

Univ. of Winnipeg Dept. of Physics
Fall/Winter 2014-15

PHYS-3301 Quantum Mechanics I

Lecture Times: MWF 10:30-11:20AM

Room: 3M64

Instructor: Fall– Dr. Andrew Frey; Winter – Dr. Melanie Martin

E-mail: a.frey, m.martin@uwinnipeg.ca

Office: AF – 2L26; MM – 3L21

Office Phone: AF – 786-9215; MM – 786-9442

WWW: Fall – <http://ion.uwinnipeg.ca/~afrey/FW1314/qm1/>

Winter – none

Office Hours: AF – W 4-5PM or by appt (Fall only)

MM – TBA (Winter only)

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:** *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

We will discuss

- Newtonian and Statistical Mechanics
 - Galilean Relativity & Rotations
 - Particle Distribution Functions
- Special Relativity
 - Einsteinian Relativity Principle
 - Lorentz Transformations & Invariants
 - 4-Vectors & The Metric
 - Relativistic Momentum & Energy
 - Particle Collisions
 - Doppler Effect
- Quantum Mechanics
 - Historical Beginnings of QM
 - Linear Algebra
 - Schrödinger Equation
 - One-Dimensional Quantum Mechanics
 - Three-Dimensional Quantum Mechanics
 - * Angular Momentum
 - * Hydrogen Atom

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

Assignment Policies

Homework: In the **fall 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 one week later by 11:59PM at the labeled drop box outside office 2L26 (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. **You will receive an updated course outline in January explaining Winter term assignment distribution and deadline requirements.** 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.

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: 28%
- December Exam: 30%
- February In-Class Test: 12%
- Final Exam: 30%

Appeals and Misconduct: See the **Regulations and Policies** section of the **Academic Calendar** regarding appeals and academic misconduct. Note that use of solutions from other courses, previous years, or from the textbook publisher will be considered cheating.

Exam & Other Important Dates: Dates to note include

- Thanksgiving Day Holiday: Oct 13, 2014
- December Exam: Dec 11, 2014, 9:00AM
(subject to university scheduling)
- Voluntary Withdrawal Date: Jan 21, 2015
- February In-Class Test: Feb 11, 2015
- Reading Week: Feb 16-21, 2015
- Final Exam: April 21, 2015, 9:00AM
(subject to university scheduling)

Miscellaneous

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 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>.

Students who plan to conduct research interviews, focus groups, surveys, or any other method of collecting data from any person, even a family member, must obtain the approval of the appropriate ethics committee before commencing data collection. Exceptions are research activities in class as a learning exercise. See <http://www.uwinnipeg.ca/research/human-ethics.html> for submission requirements and deadlines.

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.

UWinnipeg promotes a scent-free environment. Please be respectful of the needs of classmates and the instructor by avoiding the use of scented products while attending lectures. Exposure to perfumes and other scented products (such as lotion) can trigger serious health reactions in persons with asthma, allergies, migraines or chemical sensitivities.