing Human Rights Concerns**

The University and all members of the University 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 (including pregnancy), or sexual orientation, please contact the [Department of Equity and Inclusive Communities](#) at [equity@carleton.ca](mailto:equity@carleton.ca).

**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 \(PDF, 2.1 MB\)](#).

**Religious Obligations**

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 \(PDF, 2.1 MB\)](#).

**Academic Accommodations for Students with Disabilities**

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact 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, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Menton Centre website](#).

**Survivors of Sexual Violence**

As a community, Carleton University 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 as per 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 the [Equity and Inclusive Communities website](#).

**Accommodation for Student Activities**

Carleton University 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. Please contact your instructor 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 \(PDF, 25KB\)](#).

**Accommodations for Missed Work**

Carleton recognizes that these are unprecedented times during the COVID-19 pandemic, and that students may be experiencing greater stress and other life factors that are not in their control. As a result, Carleton has put into place a protocol for students to apply for accommodations using a self-declaration form in the event of missed work. The form can be found at:

<https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

**Academic Integrity**

Academic misconduct undermines the values of honesty, trust, respect, fairness, and responsibility that we expect in this class. 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

### **Sanctions for not abiding by Carleton's Academic Integrity Policy**

A student who has not adhered to Carleton's Academic Integrity Policy may be subject to one of several sanctions:

1. If you take full responsibility for your actions, and it is the first time you have violated the policy, you will receive zero on the assessment. If you are found to have violated the policy but do not take responsibility, an additional grade deduction will be applied (e.g. an A- will become a B+)
2. Subsequent violations of the policy may result in more severe sanctions such as failing the course, suspension from all studies and/or expulsion.

### **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](#). 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.

### **Plagiarism**

Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, refer [the Faculty of Science Academic Integrity website](#). To further understand Academic Integrity, consider attending the [Learning and Support Academic Integrity Workshop](#).

#### **What are the Penalties for Plagiarism?**

A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

#### **What are the Procedures?**

1. All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.
2. The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.
3. The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

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.

### **Course Copyright**

Classroom teaching and learning activities, including lectures, discussions, presentations, 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).

### **Assistance for Students**

Academic and Career Development Services: <https://carleton.ca/career/>

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

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

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

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