Physics 480 – Quantum Mechanics I – Syllabus[1]

Fall Semester 2015, University of Hawaii at Manoa
Class meets Mon, Wed, Fri 12:30 am – 1:20 pm, Watanabe Hall 114

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Description in Course Catalog

Wave mechanics, Schroedinger equation, angular momenta, potential problems.

Course Description

Quantum mechanics got me excited about physics – and I hope to pass on this excitement to you. Quantum mechanics is required to understand phenomena at the atomic scale, and thus is at the heart of modern physics. Although I will do my best to elucidate the material, be warned that Quantum Mechanics can be both mathematically and conceptually difficult. The only way to become proficient is by solving a large number of problems, so expect to work hard. The intellectual rewards are however great. Quantum Mechanics tends to lead to a number of conceptual and philosophical questions. We will begin with the math and problem solving, but stop once in a while to reflect on what it all means. We will occasionally use computer simulations to visualize quantum systems.

Prerequisites

Prerequisites: Physics 274, 310, 350, and MATH 244 or MATH 253A; and MATH 311; or consent. Co-requisite: Physics 400.

Required Materials

Textbook: "Quantum Mechanics", Second Edition, David J. Griffiths. While I believe Griffiths to be a good introduction, you will benefit greatly from referencing other books. There are many books out there. I'd particularly recommend the book by Bransden & Joachain, which is also titled "Quantum Mechanics", Second Edition.

Homework

Weekly, written homework and reading. Typically, due one week after assignment. Collaboration is encouraged, but the material handed in must be your own work. **Copying from**

[1] created 8/21/2016. Check course webpage for updates.

a solutions manual or other students is strictly prohibited.

Learning Goals

You don't need to know all that's in the book. You should understand and will be tested on all material presented in class and/or covered in homeworks. You should be able to independently solve problems of the same difficulty level as the homework.

Recitations

There will be weekly recitations led by the TA. The TA will review the previous week's concepts, give you a chance to ask questions, and practice the material in anticipation of the quizzes.

Evaluation

Quizes	(10%)
Homework	(15%)
Two midterm Exams	(2×20%=40%) (each covering about 1/3rd of material)
Final Exam	(35%) (cumulative, but emphasis on last 3rd of course)

Course Outline

This course if part of a 1-year sequence (Physics 480 and 481) that will cover most of the material in the textbook by Griffiths. I plan to cover chapters 1 through 4 in 480, but will adjust the pace as needed.

Chapter 1: THE WAVE FUNCTION
1.1 The Schrödinger Equation
1.2 The Statistical Interpretation
1.3 Probability
1.4 Normalization
1.5 Momentum
1.6 The Uncertainty Principle

Chapter 2: TIME-INDEPENDENT SCHRÖDINGER EQUATION
2.1 Stationary States
2.2 The Infinite Square Well
2.3 The Harmonic Oscillator
2.4 The Free Particle
2.5 The Delta-Function Potential
2.6 The Finite Square Well

Chapter 3: FORMALISM
3.1 Hilbert Space
3.2 Observables
3.3 Eigenfunction of a Hermitian Operator 3.4 Generalized Statistical Interpretation
3.5 The Uncertainty Principle
3.6 Dirac Notation

Chapter 4: QUANTUM MECHANICS IN THREE DIMENTIONS
4.1 Schrödinger Equation in Spherical Coordinates
4.2 The Hydrogen atom
4.3 Angular momentum
4.4 Spin