

# CHM 1478H: Quantum Mechanics for Physical Chemists

## Course Syllabus Fall 2024

### I CONTACTS

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#### INSTRUCTOR

*Name:* Paul Brumer

*Email:* paul.brumer@utoronto.ca

*Office:* Lash Miller, Room 421B

*Classes:* Time to be determined in an organizational meeting. Classes will be in hybrid mode – i.e., we will determine whether in-class or via zoom is performed. If the lectures will be delivered via zoom, they will be recorded and posted on Quercus.

#### TEACHING ASSISTANTS

There are no tutorials or TA's for this class. We will discuss approaches to interactions between class participants during the first lecture.

### II COURSE OVERVIEW

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#### COURSE DESCRIPTION:

**Classes** a systematic approach to formal quantum mechanics. Introduction of modern developments.

#### STUDENT LEARNING OUTCOMES:

By the end of this course, students will have learned:

- Fundamental quantum mechanics formulated in Hilbert space. This includes representation theory, principles of symmetry, the interrelationship between Heisenberg and Schrödinger pictures, an introduction to density matrices. Conceptual issues in measurement theory, entanglement, etc.

#### BACKGROUND PREPARATION:

CHM 326H. Also, a background knowledge in linear algebra, e.g., MAT 223H and MAT 224H would be helpful.

#### READINGS:

Required: *Quantum Mechanics* by Albert Messiah, Dover Publications.

### III HOW THE COURSE IS ORGANIZED

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Lecture notes will be posted on Quercus and used as the basis for detailed discussion during the course lectures. Students will need to have access to the notes during the lectures.

Homework problems will be assigned as necessary and will be graded.

The following is a *rough* schedule:

Lectures will cover material in Messiah's book Chapters V, VII, VIII, but with assorted perspectives introduced during the lectures. Modern Topics such as decoherence and entanglement will be addressed as well

## IV EVALUATION/GRADING SCHEME

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- Biweekly problem sets: worth 40% of final mark
- Term paper: worth 30% of final mark. Due prior to final assessment period. Content to be discussed during lecture hours.
- Final assessment: to be held during final assessment period worth 30% of final mark.

**Note:** if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the assessments.

**Note:** Use of generative AI tools such as ChatGPT is not permitted for any of these assignments.

## V COURSE POLICIES

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- The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.
- All work for the course must be submitted using Quercus.
- Normal University procedures should be followed to signal course absences and request make-up tests or exemptions from exams.

## VI TECHNOLOGY REQUIREMENTS

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This course requires the use of computers, and of course sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own computer), and schedule enough time when completing an assignment to allow for delays due to technical difficulties. Computer viruses crashed hard drives, broken printers, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension.

## VII INSTITUTIONAL POLICIES AND SUPPORT

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### ACADEMIC INTEGRITY

#### **On Academic Integrity:**

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <https://www.academicintegrity.utoronto.ca/>).

### COPYRIGHT

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session.

Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Do not

download, copy, or share any course or student materials or videos without the explicit permission of the instructor.

### **ACCESSIBILITY NEEDS**

Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact [Accessibility Services](#) as soon as possible.

### **ADDITIONAL SERVICES and SUPPORT**

The following are some important links to help you with academic and/or technical service and support

- General student services and resources at [Student Life](#)
- Full library service through [University of Toronto Libraries](#)
- Resources on conducting online research through [University Libraries Research](#)
- Resources on academic support from the [Academic Success Centre](#)
- Learner support at the [Writing Centre](#)
- Information for [Technical Support/Quercus Support](#)

### **ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES**

Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations

### **ACKNOWLEDGEMENT OF TRADITIONAL LANDS**

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

