Syllabus

Objectives: To learn the fundamentals of quantum mechanics − the basic postulates of Quantum Mechanics, matrix and wave mechanics, theory of spin and orbital angular momentum, time evolution, density operator, role of symmetry in quantum mechanics.

Learning outcomes: To be able to understand and manipulate the mathematical language of quantum mechanics at a high level expected of a graduate student, to be able to solve typical problems similar to those encountered in the homeworks.

Course Credit: 3 semester hours
Lectures: Tuesday and Thursday, 1:00-2:20pm
Classroom: TBA

Format: A lecture course with weekly problem sets, a midterm exam and a final exam.

Main textbook: J.J. Sakurai, *Modern Quantum Mechanics*, Addison-Wesley, 2010 (2nd Ed.)
(available at the University bookstore). See also next page for other useful textbooks.

Course Instructor

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Homework and Grades

A homework will be assigned each week, due usually at the beginning of class one week later. Homework sets will be distributed in class, and they will also be available in the course's *Canvas* page.

Homework Policy: You are encouraged to discuss the homework problems with your PHYS 521 classmates and with the instructor and the graders, but you must write up your solutions *independently*. Of course, you must not copy from anyone else's solutions.

Late Policy: The grade for late homework will be multiplied by a decaying exponential with a time constant of five days. After 5 days, the homework will not be accepted and you will receive zero point for that homework set. Late homework must be delivered to the grader or the instructor for that problem set and the student must write "Late" and the date and time of submission on the front page.

Grading Weights[1]**:**	Homework:	35%
	Midterm Exam:	25%
	Final Exam:	40%

Any student with a disability requiring accomodations in this class is encouraged to contact the instructor after class. Additionally, students should contact the Disabled Student Services office in the Student Center.

[1] Grading weights are subject to change by the Instructor and the final weight values will be announced before the mid-term exam.

Course Content

I plan to cover mainly Chapters 1 to 4 in the main textbook (Sakurai, see above), with some special topics from later chapters.

1. Fundamentals of QM: Stern-Gerlach experiment, quantum states and Hilbert space, observables and operators, commutation relations and uncertainty rules, pure and mixed states, density operator

2. Quantum Dynamics: Schroedinger, Heisenberg and Interaction pictures, quantization of harmonic oscillator and the creation/annihilation operators, propagators and Feynman path integrals, potential and gauge transformation

3. Approximate methods in QM: variational wavefunctions; perturbation theory (if time allows).

4. Theory of Angular Momentum: rotation and angular momentum operator, commutation relations and the spectrum of angular momentum, spin and SU(2) group, orbital angular momentum and central potential, addition of angular momenta and Clebbsch-Gordan coefficients, tensor and Wigner-Eckart theorem

5. Symmetry in QM

Other useful textbooks

1. R. Shankar, *Principles of Quantum Mechanics*, Springer, 1994 (2nd Ed.)
2. E. Merzbacher, *Quantum Mechanic*s, Wiley, 1997.
3. A. Messiah, *Quantum Mechanics*, Dover, 1999.