

PHYS*3230 Quantum Mechanics I

Fall 2017 Course Outline

Department of Physics
University of Guelph

Course Information

Calendar Description

This course consists of a formal treatment of quantum mechanics. Topics include wave packets and free particle motion, the Schrodinger equation, harmonic oscillator, piecewise constant potentials, central forces and angular momentum, and the hydrogen atom.

Credit Weight: 0.50

Prerequisites: (CHEM*2070 or PHYS*2260), MATH 2160, (MATH*2170 or MATH*2270), (PHYS*2340 or PHYS*2470)

Course Objectives

This course is intended to provide you with a basic understanding of the similarities and differences in the behavior of particles in the large (classical mechanics) and small (quantum mechanics) limit. Thus, on one hand you are expected to learn the fundamental postulates of quantum mechanics and some of the more elementary mathematical techniques of quantum mechanics and to appreciate the very peculiar predictions and observations on the small. On the other hand you are also expected to understand the many similarities in the behavior of quantum particles with the macroscopic particles of common everyday experience.

Class Schedule and Location

Lectures are Monday, Wednesday and Friday from 12:30 pm to 1:20 pm in MINS room 103.

Tutorials are Tuesdays from 7:00pm to 7:50pm in MINS room 103.

Course Instructor

Name: Michael Massa

Office: MacN 328

Office Hours: TBA, and will be arranged at the first lecture

Email: massam@uoguelph.ca

Teaching Assistant(s)

Name	Office	Email
Karl Davidson	MacN 403	Kdavid06@uoguelph.ca

Learning Resources

Course Website

The course website can be found by logging into [Courselink.uoguelph.ca](https://courselink.uoguelph.ca)

Required Materials

Introduction to Quantum Mechanics, by D.J. Griffiths (Cambridge Press, 2nd edition, 2016)

Recommended Materials

Essential Mathematical Methods for Physicists, by H.J. Weber and G.B. Arfkin (Elsevier Academic Press, 2004)

Course Topics

1. Review of mathematical tools required for the course. Wave function, Schrodinger equation. Statistical interpretation of the wave function.
2. One-dimensional quantum mechanics: Free particle and a wave packet; finite and infinite potential wells; bound states and quantization; scattering states; potential barrier tunneling; reflection and transmission; delta-potential.
3. Mathematical formalism of Quantum Mechanics; observables and Hermitian operators; eigenvalue-eigenfunction problem; operators of position and momentum and the uncertainty principle; momentum representation; Dirac notation.
4. One-dimensional quantum mechanics, additional topics, which may include Kronig-Penney potential and energy band structure of solids; the harmonic oscillator, ladder operators, coherent states.
5. Three-dimensional quantum mechanics: Coulomb potential and hydrogen atom; angular momentum. If time permits: Symmetries and Conservation Laws in Quantum Mechanics; Spin; identical particles; exchange interactions.

Evaluation

Assessment	% of Grade	Due Date
Assignments	30%	TBA: Late submissions will be accepted within one day, with a 20% late penalty.
Midterm 1	10%	Friday Oct. 13, 12:30-1:20 (in class)
Midterm 2	20%	Tuesday Nov. 7, evening (2 hrs, location TBA)
Final Exam	40%	Wednesday Dec. 13, 2:30pm-4:30pm (location TBA)

Course Evaluation

The Department of Physics requires student assessment of all courses taught by the Department. These assessments provide essential feedback to faculty on their teaching by identifying both strengths and possible areas of improvement. In addition, annual student assessment of teaching provides part of the information used by the Department's Tenure and Promotion Committee in evaluating the faculty member's contribution in the area of teaching.

The Department's teaching evaluation questionnaire invites student response both through numerically quantifiable data, and written student comments. In conformity with University of Guelph Faculty Policy, the Department's Tenure and Promotions Committee only considers comments signed by students (choosing "I agree" in question 14). Your instructor will see all signed and unsigned comments after final grades are submitted. Written student comments may also be used in support of a nomination for internal and external teaching awards.

Note: No information will be passed on to the instructor until after the final grades have been submitted.

Standard Statements

E-mail Communication

As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. [See the undergraduate calendar for information on regulations and procedures for Academic Consideration.](#)

Drop Date

The last date to drop one-semester courses, without academic penalty, is Friday November 3rd, 2017. For [regulations and procedures for Dropping Courses, see the Undergraduate Calendar.](#)

Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

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 website: <http://www.uoguelph.ca/csd/>

Academic 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.](#)

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.