

Physics 21 Fall, 2011

Information about Final

Final Exam: The final exam will be Thursday, December 15, 2011 from 7:10–10:10 pm. Almost everyone will be in PA 101; extra time students will be in LL221 and will start 90 minutes early, at 5:30 pm. The exam will be closed book and closed notes. The equation sheet and the handout 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.

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.

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 and optics. 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. 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 diagrams for mirrors and lenses using the notes handed out. Be able to draw a ray diagram for a magnifying glass or a telescope. Be able to analyze a two-lens system algebraically.

- What is refraction? What is the index of refraction?
- What is dispersion?
- Know the sign conventions for converging and diverging lenses. Know how to use the lensmaker's equation, including the sign conventions for the radii of curvature.
- 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 is the mathematical form of a traveling plane wave?
- Know how to determine where the sound from two speakers will interfere constructively or destructively. How does your analysis depend on whether the speakers are in phase or out of phase?
- What is chromatic aberration?
- What is an achromatic doublet?
- Be able to give examples of and explain phenomena included under the heading of diffraction and interference. What is a diffraction grating?
- Be able to sketch the interference pattern for the two slit experiment if you are given the width and separation of the slits. What are missing orders and why do they occur?
- What are the approximate wavelengths of visible light?
- What is Huygens' principle?
- What is the f -number of a lens?
- What is the difference between a real and a virtual image?
- What is the difference between discrete and continuous spectra? Be able to give an example of each.
- 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 \mathbf{E} and \mathbf{B} and the velocity of the wave?
- What does a polarizing filter do?