Quantum Mechanics I: Phys 3200b
Winter 2021
The University of Western Ontario

Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the Digital Student Experience website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: https://www.uwo.ca/health/.

Technical Requirements: Stable internet connection Computer (Laptop or Desktop)
Working microphone Working webcam Printer

Delivery and Important Dates:

Delivery Mode	Dates	Time
In-person tutorial/quiz MC-110	Mondays	1:30 PM – 2:30 PM
Online-office hours	TBA	TBA
Online-asynchronous	2.5 hrs/week	NA

*Details about design and delivery of the course are listed in a later section

Classes Start	Reading Week	Classes End	Study day	Exam Period
January 11	February 13 - 21	April 12	April 13	April 14 – 30

* March 14, 2021: Last day to drop a second-term half course without penalty

Prerequisite Requirements: *The prerequisites for this class are Math 1600, Phys 2101, 2102, and 2110* (Note also that Chem 3374 is an antirequiste). It would be advantageous to take AM2402-Ordinary Differential Equations prior-to or simultaneously-with this course.
Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Instructor Information: Prof. Colin Denniston, cdennist@uwo.ca, office: MC266. If you wish to contact your instructor privately, please send an email **using your Western email address** and include Phys3200 in the subject line. You can also contact the instructor on the MS Teams course site.
TA/grader: TBA

Course Description
Neils Bohr once said, "Those who are not shocked when they first come across quantum theory cannot possibly have understood it." In this course we hope to be shocked and amazed by quantum theory but to gain and deepen our understanding by applying it to concrete examples.

Learning Outcomes: : *i*) To work with and apply the Dirac formalism of Quantum Mechanics to simple, low dimensional, problems involving particle spin, angular momentum, and their time evolution.
ii) Solve for the time dependence for single particle systems in one dimension using either wave mechanics or matrix mechanics.
iii) To be comfortable working with the operator formalism for the quantum harmonic oscillator in one dimension.

Anticipated Topics: Lecture topics are centered on the key objectives of the course. The topic coverage

shown below is approximate and may change depending on lecture progress. We may not get to all topics later on the list.

1. Stern-Gerlach Experiments
2. Rotation of Basis States and Matrix Mechanics
3. Angular Momentum
4. Time Evolution
5. A System of Two Distinguishable Spin-1/2 Particles
6. Wave Mechanics in 1D
7. Harmonic Oscillator (1D)

Course Materials

Text: The required textbook is *A Modern Approach to Quantum Mechanics, 2nd edition*, by John S. Townsend. This is available from the Western Bookstore and also from Amazon.ca for $167.30. You can also get an electronic copy for $85 from the publisher at: https://www.redshelf.com/book/522/. This is the same book that was used in Phys 3200b last winter term. Assignments, supplemental information, and references will be posted on the course website.

Website: Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates. This is one of two methods by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis. The missing of critical information due to your failure to check OWL cannot be used as a basis for appeal.

MS Teams: I will be setting up a team for the course on MS Teams. This is the second method by which information will be disseminated to all students in the class. Students are responsible for checking updates on MS Teams on a regular basis. The missing of critical information due to your failure to check MS Teams cannot be used as a basis for appeal.

If you do not have MS Teams installed already, you can get a copy for Windows, Apple, or Linux using your UWO Office 365 account. If you do not want to install the application, you can also access it through the browser the same way you access your UWO Outlook mail in a browser. All meetings and will be done through MS Teams.

If students need assistance with OWL or setting up MS Teams, they can seek support on the OWL Help page or they can contact the Western Technology Services Helpdesk. They can also be contacted by phone at 519-661-3800 or ext. 83800.

Up-to-date versions of Google Chrome or Mozilla Firefox are the preferred browsers to optimally use OWL (though MS Edge should work just as well); Students interested in evaluating their internet speed, please click here.

Course Evaluation: Your grade will be based on:

10% Participation,
20% Assignments,
40% Quizzes,
30% Final Exam.

The Department of Physics and Astronomy may, in *exceptional* circumstances, adjust the final course marks in order to conform to Departmental policy.

Participation: Students are expected to participate and engage with content posted on OWL in a timely manner. Students can also participate by interacting on MS Teams with their peers and instructors. There will be a *HW discussion* channel and a *Lecture, Text, Notes discussion* channel for this purpose. Attendance (either in-person or virtually) at tutorials and other meetings can also count towards participation marks.

Assignments: There will be seven assignments of similar weight (two in January then one every 2 weeks). Late assignments will be penalized at a rate of up to 10% per day at the instructor's discretion. You will need to scan and turn-in the assignments electronically. The assignment needs to be turned in as a ***single pdf file*** (***NOT*** **a separate file for every page**). You can use a printer/scanner to pdf or a phone app like Office Lens to do this. You need to make sure the file is clearly readable with nothing cut-off. The TA will grade whatever is turned in and marks will be deducted if they cannot read the whole page.

Quizzes: There will be a quiz roughly every 2 weeks (6 altogether plus 1 makeup).
Anticipated dates for quizzes are: 25 Jan, 8 Feb, 22 Feb, 8 March, 22 March, 5 April, 12 April (makeup). Quizzes will be written in-person in the Monday class in MC-110. Students who need to work from home can do the quizzes online. The online quiz will cover the same material as the in-person quiz but may not be the same questions and may be in a different format. The online quiz could consist of a mix of written and oral components. For written components you will need to scan and return them (as a single pdf document). Online quizzes will be proctored over video conferencing using MS Teams. There will be a makeup quiz the last week of classes. The makeup will be cumulative and will act as a makeup for any quiz missed during the semester (this needs to be for a properly reported and approved absence). If more than 1 quiz is missed, weight will be transferred to the final exam.

Final: At this point we plan to have an in-person written final exam. As with quizzes, there will be the option of doing the exam online. The online exam would consist of a mix of written and oral components. For written components you will need to scan and return them (printer/scanner to pdf is ideal but a phone app like Office Lens that will produce a pdf with all pages as a single document is ok too).

Calculator Policy: For the exams it is likely you will need a scientific calculator (with log, trig functions), pen and pencil. These will not be provided and if you forget them you will probably fail the exam. However, you cannot use anything capable of wireless communication, or anything capable of storing and displaying large text files. If you are not sure if your calculator is ok, go to www.staples.ca web site, type "scientific calculator" into the search bar and any one of the calculators that come up costing less than $20 is ok. Make sure you know how to use the calculator before the exam.

6. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,

- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

7. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Tests and examinations in this course may be conducted using MS Teams. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. Note that your username and all stored documents and recordings on MS Teams are linked to UWO Office 365 accounts and licenses and have similar security and privacy as your UWO email account.

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Teams. Information about the system requirements are available at the following link:

https://support.microsoft.com/en-us/teams

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, http://westernusc.ca/services.