

Univ. of Winnipeg Dept. of Physics
Fall/Winter 2017-18

PHYS-3301 Quantum Mechanics I Updated Outline for Winter

Lecture Times: MWF 9:30-10:20AM

Room: 3M65

Instructor: Dr. Andrew Frey

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Office: 2L26

Office Phone: 204-786-9215

WWW: Winter – <http://ion.uwinnipeg.ca/~afrey/FW1718/qm1/>

Office Hours: W 2:30-3:30PM or by appt

Course Description

This course provides an introduction to 20th century physics, specifically special relativity and quantum mechanics. There will also be a brief discussion of Newtonian and statistical mechanics.

Textbooks

There are two required texts, but others may be helpful.

- **Required:** *Introduction to the Relativity Principle* by Barton
- **Required:** *Introduction to Quantum Mechanics* by Griffiths
- **Supplementary:** *Quantum Mechanics* by Scherrer
- **Supplementary:** Notes by Hogg at <http://cosmo.nyu.edu/hogg/sr/>

In addition, some extra reading (from other texts, journal articles, etc) may be assigned.

Topics

In the winter term, we will discuss

- Quantum and Statistical Mechanics
 - Momentum representations
 - Quantum statistics
 - Distribution functions
- Special Relativity
 - Relativity in Newtonian mechanics
 - Rotations
 - Einsteinian relativity principle
 - Lorentz transformations & invariants
 - 4-Vectors & the metric
 - 4-velocity
 - Relativistic momentum & energy
 - Particle collisions
 - Doppler effect

Not all topics above will be covered equally. Also, some topics may be skipped, added, or substituted due to time constraints.

Teaching Outcomes: At the end of the term, you should have gained a conceptual understanding of the topics listed above. You should be able to calculate with quantum distributions, change reference frames (including in 4-vector notation), calculate invariants, and solve for energy and momentum conservation in special relativity. In addition, you will learn approximation techniques from the assignments.

REVISED Assignment Policies

Homework: In the winter term, assignments will be posted on the course web page (see above) in PDF format approximately once per week, and you will be notified in class. They will **NOT** be handed out in class, so you must notify the instructor if you cannot access the assignments! The assignment will then be

due by 10:59PM at the labeled drop box outside office 2L26 on the due date (the due date will be listed on the web page and the assignment). Make sure to label assignments with your name and “QMI.” Alternately, you may email typed or scanned (*not photographed*) assignments to the instructor. Homework solutions will be posted on the course web page as soon as possible after the homework is due. Collaboration on the problems is allowed, but each student must write up the solutions independently. Late assignments will **not** be accepted without prior permission from the instructor.

Exams: No electronic equipment is allowed during either in-class tests or the final exam, except at the discretion of the instructor. Students should be prepared to present identification at tests and exams.

Religious Holidays: You may choose not to attend class or write tests/examinations on holy days of your religion, but you must notify me at least two weeks in advance. If so, I will provide the opportunity to make up work without penalty. A non-exhaustive list of religious holidays is available in the academic calendar.

Organization: Your homework and exam solutions should be written (or typed) neatly with steps explained *as if you were writing a research paper or lab report*. Not all algebra need be shown if the steps are explained in words; however, showing your work may improve your credit if you make a mistake. Homework that is not neatly organized and written will not be graded and will be given **zero credit** (one warning will be allowed). In addition, multiple pages must be stapled together.

Evaluation

Grades: Grades will consist of the following components:

- Homework Assignments: 30%
- Fall In-Class Test: 10%
- December Exam: 25%
- Winter In-Class Test: 10%
- Final Exam: 25%

Guidelines for the assignment of numerical percentage grades to letter grades are as follows:

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| • A+ = 95-100% | • B+ = 74-79% | • C = 53-60% |
| • A = 87-94% | • B = 67-73% | • D = 50-52% |
| • A- = 80-86% | • C+ = 61-66% | • F = 0-49% |

Note that these are guidelines. Final grades shall be approved by the Department Review Committee and may be subject to change.

Appeals and Misconduct: See the **Regulations and Policies** section of the **Academic Calendar** (<https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf>) regarding appeals and academic misconduct. Note that use of solutions from other courses, previous years, or from the textbook publisher will be considered cheating; uploading course work to file-sharing sites for the use of other students may be considered misconduct as aiding plagiarism. Students facing a charge of academic or non-academic misconduct may choose to contact the University of Winnipeg Students’ Association (UWSA) where a student advocate will be available to answer any questions about the process, help with building a case, and ensuring students have access to support. For more information or to schedule an appointment, visit our website at <http://www.theuwsa.ca/academic-advocacy> or call 204-786-9780.

Exam & Other Important Dates: Dates to note for winter include

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| • First Lecture: Jan 5, 2018 | • Last Regular Lecture: April 4, 2018 |
| • Voluntary Withdrawal Date: Feb 14, 2018 | • Make-Up Day: April 5, 2018 |
| • In-Class Test: mid-Feb, 2018 (TBA) | • Final Exam: April 11, 2018, 9:00AM |
| • Reading Week: Feb 18-24, 2018 | room 3M65 (subject to university scheduling) |
| • University Closed: March 30, 2018 | |

Miscellaneous

Emails: I may at times need to communicate with the class as a whole via email, which will be through your official university email address. Please check that account.

Accessibility Services: Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 204-786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential. <http://www.uwinnipeg.ca/accessibility>.

Respectful Working and Learning Environment Policy: All students, faculty, and staff have the right to participate, learn and work in an environment that is free of harassment and discrimination. The UW Respectful Working and Learning Environment Policy may be found online at www.uwinnipeg.ca/respect.

Copyright: Course materials are owned by the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the same class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also obtain instructor/presenter permission before photographing or recording slides, presentations, lectures, and notes on the board.