PHYS 4040 Quantum Mechanics II
University of Guelph
Department of Physics
Winter 2018

Class Schedule
Monday and Wednesday from 1:00 p.m to 2:20 p.m

Lecture Room
MCKN, Room 238

Tutorials
Wednesday 07:00PM - 09:50PM
ANNU, Room 204

Instructor
Liliana Caballero
email:ocaballe@uoguelph.ca
Office: MacN 433D

Office hours
Monday from 10:30 a.m to 12:00 p.m (or by appointment).

Teaching Assistant
Karl Davidson, office hours: Wednesday 5:30 pm to 6:30 p.m
email: kdavid06@uoguelph.ca

Pre-requisites:
Quantum Mechanics I- PHYS 3230
The course also relies on a working knowledge of classical mechanics, electromagnetism, and mathematics.

Textbook

Recommended texts
C. Cohen-Tannoudji, B. Diu and F. Laloe, Quantum Mechanics, Wiley, 1977
The University of Guelph Library has a wonderful resource of e-books at Scholars Portal books.

You can login in with your University credentials and have access to countless books with problems to practice. As an example, you will find:


Course content

Specific learning outcomes
After taking this course the student will be able to:

1. Demonstrate an understanding of the postulates of quantum mechanics.
2. Employ Dirac’s notation to describe and manipulate quantum states and operators.
3. Demonstrate a practical knowledge of spin as a property of quantum-mechanical particles, and how it relates to total angular momentum.
4. Solve quantitative problems involving spin interactions with an external magnetic field, and mutual spin interactions.
5. Apply the laws of quantum mechanics to multi-particle systems, including bosonic and fermionic systems.
6. Apply the theory of time-independent perturbations to find approximate solutions to quantitative problems in quantum mechanics.
7. Demonstrate an understanding of how spin and relativistic effects create a fine structure in the degenerate energy levels of the hydrogen atom.

Lecture Content

- **Multiple Particles.** Schroedinger equation for many particles. Two particles. Distinguishable vs indistinguishable particles. Bosons and fermions.
- **Time-Independent perturbation theory.** Nondegenerate and degenerate perturbation theory. Applications.
- **Fine and Hyperfine structure of Hydrogen Atom.** Relativistic corrections to atomic Hamiltonian. Perturbation of the ground state. Fine structure of the first excited state.
- **Scattering** (If time allows). Partial-wave phase shifts.

Grading

There will be two midterms and one final exam. They will be closed-book exams.
We will also have weekly homework. The assignments should be returned a week after they are posted. Later assignments will not be accepted unless special arrangements are made ahead of time. The Teaching Assistant will be responsible for marking the homework assignments. Note that although you are permitted to discuss the homework problems with your classmates, you must to write up the solutions yourself. At this stage of your career you should develop your answers independently of anyone else. Copying will not be tolerated. The homework problems are exercises that give you practice, and keep you up-to-date with the course material. However, you need to work on more problems on your own in order to master the content of the course.

The final mark of the course will be calculated with the following scheme. No other marking schemes will be considered.

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<th>Scheme</th>
<th>Assignments</th>
<th>First midterm</th>
<th>Second midterm</th>
<th>Final exam</th>
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**First midterm date and time:** Wednesday February 7th 2018 from 1:00 p.m to 2:20 p.m, in class

**Second midterm date and time:** Wednesday March 14th 2018 from 1:00 p.m to 2:20 p.m, in class

**Final exam date and time:** April 11th 2018 from 14:30 to 16:30, Place TBA.

Assignments are due every Wednesday at the beginning of the lecture.

**Drop date**
The last date to drop one-semester courses, without academic penalty, is March 9, 2018. For regulations and procedures for Dropping Courses, see the Academic Calendar.

**Course Policy regarding use of electronic devices and recording of lectures**
Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

**Academic Consideration**
When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration.
Misconduct
The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar

Accessibility
The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community’s shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the university website on Accessibility.

Course Evaluation Information
Please refer to the Course and Instructor Evaluation Website