Physics 21
Fall, 2004

Information about Final

Final Exam: The Final Exam will be Wednesday, December 15, 2004 from 8:00 to 11:00 am. Some sections are in LL270; other sections are in RB184. The exam will be closed book and closed notes. An equation sheet and the notes on optics (now posted on the course web site) will be included with the exam. Any physical constants and integrals you will need will be given on the equation sheet.

Practice Questions: Representative questions on waves and optics taken from previous exams in Physics 21 will be posted on the class web site. The two previous hour exams and the associated practice exams provide representative questions on electricity and magnetism. The solution to the practice questions will be posted on the web and also may be discussed in a review session (see next paragraph).

Review Session: Prof. Shaffer will present a review session at 7:00 pm in LL270 on Monday, Dec. 13.

Use of Calculators: You should bring a calculator. In general, however, setting up the problems and demonstrating the correct strategy for solving them are worth more than doing the arithmetic to get a numerical result. If you are asked to solve simultaneous algebraic equations, you must solve them by hand and show the solution to receive full credit.

Physics 19: The Physics 19 exam will consist of selected problems from the full Physics 21 exam. Physics 19 students may take the full three hours to work the exam.

Make up exams: Some students missed one or the other of the two hour exams. Selected problems from the full exam will count as the make up exam for those students.

Coverage: The exam will cover all the material presented this semester. About 50% of the exam will be on electricity and magnetism and about 50% on waves, optics and quantum mechanics. The emphasis will be on the material covered in lecture, recitation or homework. Some questions may come from material presented only in the lectures. There may be some short-answer questions, that is, you might be asked for a short definition or an example. You will not be asked to solve differential equations, but you may be asked to verify that a given function satisfies a differential equation.

You should be familiar with all the topics and questions listed on the study guides for Hour Exams #1 and #2, as well as with the items listed below that cover optics and quantum mechanics. The list is not necessarily complete but is representative.

- What is the Poynting vector? Know how to use it to describe the transport of energy by an E&M wave.
- What is the difference between geometric and physical optics? What is the essential assumption of geometric optics?
- What is the law of reflection (for a mirror)?
- Know how to use Snell's Law.
- What is the paraxial approximation?
- Be able to draw ray diagams for mirrors and lenses using the notes handed out. Be able to draw a ray diagram for a magnifying glass or a telescope.
- What is refraction?
- What is the index of refraction?
- How can you describe the path of a light ray using the principle of least time?
- Why is the case of parallel light rays important for a lens or mirror?
- What is total internal reflection? What is the critical angle?
- What makes a rainbow?
- What does "diopter" mean? How does the strength of a lens change if it is submerged under water?
- What is a chromatic doublet?
- Be able to give examples of and explain phenomena included under the heading of diffraction and interference. What is a diffraction grating? What are missing orders and why do they occur?
- What is Huygens' principle?
- What is the difference between discrete and continuous spectra?
- What limits the ability of a telescope to resolve two closely spaced binary stars? What is the Rayleigh criterion?
- What determines the polarization of an E&M wave? What is the relation between **E** and **B** and the velocity of the wave?
- What does a polarizing filter do?
- What is the wave-particle duality?
- What is a de Broglie wave? What are the wavelength and frequency of the wave associated with a particle of given momentum and energy?
- What is the Heisenberg Uncertainty Principle?
- What is Schroedinger's Equation for a free particle?