PHYS 709: Applied Quantum Mechanics

TU 12:30, CW 146

Fall 2002

Instructor:

Dr. Brett Esry
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Office hours:

By appointment, drop by, or send email for faster response. The preferred channel for asking questions is the Message Board at KSU Online so that everyone can benefit.

Textbook:

Principles of Quantum Mechanics, Second Edition, R. Shankar

Supplements:

Physics of Atoms, Molecules, and Nuclei, Eisberg and Resnick
The Picture Book of Quantum Mechanics, S. Brandt and H.D. Dahmen
Quantum Mechanics, Cohen-Tannoudji, Diu, and Laloë
Modern Quantum Mechanics, Sakurai

Grading:

Midterm	20%
Final	30%
Homework	50%

Course philosophy:

This course will challenge you. I expect that you will learn the most in this course from the homework, so there will be quite a bit of it: assignments will be given roughly once per week. I encourage you to discuss the problems with your classmates, but you should write up the assignment *on your own*. Some assignments will require computer work.

Take advantage of the message board at KSU Online. You can discuss questions with each other there, and I will answer questions there as well.

Students with disabilities:

If you have any condition such as a physical or learning disability that will make it difficult to carry out the work as I have outlined it or that will require academic accomodations, please notify me and contact the Disabled Students Office (Holton 202) in the first two weeks of the course.

Plagiarism:

Plagiarism and cheating are serious offenses and may be punished by failure on the exam, paper, or project; failure in the course; and/or expulsion from the University. For more information refer to the "Academic Dishonesty" policy in the *K-State Undergraduate Catalog* and the *Undergraduate Honor System Policy* on the Provost's web page at http://www.ksu.edu/honor/.

Preliminary Course Outline:

I will assume that you have a working knowledge of Chaps. 1, 2, 3, 5, 7, and 13. The more important material from these chapters will be reviewed in class — especially Chap. 1 — but will not be covered completely. If you do not feel comfortable with the material in any of these chapters, then I strongly suggest that you at least read through them.

The following is the tentative list of topics that will be covered in lecture (we may not get to the whole list and there may be others added):

Chap. 1 Mathematical Introduction

Covered in the first few lectures.

Chap. 2 Review of Classical Mechanics

Sec. 2.8 — symmetries are important.

Chap. 4 The Postulates — a General Discussion

Skip density matrices. Choosing a basis is important.

Chap. 5 Simple Problems in One Dimension

Gaussian wavepackets and lots of homework; applications. 1D scattering and computer work.

Chap. 7 The Harmonic Oscillator

Algebraic solution and applications.

Chap. 8 The Path Integral Formulation of Quantum Theory

Just the idea.

Chap. 9 The Heisenberg Uncertainty Relations

Review canonical pairs of observables.

Chap. 10 Systems with N Degrees of Freedom

Direct product solutions and nonseparable systems.

Chap. 11 Symmetries and Their Consequences

Relation to quantum numbers, etc.

Chap. 12 Rotational Invariance and Angular Momentum

Chap. 14 Spin

Application to two-level systems.

Chap. 15 Addition of Angular Momenta

Chap. 16 Variational and WKB Methods

Just the variational method. Applications to atomic and molecular structure. Possibly also structure of solids. Some computer work.

Chap. 17 Time-Independent Perturbation Theory

Should be mostly review; few applications.

Chap. 18 Time-Dependent Perturbation Theory

Electromagnetic transitions.