Physics 202

Special Relativity
Introduction to Quantum Physics

Spring 2016

Instructor: Professor Marj Corcoran, Herman Brown, 230C, phone x6078. I will post office hours on Owlspace, but feel free to stop by anytime to see me. The best way to get in touch with me is through E-mail, corcoran@rice.edu.

Physics 202 is an introductory course in special relativity and quantum mechanics. It is a required course for physics majors but is also appropriate for students who just want an introduction to this material. Physics 201 (Waves and Optics) is not a prerequisite for this course, but it is helpful to be familiar with this material. You should have taken or be taking concurrently differential equations and vector calculus. The textbook is **Quantum Physics** by John Townsend. For the special relativity section, the appendix of Townsend plus notes I will post on Owlspace will probably be sufficient. However, I also recommend a classic text **Special Relativity** by A. P. French if you want a more detailed treatment.

Homework will be assigned weekly and will be a substantial part of your grade. The homework will be open book, and for about half of the problems you are permitted to work together on your assignments. Some of the problems will be pledged, and for these problems you must work by yourself, although you will be permitted to use your book and notes. We will have at least one help session per week (time and place to be announced) to help with the unpledged homework, and you are welcome to come to my office with questions. We will also have in-class closed-book **quizzes** approximately biweekly. These will be short, conceptual questions not requiring much calculation. We will have two **exams**, a midterm and a final.

The grades will be assessed as follows:

Homework 40%
Quizzes 10%
Midterm 25%
Final 25%

Both exams will be take-home. You will be able to take the midterm any time during a one-week period (to be determined later). You are required to turn in the exam within 24 hours of the time you checked it out. The final exam will be due on the last day of the final exam period. You will also be required to turn in the final exam within 24 hours of when you checked it out.

In writing out your solutions, both on the homework and exams, it is important to present your work clearly and logically. The answer alone, even if it is correct, is not sufficient. You need to demonstrate how you arrived at your answer.

Solutions to homework and exams will be posted on the Owlspace web site for this course. If, after looking over these solutions, you feel that your exam or homework was not graded correctly, you may request a **regrade**. Do not write on the exam or homework paper, rather write a note explaining what you think was incorrectly graded and staple it to the paper. Submit this to the instructor within a

week from the time the paper was returned to you.

Makeups for missed homework or exams will be handled on a case-by-case basis. If you must miss an exam or assignment due to university business, let the instructor know *before* the exam or due-date for the assignment. If an unexpected circumstance arises, such as an illness or death in your family, let the instructor know as soon as possible.

Any student with a disability requiring accommodations in this class is encouraged to contact the instructor outside of class early in the semester. Additionally, students should contact the Disability Support Services in room 111 of Allen Center (adarice@rice.edu).

Learning Outcomes and course outline:

Special Relativity: Students will be able to perform a Lorentz transformation from one reference frame to anther. Students will understand the concept of a four-vector and a Lorentz invariant quantity.

Historical developments and the nature of light: Students will understand the early development of quantum mechanics, wave-particle duality, and the non-locality of the wave function.

Wave mechanics: Students will solve the Schroedinger equation in several typical potentials, including the 1D and 3D particle in a box, the simple harmonic oscillator, and step potentials. Students will learn about scattering and tunneling in 1D step potentials. Students will understand the uncertainty principle and the concept of wave packets and expectation values.

Operators and observables: Students will understand the connection between Hermitian operators and observables. Students will learn about the properties of Hermitian operators and commuting and non-commuting operators.

Multiparticle systems: Students will learn about the symmetry of the wavefunction for fermions and bosons and the consequences of these symmetries for atomic structure.

Special topics: If time permits we will cover one or more of the special topics
Condensed matter
Nuclear physics
Particle physics