OSE6349: Applied Quantum Mechanics for Optics and Engineering (Fall 2020)

Grading

50% homework
25% midterm
25% final

Suggested textbooks


Bibliography:

There are of course a very large number of introductory textbooks on quantum mechanics. There is no single agreed upon textbook for applied quantum mechanics geared towards the student of optics. Here are some suggestions (other suggestions will be provided as we go along):


The students will also be provided with course notes prepared by the instructor.
Week 1:
Lecture 1: Introduction; Lecture 2: 2D linear vector spaces

Week 2:
Lecture 1: Quantum mechanics using 2x2 matrices I; Lecture 2: Quantum mechanics using 2x2 matrices II

Week 3:
Lecture 1: General linear vector spaces I; Lecture 2: General linear vector spaces II

Week 4:
Lecture 1: Axioms of quantum mechanics I; Lecture 2: Axioms of quantum mechanics II

Week 5:
Lecture 1: Infinite quantum wells, density of states I; Lecture 2: Infinite quantum wells, density of states II

Week 6:
Lecture 1: The quantum harmonic oscillator I; Lecture 2: The quantum harmonic oscillator II

Week 7:
Lecture 1: Quantum mechanics in 1D I: General formalism, scattering states from a barrier, and bound states in a finite quantum well
Lecture 2: Quantum mechanics in 1D II: Multiple barriers, coupled quantum wells, and degenerate perturbation theory

Week 8:
Lecture 1: Quantum Mechanics in 1D III: Defect states, non-degenerate perturbation theory
Lecture 2: Quantum Mechanics in 1D IV: Linearly varying potentials, Variational principle

Week 9:
Lecture 1: Quantum Mechanics in 1D V: Periodic potentials
Lecture 2: Quantum Mechanics in 1D VI: Periodic potentials, perturbation theory

Week 10:
Lecture 1: Rotational motion and angular momentum
Lecture 2: Hydrogen and hydrogen-like atoms, the periodic table

Week 11:
Lecture 1: Time-dependent perturbation theory I; Lecture 2: Time-dependent perturbation theory II

Week 12:
Lecture 1: Hydrogen molecule I; Lecture 2: Hydrogen molecule II

Week 13:
Lecture 1: Applications I; Lecture 2: Applications II

Week 14:
Lecture 1: Applications III; Lecture 2: Applications IV

Week 15:
Lecture 1: Applications V; Lecture 2: Applications VI