



Lahore University of Management Sciences

PHY517 – Quantum Mechanics Fall 2023

To understand how to navigate course outlines, consult: How to Use a Course Outline (<http://surl.li/gpvuw>)

Instructor	Muhammad Shahbaz
Room No.	
Office Hours	TBA
Email	
Telephone	
Secretary/TA	
TA Office Hours	TBA
Course URL (if any)	
Support Services	LUMS offers a range of academic and other services to support students. These are mentioned below, and you are encouraged to use these in addition to in-class assistance from course staff. For a complete list of campus support services available for you click here (https://advising.lums.edu.pk/#supportservices)

Course Teaching Methodology (Please mention following details in plain text)

- **Teaching Methodology:** In-person
- **Lecture details:** In-person

Course Basics

Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75 mins
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	TBA	Duration	TBA
Tutorial (per week)	Nbr of Lec(s) Per Week	1	Duration	60 mins

Course Distribution

Core	MS Physics
Elective	SSE PhD
Open for Student Category	Graduate



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Close for Student
Category

Undergrade

COURSE DESCRIPTION

Discovered at the dawn of 20th century, Quantum theory, challenged not only our conception of reality and the material world around us but revolutionized the world of science and technology from semiconductor electronics to the emergent field of quantum computing.

Understanding the basic principles of quantum theory and the application of those principles to simple model problems and more realistic problems is the main objective of this course.

COURSE PREREQUISITE(S)

- Quantum Mechanics - II for undergraduates
- Non for graduates

COURSE OBJECTIVES

- This course is offered as a refresher to make up for any weaknesses left in the earlier training of students in quantum mechanics.
- Reinforcing the understanding of conceptual foundations of quantum mechanics with its application to more realistic and
- relatively complex problems is the main objective.

Learning Outcomes

- 1. Introduction to the mathematical formalism and language of quantum mechanics.
- 2. Learning postulates of quantum mechanics and their implications.
- 3. Application of the principles of quantum mechanics to model problems.
- 4. Application of the principles of quantum mechanics to real problems.
- 5. Introduction to approximate methods.
- 6. Learning about a modern technological application of quantum mechanics

Grading break up: Component Details and weightages



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Assignment(s):

Home Work: **20%**

Quiz(es), Class Participation, Attendance: **20%**

Midterm Examination: **20%**

Project:

Final Examination: **40%**

The grading breakup is subject to change if the teaching shifts to online modality.

Examination Detail

Midterm Exam	Yes/No: Yes Combine Separate: Duration: class duration Preferred Date: Exam Specifications:
Final Exam	Yes/No: Yes Combine Separate: Duration: 3 hours Exam Specifications:

COURSE OVERVIEW

Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
1-2	<ul style="list-style-type: none">- Introduction to basic formalism, linearity, operators, expectation values, wavefunctions, Dirac notation- the postulates of quantum mechanics- Time-dependent and time-independent Schrodinger wave equations.		CL1, CL2



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3	- One dimensional problems (particle in an infinite square potential well and free particle)		CL3
4	- Simple harmonic oscillator (analytical and algebraic approach)		CL3, CL4
5-6	- Particle in Coulomb potential (Hydrogen atom) - Fine structure, hyperfine structure		CL4
7	- Angular momentum and spin		CL4
8	- Time-independent perturbation theory		CL5
9	- Time-dependent perturbation theory		CL5
10	- Identical particles		CL1,CL2
11-12	- Band Structure		CL4
13	- Introduction to quantum computing (if time permits)		CL6

Textbook(s)/Supplementary Readings

There is no single textbook. In addition to lecture notes the following texts are a useful supplementary resource.

- Introduction to Quantum Mechanics by R. J. Griffiths
- Quantum Mechanics by N. Zettili
- A Modern Approach to Quantum Mechanics by J. S. Townsend

Campus supports & Key university policies

Campus Supports

Students are strongly encouraged to meet course instructors and TA's during office hours for assistance in course-content, understand the course's expectations from enrolled students, etc. Beyond the course, students are also encouraged to use a variety of other resources. (Instructors are also encouraged to refer students to these resources when needed.) These resources include Counseling and Psychological Services/CAPS (for mental health), LUMS Medical Center/LMC (for physical health), Office of Accessibility & Inclusion/ OAI (for long-term disabilities), advising staff dedicated to supporting and guiding students in each school, online resources (<https://advising.lums.edu.pk/advising-resources>), etc. To view all support services, their specific role as well as contact information click [here](https://advising.lums.edu.pk/#supportservices) (<https://advising.lums.edu.pk/#supportservices>).

Academic Honesty/Plagiarism



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LUMS has zero tolerance for academic dishonesty. Students are responsible for upholding academic integrity. If unsure, refer to the student handbook and consult with instructors/teaching assistants. To check for plagiarism before essay submission, use similarity@lums.edu.pk. Consult the following resources: 1) Academic and Intellectual Integrity (<http://surl.li/gpvwb>), and 2) Understanding and Avoiding Plagiarism (<http://surl.li/gpvwo>).

LUMS Academic Accommodations/ Petitions policy

Long-term medical conditions are accommodated through the Office of Accessibility & Inclusion (OAI). Short-term emergencies that impact studies are either handled by the course instructor or Student Support Services (SSS). For more information, please see Missed Instrument or 'Petition' FAQs for students and faculty (<https://rb.gy/8sj1h>)

LUMS Sexual Harassment Policy

LUMS and this class are a harassment-free zone. No behavior that makes someone uncomfortable or negatively impacts the class or individual's potential will be tolerated.

To report sexual harassment experienced or observed in class, please contact me. For further support or to file a complaint, contact OAI at oai@lums.edu.pk or harassment@lums.edu.pk. You may choose to file an informal or formal complaint to put an end to the offending behavior. You can also call their Anti-Harassment helpline at 042-35608877 for advice or concerns. *For more information: Harassment, Bullying & Other Interpersonal Misconduct: Presentation* (<http://surl.li/gpvwt>)