Course Outline
PHYS 4707 - A: Introduction to Quantum Mechanics I - Fall 2020

Course description

Instructor: Thomas Grégoire (gregoire@physics.carleton.ca)

Office Hours: TBD

Course Modality: This course is an online course where there is a mixture of synchronous meetings and asynchronous activities. The course material will be provided in short videos posted on CuLearn and in the textbook. During the live sessions the material will be reviewed but emphasis will be put on examples and interactions with the students. Attending the live sessions is strongly encouraged but will be mandatory only for the tests and midterms.

Live Sessions: Monday and Wednesday 10:05 am - 11:25 pm, BigBlueButton (The live sessions will be recorded.)

First class on Wednesday Sept. 9, last class on Friday Dec. 11, 2020.

Prerequisites: PHYS 3701 (Elements of Quantum Mechanics) and PHYS 3807 (Mathematical Physics). Some of these prerequisite can be waived with consent of the instructor.

Textbook: Stephen Gasiorowicz, *Quantum Physics* , 3rd edition Wiley, ISBN 978-0-471-05700 **further reading**:

- David J. Griffith *Introduction to Quantum Mechanics*
- John S. Townsend *A Modern Approach to Quantum Mechanics*
- Claude Cohen-Tannoudi, Bernard Diu, Frank Laloe, *Quantum Mechanics*
- The Feynman Lectures on Physics, volume 3
- Richard Liboff, *Introductory Quantum Mechanics*

Goal and content of the course: The goal of this class is to give a rigorous introduction to quantum mechanics. We sill study the fundamental postulates of quantum mechanics and their mathematical implementations. We will see how they apply to various simple physical systems. We will cover chapters 1 to 10 of the textbook. Covered topics will include

- Wave-particle duality.
- Schrodinger equation.
- 1-D potential
- Operator Methods
- Angular Momentum
- Hydrogen atom
- Matrix representation of operators
- Spin

Learning outcomes At the end the course the students should be able to:

- Understand and apply the postulates of quantum mechanics for simple quantum systems.
- Analyze and solve the Schrodinger equation for simple 1-dimensional potential problems.
- Be able to use the Dirac bra-ket notation to solve various problems in quantum mechanics, including the harmonic oscillator and problems involving angular momentum
- Solve the hydrogen atom problem in quantum mechanics

Assessment

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

$A+ = 90-100$	$B+ = 77-79$	$C+ = 67-69$	$D+ = 57-59$
$A = 85-89$	$B = 73-76$	$C = 63-66$	$D = 53-56$
$A- = 80-84$	$B- = 70-72$	$C- = 60-62$	$D- = 50-52$
$F =$ below 50			

Use of e-Proctoring system: This course has timed written assessments, which may consist of tests, midterms and/or final examinations. The Carleton University e-Proctoring system may be used in your assessments, and requires the use of webcams, microphones, and smart phones.

Reading quizzes (10 %): There will be short weekly reading quizzes. These will be multiple choice conceptual questions and will be give through CuLearn. You will be notify in advance of any quizz.

Homework assignements (35 %): One homework will be assign roughly every week in class. It will be due the following week. To submit your homework you will need to take pictures of your problem set and send it as one PDF. Make sure your document is legible before you send it. I strongly suggest the use of a scanning app. You are encouraged to discuss the concepts and strategies relative to the assignments together, but the work that is handed in **must be your own**. Late assignment will not be accepted without an acceptable reason.Note: Viewing or searching for solutions in any form before your assignment is submitted is forbidden and will be considered an academic offence. This includes solution manuals, worked problems on the internet, solutions written by other students, and solutions provided by course instructors in previous years."

Midterms (20 %): There will be two one hour midterm during the live session at a date to be determined. This will be an open book exam (no internet), and a formula sheet will be provided.

Final (35 %): The final exam will be 3 hours long and will be held during the final exam period. It will be open book (no internet) and a formula sheet will be provided

Useful informations

Website cuLearn will be used as the course website.

Academic policy: 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: http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/

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, the potential penalties and the procedures refer to the policies on academic integrity https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy.pdf

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?

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

Faculty of Science penalties for violation of the Carleton policies on academic integrity

- First offence: F in the course
- Second offence: one year suspension of the program
- Third offence: Expulsion from the University

Note: stronger penalties can be imposed at the discretion of the associate dean.

Academic accommodation: You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

- **Pregnancy**: Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.
- **Religious obligation**:Students requesting academic accommodation on the basis of religious obligation should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student. Students or instructors who have questions

or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance.

- **Students with disabilities requiring academic accommodations** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). *The deadlines for contacting the Paul Menton Centre regarding accommodation for final exams for the Fall exam period is November 8, 2019 and for the Winter exam period is March 13, 2020.

Assitsance for students: The following resources might be useful :

- Academic and Career Development Services: http://carleton.ca/sacds/
- Writing Services: http://www.carleton.ca/csas/writing-services/
- Peer Assisted Study Sessions (PASS): https://carleton.ca/csas/group-support/pass/
- Science Student Success Centre: https://sssc.carleton.ca/
- Math Tutorial Centre: https://carleton.ca/math/math-tutorial-centre/

Important Information:

- Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).
- Students must always retain a hard copy of all work that is submitted.
- Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.
- Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton?s Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario?s Freedom of Information and Protection of Privacy Act (FIPPA) within the university.
- In accordance with FIPPA, please ensure all communication with staff/faculty is via your Carleton email account. To get your Carleton Email you will need to activate your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.