

Quantum Mechanics II: AM/Phys 4251a
Fall 2024
Western University

Instructor: Andrea Soddu asoddu@uwo.ca. If you wish to contact your instructor, please send an email **using your Western email address** and include 4251 in the subject line.

Office hours: on email request via zoom.

Prerequisite Requirements: 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. The prerequisite for this class is Phys 3200 (Note that AM4251 and Phys4251 are antirequisites as they are the same course).

Accessibility: 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 Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

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

Course Website: Students should check OWL Brightspace (<https://westernu.brightspace.com/>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. The missing of critical information due to your failure to check OWL Brightspace cannot be used as a basis for appeal.

Course Materials: The required textbook is *A Modern Approach to Quantum Mechanics, 2nd edition*, by John S. Townsend. Copies are available at the Western Bookstore. Assignments, supplemental information, and references will be posted on the course website. Material from the textbook *Introduction to Elementary Particles, 2nd edition*, by David Griffiths may also be used.

Course Objectives: 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 understanding by applying it to concrete examples.

Learning Outcomes:

- i) To work with and apply the Dirac formalism of Quantum Mechanics to bound states of central potential.
- ii) To gain a deeper understanding of the fundamentals of Quantum Mechanics through the path integrals formalism.
- iii) To be comfortable with the theory of scattering.

Anticipated Topics: Lecture topics are centered on the key objectives of the course. The topic coverage shown below is only approximate and may change depending on lecture progress.

Chapter 8 Path Integrals
Chapter 9 Translational and Rotational Symmetry in the Two-Body Problem
Chapter 10 Bound States of Central Potential
Chapter 12 Identical Particles
Chapter 13 Scattering

Course Evaluation: Your grade will be the better of:

I: 30% Assignments, 30% Midterm Exam, 40% Final Exam

OR: II: 30% Assignments, 70% Final Exam

Option II is only available if you have a valid reason for missing it, as determined by the Faculty of Science Academic Counselling (see below).

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

There will be around four assignments of similar weight (approximately one every 3 weeks). No assignments will be dropped from your grade for any reason (If you are sick and the solutions have already been given out or discussed in class, you will have to do a different make-up assignment). Late assignments will be penalized at a rate of up to 10% per day at the instructors' discretion. Assignments must be completed independently. Students may not obtain "help" from the problem solutions of another student in this or any previous class here at Western or any other university, or from any "answer key" from the internet. Students may discuss the problems to help each other, but NOT by simply lending solutions. The final solution must be your own work; provide complete solutions, including clear explanations and analysis; be completed using neat handwriting or typed; have each problem beginning on a new page; be submitted in person (problem sets submitted electronically or slid under my office door will not be accepted unless specifically arranged with the instructor); be stapled together in one group (unstapled assignments are only guaranteed to have the first page marked). Do not submit your assignment in a plastic "envelope".

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 \$25 is ok. Make sure you know how to use the calculator before the exam.

Academic Consideration for Student Absences: Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

(i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:

- an absence must be no more than 48 hours
- the assessments must be worth no more than 30% of the student's final grade
- no more than two SRAs may be submitted during the Fall/Winter term

(ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed

medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.

(iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration. Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline. 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 the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf
and for the Student Medical Certificate (SMC), see:

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

Religious Accommodation: When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Absences from Final Examinations: If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you can do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47- hour period).

Academic Integrity: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

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