University of Victoria
Department of Physics and Astronomy

# Physics 323 - Quantum Mechanics I

Summer 2017 Syllabus

## General Information

**Instructor:** Travis Martin
**Email:** travismartin@uvic.ca
**Office:** Elliot 402B
**Office Hours:** Monday, Tuesday & Wednesday, 4:00-5:00pm
**Office Phone:** 250-721-6127
**Course Webpage:** http://coursespaces.uvic.ca

**Lecture Schedule:**

Monday and Thursday from 10:00am - 11:20pm in **David Strong C130**.

**Prerequisites:**

PHYS215, PHYS216, MATH204. The course is structured assuming you are taking MATH342 at the same time as PHYS323, thus MATH342 is either a pre-requisite or co-requisite course.

**Required Materials:**

Textbook: *Quantum Mechanics* by McIntyre - we will be using this textbook primarily for this course.

McIntyre does a good job of balancing formalism with approachability. If students would prefer to get a copy of Griffiths's *Introduction to Quantum Mechanics*, this would be fine and you will likely be able to keep up with the material. Griffiths has less formalism and does not explore topics in as much detail as I would prefer. For advanced students, I recommend a copy of *Modern Quantum Mechanics* by Sakurai. It is an excellent textbook aimed at an advanced audience that bridges the gap between undergraduate and graduate quantum mechanics.

**Labs:**

The lab schedule can be found at `http://www.uvic.ca/science/physics/current/undergraduate/timetables/index.php`.

Some notes regarding the labs for this course:

- **You must complete all labs to pass the course.**
- **You must achieve a passing grade in the labs in order to pass the course.**

## Course Overview

The end goal of this course is to provide all of the necessary tools and methods for understanding the full quantum mechanical hydrogen wavefunction. A rough outline of the course is below. Since this is my first time teaching this course, the order of the material is left approximate.

1. Review
    (a) Quantized Systems
    (b) Waves on a String
    (c) Bohr Model of Hydrogen
2. Particle waves and Quantum Formalism
    (a) Shroedinger's Equation
    (b) Statistical Interpretation
    (c) Linear Algebra
    (d) Bra-ket Notation
    (e) Stern-Gerlach Experiment - practice with Bra-ket
    (f) Connecting Bra-ket with Vectors
    (g) Operators and Observables
    (h) The Uncertainty Principle

    **MIDTERM** - TBD somewhere within the Quantized Energies section
3. Quantized Energies
    (a) Energy Eigenfunction Equation & Time Evolution of Energy Eigenstates
    (b) Energy in Spin States
    (c) Infinite Square Well & Finite Square Well
    (d) Harmonic Oscillator
    (e) Scattering & Tunneling
4. Spin and Angular Momentum
    (a) Angular Momentum
    (b) Spin
    (c) Combined/Mixed States & Clebsch-Gordon Coefficients
5. Hydrogen Atom
    (a) Shroedinger's Equation in Spherical Coordinates
    (b) Radial Equation
    (c) Angular Equation
6. Quantum Peculiarities
    (a) Einstein-Podolsky-Rosen Paradox
    (b) Shroedinger's Cat Paradox

    **FINAL EXAM**

## Grading

Below is an approximate weighting of the material in the course. At the end of the semester, grades will be examined and may be adjusted upwards to reflect any disparity between the actual and the intended difficulty of the material.

**Assignments:** 25%

Approximately each week there will be an assignment on the material discussed since the previous assignment. Assignments will be due at the start of class on the provided due date (generally Mondays). Late assignments will not be accepted without sufficient reason and approval from the instructor.

Assignment Policy: You are ALLOWED to collaborate on assignments, so long as your work and your solutions are your own. I take a very strict stance on copying and academic infringement, but I do understand the value in collaborative work. Discussing with a friend is no different from discussing with a professor, except it will likely help your friend learn the material better (teaching someone is the best way to learn material).

**Laboratory Activities:** 15%

This class comes with labs, for logistical rather than pedagogical reasons. Note that it is a departmental policy that you have to pass the labs in order to pass the course.

**Midterm Exam:** 20%

The midterm is designed to encourage students to summarize their knowledge of the material in the first half of the course - namely, the quantum formalism and linear algebra. The midterm will be held in-class at a date that will be determined near the end of September (approximate date of exam will mid-October).

**Final Exam:** 40%

The final exam will be comprehensive in that it will require knowledge of all of the material of the course. However, the exam will focus primarily on the material after the midterm, while the pre-midterm material will be necessary tools/techniques in order to solve the problems of the final exam.

**Accommodations:**

Accommodations can be made for missed exams/assignments due to illness or other severe affliction, as well as conflicts with classes and religious observances. Accommodations will also be made for issues documented through RCSD.

If you miss an exam or assignment, I expect you to contact me as soon as possible. If you anticipate missing a course requirement, you must contact me a reasonable time in advance. If an emergency occurs during a test, please talk to me. I can't help if I don't know about the problem.

## University Regulations on Academic Integrity

These regulations are reproduced from `http://web.uvic.ca/calendar2011/FACS/UnIn/UARe/PoAcI.html`. For full information, including procedures for dealing with academic integrity infringement, see the webpage linked above.

Academic integrity requires commitment to the values of honesty, trust, fairness, respect, and responsibility. Any action that contravenes this standard, including misrepresentation, falsification or deception, undermines the intention and worth of scholarly work and violates the fundamental academic rights of members of our community.

Several types of academic integrity violations are covered in brief below.

### Plagiarism

A student commits plagiarism when he or she:

- submits the work of another person as original work
- gives inadequate attribution to an author or creator whose work is incorporated into the student's work, including failing to indicate clearly the inclusion of another individual's work
- paraphrases material from a source without sufficient acknowledgement as described above

Students who are in doubt as to what constitutes plagiarism in a particular instance should consult their course instructor.

### Falsifying Material Subject to Academic Evaluation

Falsifying materials subject to academic evaluation includes, but is not limited to:

- fraudulently manipulating laboratory processes, electronic data or research data in order to achieve desired results
- using work prepared by someone else (e.g., commercially prepared essays) and submitting it as one's own
- citing a source from which material was not obtained
- using a quoted reference from a non-original source while implying reference to the original source
- submitting false records, information or data, in writing or orally

### Cheating on Assignments, Tests/Quizzes and Examinations

Cheating includes, but is not limited to:

- copying the answers or other work of another person
- sharing information or answers when doing take-home assignments, tests and examinations except where the instructor has authorized collaborative work
- having in an examination or test any materials or equipment other than those authorized by the examiners impersonating a candidate on an examination or test, or being assigned the results of such impersonation
- *assisting others to engage in conduct that is considered cheating*