

## PHYS 4708 A - Winter 2025

Introduction to Quantum Mechanics II

*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:** Wafia Bensalem

**Email:** [wafiabensalem@cunet.carleton.ca](mailto:wafiabensalem@cunet.carleton.ca)

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

**Student Hours:** Mondays, 4pm-5pm, HP3313

**Office Location:** Room 3313, Herzberg Laboratories

**Class Times:** Mon & Wed, 14:35 – 15:55

**Prerequisites:** PHYS 4707 or permission of the Department

**Department:** Physics

**Teaching Assistant:**

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# Topics Covered and Learning Outcomes

## Topics to be Covered

Week	Subject	Textbook chapter
1	- Course Details / Introduction - Review of Some PHYS 4707 topics	
2	Time-Independent Perturbations	11
3	Time-Independent Perturbations	11
4	Time-Independent Perturbations	11
5	Identical Particles	12
6	<b>Midterm Exam on February 10</b>	
	Identical Particles	12
7	Identical Particles	12
8	Scattering	13
9	Scattering	13
10	Scattering	13
11	Photons and Atoms	14
12	Path Integrals	8
13	Review	

**Important dates and deadlines can be found here:**

<https://carleton.ca/registrar/registration/dates/academic-dates/>

Including class suspension for fall, winter breaks, and statutory holidays.

### Course level learning outcomes:

- Apply quantum mechanics concepts to real-world physical systems.
- Given a system of multiple particles, identify the correct quantum behavior.
- Given a Hamiltonian for a system, identify the main interactions and perturbations.
- Identify the assumptions that can simplify a complicated Hamiltonian.
- Given a complex system, identify the most suitable approximation method to be used to understand the behavior of that system.
- Given a complex system, use perturbation theory to draw correct conclusions about its behavior.
- Given a complex system, use the variational method to find its ground state.

### Assessments

- There will be **biweekly assignments** which will be posted as pdf files on Brightspace. The lowest assignment grade will not be included in the overall assignment grade calculation.
- The **midterm exam** will occur on **February 10<sup>th</sup>** during the class time. It will be closed-book and closed-notes, and a formula sheet will be provided (to be posted on Brightspace in advance). The midterm exam is not optional and must be attempted to successfully pass the course.
- The **final exam** will occur during the final exam period as scheduled by the university. It will be closed-book and closed-notes. A formula sheet will be provided (to be posted on Brightspace in advance). The final exam is not optional and must be attempted to successfully pass the course.

### Grade Breakdown

Component	Grade Value
Assignments	<b>40%</b>
Midterm exam	<b>20%</b>
Final exam	<b>40%</b>

## Late and Missed Work Policies

### Late Work

Assignments must be handed in by the indicated due date or they will not be graded and receive a mark of zero.

### Missed Work

If you encounter extenuating circumstances preventing you from doing a coursework, you can provide an [academic considerations form](#). You can also provide a [longer-term accommodation](#) in case of long-term (> 5 days) extenuating circumstances. Only one form is allowed for each student.

- If you miss the midterm for an approved reason, your final exam will count for 60% of your final grade.

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## Learning Material(s)

Learning Material	Options for Purchasing	Approximate Cost
<a href="#">A Modern Approach to Quantum Mechanics, 1st or 2nd Edition, John S. Townsend, University Science Books</a>	<ul style="list-style-type: none"><li>- Bookstore</li><li>- Used (Kijiji, FB-marketplace, ...)</li><li>- <a href="#">financial aid</a></li></ul>	\$191

## 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

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 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](#).