

# Syllabus for Physics 5393

## Graduate Quantum Mechanics I

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Instructor:	P. Gutierrez	Office:	NH 339
Phone:	325-3961 ext. 36205	email:	Use Canvas email facility
Lecture:	9:00 to 10:15 MW in NH 203	Office Hours:	Mon. Tues. 1:30 to 3:00 PM
Course Information:	<a href="http://CANVAS.OU.EDU">HTTP://CANVAS.OU.EDU</a>		Anytime I'm in the office

☐ Texts:

- ◇ Modern Quantum Mechanics 2<sup>nd</sup> Edition      *J.J. Sakurai, et al.*

☐ References—*can be found in the physics library*

- ◇ Principles of Quantum Mechanics      *R. Shankar*  
◇ Quantum Mechanics      *C. Cohen-Tannoudji et al.*  
◇ Lectures on Quantum Mechanics      *S. Weinberg*  
◇ Lectures on Quantum Mechanics      *G. Baym*

☐ Grading (*Tentative*):

- ◇ Homework      20%.  
◇ Three Exams      20%. (*each exam*)  
◇ Final Exam      20%.  
◇ The current university regulations concerning incomplete (I) grades and dropping of courses will be strictly followed.

☐ Homework:

- ◇ The goal of the homework is to expand on the material covered in lecture and to serve as a test of your understanding of the material. Feel free to work on the homework with your fellow classmates, but remember that you will only get out as much from the homework as you put in. Do not copy solutions from internet websites. That is consider plagiarism and you will receive no credit for the assignment. As a policy I do not accept late homework, but if you have a valid reason such as illness, please notify me as soon as possible.

Homework will be assigned every week. The assignment will be posted on Canvas by Tuesday morning at 9:00 AM and will be due the following Monday by 5:00 PM, in my mailbox Solutions to the homework problems will be posted on Canvas.

The solutions you hand in must be neat, clear, and complete; *never submit “scratch work”*. You are responsible for preparing solutions that contain enough detail that we can figure out what you were doing and why; we cannot read your mind. Provide sufficient discussion to clarify your thinking about the problem. A well-presented solution will ensure maximum partial credit even if your answer is wrong. A poorly presented solution without discussion will ensure almost no credit even if your answer is right. Homework that fails to meet these criteria will be returned ungraded and will receive no credit.

☐ Tentative Exam Schedule (NH 203)

- ◇ Exam I      Fri. Sept. 24      1:00 to 3:00 PM  
◇ Exam II      Fri. Oct. 22      1:00 to 3:00 PM  
◇ Exam III      Mon. Nov. 22      3:00 to 5:00 PM  
◇ Final Exam      Tues. Dec. 14      8:00 to 10:00 AM

□ Prerequisites

- ◇ Physics 3803 & 4803, undergraduate quantum mechanics I & II, in addition to all their prerequisites.  
This semester requires an understanding of the material in, for example, Griffiths chapters 1 through 4.

□ Tentative Course Outline

- ◇ The goal is to develop the mathematical foundations of quantum mechanics.
  - The mathematical foundations:
    - ▷ Dirac notation, quantum states, and observables.
    - ▷ Hilbert space.
    - ▷ Representations.
  - Quantum dynamics:
    - ▷ Time evolution and the Schrödinger equation.
    - ▷ The Schrödinger and Heisenberg representations.
    - ▷ Solutions of the Schrödinger equation.
    - ▷ Feynman path integrals.
    - ▷ Potentials and gauge transformations.
  - Angular momentum:
    - ▷ Rotations and angular momentum.
    - ▷ Spin 1/2 systems and finite rotations.
    - ▷  $SO(3)$ ,  $SU(2)$ , and Euler rotations.
    - ▷ Orbital angular momentum and the Schrödinger central force problem.
    - ▷ Addition of angular momentum.
  - Symmetries and group theory:
    - ▷ Symmetries, conservation laws, and degeneracies.
    - ▷ Discrete symmetries.

□ Special Notice

- ◇ *Any student in this course who has a disability that may prevent him or her from fully demonstrating her or his abilities should contact me as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.*