Physics 4617/5617: Quantum Physics
Syllabus — Fall 2006

Course ID:	PHYS-4617-001 (undergraduate), PHYS-5617-001 (graduate level)
Lecture Times:	T R 2:15 p.m. – 3:35 p.m.
	Additional Arranged Time
Lecture Location:	Brown Hall, Room 264
Lecturer:	Dr. Donald Luttermoser
E–mail:	lutter@etsu.edu
WWW HomePage:	http://www.etsu.edu/physics/dglhome.htm
Office Hours:	R 4:30 p.m. – 5:30 p.m. (279 Brown Hall, 439-7064)
Textbook:	*Understanding Quantum Physics: A User's Guide* (1990)
	by Michael A. Morrison

Course Outline

Days	Topics	Readings
August 29, 31	Introduction: Atoms and Light	§I, Chap 1
September 5, 7	Atoms and Light (continued)	§I, Chap 2
September 12, 14	The Wave Function	§II, Chaps 3-5
September 19, 21	Time-Independent Schrödinger Equation (**Project Proposals due on 9/21**)	§III, Chap 6
September 26	Time-Independent Schrödinger Eq. (cont.)	§III, Chap 7
September 28	**Exam 1**	§I-II, Chaps 1-5
October 3, 5	Time-Independent Schrödinger Eq. (cont.)	§III, Chap 8
October 10, 12	Time-Independent Schrödinger Eq. (cont.)	§III, Chap 9
October 17	**Fall Break — No Class**	
October 19	Formalism & Techniques	§IV, Chap 10
October 24, 26	Formalism & Techniques (continued)	§IV, Chap 11
October 31	**Exam 2**	§III-IV, Chaps 6-11
November 2	Quantum Mechanics in Three Dimensions	§V
November 7, 9	3D QM: The Hydrogen Atom	§V
November 14	3D QM: The Hydrogen Atom (continued)	§VI, Chap 12
November 16	Angular Momentum and Spin	§VI, Chap 12
November 21	Angular Momentum and Spin (continued) (**Projects due on 11/21**)	§VI, Chap 12
November 23	**Thanksgiving Break — No Class**	
November 28	Angular Momentum and Spin (continued)	§VI, Chap 12
November 30	Course Project Presentations	
December 5, 7	Summary and Advanced Topics	
December 12*	**Exam 3 (from 10:30 a.m. – 12:30 p.m.)**	§V-VI, Chap 12

$\star$ — Note that Exam 3 falls on Tuesday, December 12th at the time listed above.

For other university information, please consult the ETSU supplemental syllabus attachment at:
http://www.etsu.edu/reg/syllabus.htm
Thw web page for this course can be found at:
http://www.etsu.edu/physics/lutter/courses/phys4617/index.htm

Overview

Quantum Physics starts with a discussion of the semi-classical approach to the physics of the interaction of electromagnetic radiation (*i.e.*, , energy or light) and electrons (*i.e.*, , matter). It then quickly introduces the student to the concept of the wave function and of probabilities. Techniques for solving the Schrodinger equation for various potentials are examined in both one- and three-dimensions. An in-depth study of the hydrogen atom, along with angular momentum and spin, is also carried out in this course. Much of the course involves the use of sophistcated mathematical techniques of differential equations and linear algebra using the Dirac notation. The student is graded on results of the exams, homework, and a course computer project.

Exams & Homework

There will be 3 exams taken on the dates listed on the syllabus — **there will <u>not</u> be a comprehensive final**. Each exam will cover material after th previous test. You will be allowed access to your notes and textbook during the exams. Each exam will be worth 100 points. Homework problem sets will be assigned approximately every two weeks throughout the semester. The homework and each exam will be worth 20% of your grade. Please note that PHYS-4617/5617 is a writing intensive course. As such, **each homework set must conform to the standards of professional scientific journals** — besides the equations needed to solve a problem, a detailed *write-up* that describes this solution must be included as well, written in proper English.

Exam	Note Sections	Textbook Chapters	Date Given
1	I, II	1, 2, 3, 4, 5	Thursday, September 28, 2006
2	III, IV	5, 6, 7, 8, 9, 10, 11	Tuesday, October 31, 2006
3	V, VI	12	Tuesday, December 12, 2006

Class Project

A class project will be assigned and will be worth 20% of your grade. Your project will involve solving the Schrödinger equation in a numerical fashion via a computer program. As an introduction to working in the scientific community, you will be required to submit a Research Proposal to me by Thursday, September 21st. I will return your proposals with comments and grades the following week. You must get at least a 3.2 (out of 4) before you can begin your work. Should you get below a 3.2 on your first proposal submission, you will have to resubmit it with corrections by

October 3rd. You will get official proposal instructions during the second week of class. You will be required to submit a final report and a manuscript of the results of your project by November 21st. This manuscript must be typeset by either using LaTeX (preferably) or by some PC word processor. Once again, the style of the manuscript must follow the format of a professional scientific journal (see me for examples). The software that you design for your simulation can be written in any programming language you desire. (If you have no computer experience, see me for further information on which programming languages are the easiest to use.) In previous semesters, Fortran 77, Fortran 90, Visual Basic, and IDL have been used. The language you plan to use must be documented in your Project Proposal. Your final score on your project will be based upon your Project Proposal, Project Manuscript, Final Report, and a 15 minute Presentation that you will give on your project.

Grading

The grading system will be based by the following criteria:

$$\textbf{Final Grade} = 20\% * (\tfrac{\text{Exam 1}}{100}) + 20\% * (\tfrac{\text{Exam 2}}{100}) + 20\% * (\tfrac{\text{Exam 3}}{100}) + 20\% * (\tfrac{\text{Project}}{100}) + 20\% * (\tfrac{\text{Homework}}{\text{HW Total}})$$

The final grades will be based on the following scale:

A	=	90% or better	**B-**	=	73–75.9%	**D+**	=	56–58.9%
A-	=	88–89.9%	**C+**	=	70–72.9%	**D**	=	50–55.9%
B+	=	86–87.9%	**C**	=	62–69.9%	**F**	=	Less than 50%
B	=	76–85.9%	**C-**	=	59–61.9%			

Note that a failing grade also will be given if the student has engaged in any form of academic dishonesty.