# PHYS 234: Introduction to Quantum Mechanics

**Winter 2026 Course Outline**

## Course Description

This course provides a comprehensive introduction to the fundamentals of quantum mechanics, focusing on the core principles and mathematical formalism necessary to analyze modern physical systems. Based on *Quantum Mechanics: A Paradigms Approach* by David H. McIntyre, we will begin with the inherently quantum nature of spin systems before transitioning to wave mechanics and the rigorous analysis of canonical problems, including the harmonic oscillator and the hydrogen atom. The course culminates in an introduction to advanced topics such as perturbation theory and the behaviour of identical particles.

**Prerequisites:** Familiarity with linear algebra and intermediate modern physics is assumed.

## Textbook

- **Quantum Mechanics: A Paradigms Approach** by David H. McIntyre (Required)

## Schedule (12 Weeks)

| Week | Date | Topic | Assessment / Key Focus |
|---|---|---|---|
| 1 | Jan 8 | **Foundations: Spin-1/2** (Ch 1) | Kets, Bras, Postulates, Stern-Gerlach Experiments |
| 2 | Jan 15 | **Operators and Formalism** (Ch 2) | Operators, Eigenvalues, Eigenvectors, Matrix Mechanics |
| 3 | Jan 22 | **Dynamics I** (Ch 3) | Schrödinger Equation, Spin Precession, Rabi Oscillations |
| 4 | Jan 29 | **1D Wave Mechanics** (Ch 5) | Wave Functions, Infinite and Finite Square Wells |
| 5 | Feb 5 | **Unbound States & Uncertainty** (Ch 6, Ch 4) | Free Particle, Wave Packets, Heisenberg Principle, Quantum Spookiness (Self-study/Review) |
| 6 | Feb 12 | **Angular Momentum I** (Ch 7) | Angular Momentum Operators, Particle on a Ring/Sphere |

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|---|---|---|---|
| 7 | Feb 19 | **Hydrogen Atom** (Ch 8) | Radial Equation, Energy Levels (Bohr Energies), Full Wave Functions |
| 8 | Feb 26 | **MIDTERM EXAMINATION #1** | Covers Weeks 1–5 (Ch 1, 2, 3, 5, 6, 4) |
| 9 | Mar 4 | **Harmonic Oscillator** (Ch 9) | Operator Method (Ladder Operators), Wave Functions, Expectation Values |
| 10 | Mar 11 | **Perturbation Theory** (Ch 10) | Nondegenerate and Degenerate Perturbation Theory |
| 11 | Mar 18 | **Addition of Angular Momenta** (Ch 11) | Hyperfine Structure, Coupled vs. Uncoupled Bases |
| 12 | Mar 25 | **Identical Particles** (Ch 13) | Symmetrization Postulate, Bosons, Fermions, Pauli Principle |
| — | Apr (Finals Week) | **FINAL EXAMINATION** | Comprehensive |

## Assessments and Grading

The course grade is based entirely on examinations. There are no weekly assignments.

| Component | Default Weight | Contingent Weight | Coverage |
|---|---|---|---|
| Midterm Examination 1 (M1) | **40%** | **40%** | Weeks 1–5 |
| Midterm Examination 2 (M2) | 20% | 10% | Weeks 7–11 (Non-cumulative, but uses previous material) |
| Final Examination (F) | 40% | 50% | Comprehensive (Weeks 1–12) |

**Contingency Grading Rule:**
If a student's percentage score on the Final Examination (**F**) is higher than their percentage score on Midterm Examination 2 (**M2**), the weighting will shift as follows:

- M2 drops to **10%**.
- F increases to **50%**.
- M1 remains fixed at **40%**.

### *Mandatory Withdrawal Policy (INC Policy)*

**Failure to achieve a passing grade (50% or higher) on Midterm Examination 1 will result in an automatic requirement to withdraw from the course.**

- Students who score below 50% on M1 will be assigned a final grade of **INC** (Incomplete/Required Withdrawal).
- The high weighting and mandatory pass criterion for M1 reflect the foundational nature of the early course material (Dirac notation, operators, and basic postulates), which is essential for success in later weeks.

## Asking Questions

The primary platform for course questions and discussion will be the **Piazza forum**. Teaching assistants will monitor the forum regularly. Remote office hours with the lecturer or TAs may be scheduled by appointment.

## Exams and Time Limit

The final examination will be comprehensive, covering material from all 12 weeks, and will be scheduled by the Office of the Registrar.

**Final Exam Details (Example Placeholder):**

- **Date:** Sunday, April 18, 2024
- **Time:** 4:00 PM – 6:30 PM (2.5 hours to finish the exam)
- **Submission Window:** Access will be provided via Crowdmark/LEARN at 3:45 PM. Answers must be submitted via Crowdmark by **6:45 PM** (15 minutes after the examination ends).

## Academic Policies (Abbreviated)

**Academic Integrity:** Students are expected to maintain the highest standards of academic honesty. Any submitted work suspected of academic misconduct will be reported to the Faculty Integrity Officer.

**Collaboration and Internet Usage:** Discussions about course material are encouraged, but solutions to examinations must be entirely your own work. The direct use or consultation of solutions from previous course offerings or external online sources (e.g., Chegg) during examinations is strictly forbidden.

**Grievance and Discipline:** Students seeking a formal grievance or appeal related to a decision affecting them should refer to University Policies 70, 71, and 72.

**Students with Disabilities:** Students requiring academic accommodations should register with the university's AccessAbility Services at the beginning of the academic term.