



Phys 451: Introduction to Quantum Mechanics

University of Mississippi

"In quantum mechanics, one can know everything about a system and nothing about its individual parts" Leonard Susskind, physicist.

Instructor: Cecille Labuda, Associate Professor of Physics
Class time/location: MWF 09:00 – 09:50, Lewis 109
Office hours: M 03:30 – 04:30, ThF 02:30 – 04:30 and by appointment

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Syllabus version 3: 08/15/2022

Books

[Griffiths and Schroeter. Introduction to Quantum Mechanics 3rd Edition. Cambridge University Press. ISBN: 978-1107189638.](#)

Description

An introduction to nonrelativistic quantum mechanics, the Schrodinger equation and its application to simple physical systems.

Prerequisites

Math 353. Phys 308, Phys 318.

Course Objectives

On completion of this course, students should be able to:

- Solve Schrodinger's equation for various quantum physical systems and determine the behaviour of the systems
- Describe various interpretations of quantum mechanics

Grading Scale

Plus-minus grades may be assigned if they benefit the student.

- $90\% \leq \mathbf{A} \leq 100\%$
- $80\% \leq \mathbf{B} < 90\%$
- $70\% \leq \mathbf{C} < 80\%$
- $50\% \leq \mathbf{D} < 70\%$
- $\mathbf{F} < 50\%$

Evaluation

Class Exercises and Summaries (5%) [c]

In-class exercises, class summaries and blackboard presentations of problem solutions during class meetings. Graded for completion; no make-ups.

Written exams (45%) [i]

3 closed-book exams weighted as follows:

- 2 exams highest grades: $17.5\% + 17.5\% = 35\%$
- 1 exam lowest grade: 10%

Oral exam [5%][i]

A short list of fundamental quantum mechanics systems will be given. Students will be asked to present one of the problems on the list, selected by the instructor, on the board. Questions will be asked after the presentation.

Homework (20%) [c]. Note that the homework grade will only count if the exam average is $>50\%$. *Otherwise the homework grade will be computed as zero.*

- Homework sets must be turned in at the beginning of class when due. [c]
- Students are encouraged to work together to solve the homework problems. However, students may not copy homework solutions, in particular, from each other, from solutions manuals or from any source whatsoever. Copied homework will be given a grade of zero.
- Homework solutions must be presented according to the homework rubric or it may not be graded.

Final exam (25%) [i]

- The final exam will be comprehensive. The format will be similar to the tests.

Examination Dates

Test dates and topics are subject to change. The final exam date is fixed and cannot be changed.

Test 1: 09/19

Test 2: 10/17

Test 3: 11/14

Final Exam: Wednesday December 07, 08:00 am.

Policies

Attendance

Class attendance is **required**. If a student is absent for more than 3 classes during the semester, the final calculated grade will be **reduced by a letter grade** at the time grades are officially assigned. If you must be absent for exams, you must speak to me before the exam to determine whether the absence will be excused and whether the exam will be rescheduled. For unexpected exam absences, you must contact me by email or telephone within 24 hours after the absence or the exam will not be rescheduled.

Allowances will be made for non-attendance due to covid-19 health concerns or other circumstances deemed to be reasonable by the instructor.

If you need to isolate due to contracting COVID-19 at any point this semester, you must do so, and email me as soon as possible. I will work with you to help you continue your progress in the course. In your email, state how long you expect not to attend class. I will not provide recordings of class sessions, however, we can work together to establish a plan for completing the necessary work. You will have access to your texts, my course content, and our Blackboard course site. More information on isolation protocols can be found at <https://healthcenter.olemiss.edu/covid-19-faqs/>. Follow the most up-to-date guidance from the CDC:

<https://www.cdc.gov/coronavirus/2019-ncov/your-health/isolation.html>.

Quarantines are an important tool for controlling the spread of the virus. More information on quarantine protocols can be found at

<https://www.cdc.gov/coronavirus/2019-ncov/your-health/if-you-were-exposed.html>.

Academic Integrity

By choosing to be part of the University of Mississippi community, every student agrees to abide by the University of Mississippi Creed and the UM Academic Integrity Policy. Cheating is forbidden and, in this course, will result in a zero grade on the given assignment. If a second case of cheating occurs, this will result in an F for the entire course.

Unless explicitly permitted by the instructor, distribution of materials provided in this class via the internet or otherwise. Accessing such materials for your own use is also in violation of the UM Academic Conduct Code. Additionally, the distribution of your own class notes is strongly discouraged except for occasional loaning of notes to students also enrolled in the class.

University of Mississippi Access and Inclusion

The University of Mississippi is committed to the creation of inclusive learning environments for all students. If there are aspects of the instruction or design of this course that result in barriers to your full inclusion and participation or to accurate assessment of your achievement, please contact the course instructor as soon as possible. Students should also contact Student Disability Services at 662-915-7128 so that office can 1) provide you with an Instructor Notification form, 2) facilitate the removal of barriers and 3) ensure you have equal access to the same opportunities for success that are available to all students.

Audio and video recording

Audio and/or video recording of class lectures is not allowed unless explicit permission is given by the instructor. Permitted recordings may not be distributed online or elsewhere and all must be deleted at the end of the semester.

Important Dates

Please see the UM academic calendar (<https://registrar.olemiss.edu/fall-2022/>)

[c] – collaborative

[i] - individual

Schedule of Topics (subject to change; updated 08/15/2022)

Week	Topic	Textbook Sections
01: 08/22 – 08/26	Schrödinger's equation, the wave function, normalization	Ch 1
02: 08/29 – 09/02	Normalization, expectation values, the time-dependent wave function	Ch 1, Ch 2
03: 09/05 – 09/09	The time-independent wave function, infinite square well potential	Ch 2
04: 09/12 – 09/16	The infinite square well potential	Ch 2
05: 09/19 – 09/23	Harmonic oscillator potential 09/19: TEST 1	Ch 2
06: 09/26 – 09/30	Harmonic oscillator potential, free particle potential	Ch 2
07: 10/03 – 10/07	Free particle potential, delta function potential, finite square well potential	Ch 2
08: 10/10 – 10/14	Finite square well potential, Hilbert space, Hermitian operators	Ch 2, 3
09: 10/17 – 10/21	Generalized statistical interpretation, uncertainty principle 10/17: TEST 2	Ch 3
10: 10/24 – 10/28	Dirac notation, Schrödinger's equation in 3D	Ch 4
11: 10/31 – 11/04	Angular equation, radial equation, hydrogen atom Oral Exam (scheduled out of class period)	Ch 4
12: 11/07 – 11/11	Hydrogen atom	Ch 4
13: 11/14 – 11/18	Angular momentum 11/14: TEST 3	Ch 4
14: 11/21 – 11/25	THANKSGIVING BREAK	
15: 11/28 – 12/02	Interpretations of quantum mechanics; Entanglement	