



PC 1300 - Waves, Sound and Optics

3.8(3-0-1.5) UT(3.8) Fall 1995

U of A Equivalent - Phys 130

Course Information

Calendar Description: Geometrical optics, optical instruments, oscillations, waves, sound, interference, diffraction.

Prerequisite: Mathematics 30, Mathematics 31, Physics 30

Corequisite: MA 1000 or equivalent

Note: Restricted to engineering students only.

Instructor	Dr. Jaime P. Santiago J209, 539-2865
Lecture	M 2:00 - 2:50 p.m. TR 9:30 - 10:20 a.m.
Laboratory	M 3:00 - 5:50 p.m.
Textbook	Fundamentals of Physics, 4th Edition by David Halliday, Robert Resnick and Jearl Walker (John Wiley and Sons)
Laboratory Manual	Physics Laboratory Manual by Physics Department, University of Alberta (McGraw-Hill)

Grading	Assignments	10%
	Laboratory	20%
	Midterm Examination	25%
	Final Examination	45%

Assignments

There will be 12 problem sets in this course. Assignment problems are from the text book and will be assigned 1 week before their due dates. **Late assignments will not be accepted.**

Laboratory

Laboratory work is performed every other week. There will be a lab final exam. Lab mark will be based on lab reports (80 %) and the lab exam (20 %).

Laboratory reports are due at the end of the period. No late reports will be accepted. Lab reports should be handwritten on black Physics Laboratory books. (Lab books may be purchased at the bookstore.) A student who misses a lab due to illness or other reasons must make up the lab at a different time. The student should make arrangements with the lab technician and the lab instructor with regards to make up labs.

Laboratory Marks and Final Grade

Students must pass the laboratory component in order to pass the course. A student who fails the lab must repeat the entire course.

Midterm Examination

The midterm exam will be written during a regular class period. You will be given at least two weeks advance notice.

Final Examination

Final exams are normally 3 hours long. Dates and times will be announced later by the registrar's office. Any conflicts should be reported to the registrar.

PC 1300 - Wave Motion, Optics and Sound Course Outline

Part 1 Geometrical Optics and Optical Instruments (3 weeks) Chapter 39, all sections

1.1 The Mathematical Tools for Geometrical Optics (1.5 weeks)

- 1.1.1 A brief introduction to problem solving in physics
- 1.1.2 The nature of light
- 1.1.3 The ray approximation
- 1.1.4 Reflection and refraction -- total internal reflection, polarization by reflection

1.2 Optical Devices (1.5 weeks)

- 1.2.1 Plane and spherical mirrors
 - paraxial and non-paraxial rays, real and virtual images
- 1.2.2 Refracting optics including thin lenses and multiple lens systems
- 1.2.3 Other optical instruments (the eye, compound lenses, telescopes, microscopes)
 - spherical and chromatic aberration

Part 2 Oscillations and Waves (6 weeks) Chapters 14, 17 and 18. All sections.

2.1 Oscillations (Chapter 14) (1.5 weeks)

- 2.1.0 Review of Newton's Laws of Motion for translation and rotation
- 2.1.1 Simple harmonic motion
- 2.1.2 The equations of simple harmonic motion
- 2.1.3 Harmonic motion and circular motion
- 2.1.4 The force law
- 2.1.5 Energy in simple harmonic motion
- 2.1.6 Examples of simple harmonic motion (spring and mass, simple pendulum, torsional pendulum)

2.2 Waves (Chapter 17) (2.5 weeks)

- 2.2.1 Characteristics of waves, including transverse(string) and longitudinal(sound) waves
- 2.2.2 Wavelength and frequency
- 2.2.3 The speed of traveling waves
- 2.2.4 Traveling waves in the stretched string
- 2.2.5 Energy in a traveling wave
- 2.2.6 Superposition, dispersion and interference
- 2.2.7 Standing waves and reflections
- 2.2.8 Standing waves and resonance (the guitar string)

2.3 Sound Waves (Chapter 18) (2.0 weeks)

- 2.3.1 The characteristics of sound waves
- 2.3.2 The speed of sound
- 2.3.3 Traveling sound waves
- 2.3.4 Intensity of sound waves
- 2.3.5 Superposition of sound waves (including interference and beats)

- 2.3.6 Musical instruments
- 2.3.7 The Doppler effect

Part 3 The Wave Nature of Light and Physical Optics (3 weeks)
Chapter 40 and 41. All sections.

3.1 Interference (Chapter 40) (1.5 weeks)

- 3.1.1 An introduction to the wave nature of light (Huygen's principle, refraction, polarization, spatial and temporal coherence)
- 3.1.2 Introduction to diffraction
- 3.1.3 Young's experiment
- 3.1.4 Thin films

3.2 Diffraction (Chapter 41) (1.5 weeks)

- 3.2.1 Single slit diffraction (including phasors)
- 3.2.2 Circular apertures
- 3.2.3 The double slit; multiple slits including phasors
- 3.2.4 The diffraction grating

Laboratory Experiments

Lab No.	Title
1	Geometrical Optics
2	Hooke's Law
3	Standing Waves on a String
4	Standing Waves in Air
5	Interference of Light
6	Lab Test