

Syllabus

Instructor: Professor Lin Tian

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Lecture time and location: TR 3:00 pm – 4:15 pm, classroom building 286

Discussion/Recitation: R 8:00 am – 8:50 am, classroom building 260

Office hour and location: T 4:15 pm – 5:30 pm, Science and Engineering 226

Classmates to contact: _____

Prerequisites: phys 105 and math 23, 24.

Goal: This course is a core physics course for undergraduate physics majors and covers the basic topics in one of the most fundamental subjects in contemporary physics – quantum mechanics. The goal of this course is to teach basic concepts, theoretical framework, and key experimental phenomena in quantum mechanics, as well as to develop problem solving skills for undergraduate students. The goal will be achieved through the combination of lectures, recitation sessions, problem sets, and exams.

By the end of this course, the students are expected to be able to:

- solve time-independent Schrodinger equations for eigenvalue problems under proper boundary condition
- use and understand the operator representation of quantum mechanics
- apply several techniques such as perturbation theory, WKB approximation and adiabatic approach to study quantum particles under external fields
- understand particle statistics and their effects on many body systems.

Text book: Griffiths, David J. *Introduction to Quantum Mechanics*. 2nd ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2004. (Book store, amazon.com, half.com)

Other reading materials: Shankar, Ramamurti. *Principles of Quantum Mechanics*. 2nd ed. New York, NY: Plenum Press, 1994.

Feynman, R. P. *Feynman Lectures On Physics*. Vol. 3.

Cohen-Tannoudji, Claude. *Quantum Mechanics*. 2 vols. New York, NY: Wiley, 1977.

<http://www.quantumintro.com/>

<http://www.chemistry.ohio-state.edu/betha/qm/>

Course contents: The course includes 14 weeks of lectures and recitation sessions. A list of topics include:

1. Schrodinger equation and probability
2. momentum and uncertainty principle
3. time independent equation and harmonic oscillator
4. free particle and finite square well
5. abstract formalism and measurement
6. uncertainty principle and Dirac notation – midterm exam
7. spherical coordinate and H atoms
8. angular momentum and spin
9. Perturbation theory and Zeeman effect
10. WKB and quantum tunneling
11. Two-level atom and spontaneous emission
12. adiabaticity and AB effect
13. identical particle and periodic table
14. quantum scattering and Born approximation
15. exam week, Thursday, Dec.18th 3 pm – 6 pm (check time and location)

Homework: will be an integrated part of this course. By working on the problem sets, the students will be expected to deepen their understanding of the concepts and techniques from class. It will help the student develop problem solving skills as well.

In this class, I will assign homework problems each Thursday at the end of the lecture. Normally 2–3 problems will be assigned each week. The due date for the problem set will be the Thursday of the following week before class starts. Each problem set will be graded with the full score 100.

Midterm exam and final exam: The midterm exam will be held during the 6th week and homework of that week will be reduced. The final exam will be held during the 15th week according to university schedule.

Grades determination: The grade will be determined based on performance in problem sets, midterm exam and final exam. The percentage of the grades are: homework %40, midterm %25, and final %35.