



**PC 1300 Wave Motion, Optics and Sound**

**3.8(3-0-1.5) UT Fall 1997**

**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.*

<b>Instructor:</b>	Tola Adeodu J209, 539-2865
<b>Lecture:</b>	M 2:00 - 2:50 p.m., J228 TR 9:30 - 10:20 a.m., J226
<b>Laboratory:</b>	T 3:00 - 5:50 p.m., J226
<b>Textbook:</b>	<b>Fundamentals of Physics, 5th Ed.</b> by David Halliday, Robert Resnick and Jearl Walker (Wiley)
<b>Laboratory Manual:</b>	<b>PHYSICS Laboratory Manual</b> by Physics Department, University of Alberta

<b>Grading:</b>	Assignments 10%
	Laboratory 20%
	Midterm Examination 25%
	Final Examination 45%

## **Assignments**

There will be 10 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 (75%) and the lab exam (25%).

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 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 to pass the lab must repeat the entire course. Students who have previously taken the course and passed the laboratory component with at least 70% may be exempted from the lab.

## **Midterm Examination**

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

## **Final Examination**

Final exams are 3 hours long and are normally held at the College Gym. 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 (4th Edition)

- 1.1 *The Mathematical Tools for Geometrical Optics (1.5 weeks)* (Chapters 1, 34)
- 1.1.1 A brief introduction to problem solving in physics
  - 1.1.2 The nature of light (A somewhat nonrigorous discussion including wave characteristics. A brief history of the development optics.)
  - 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)* (Chapter 35)
- 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 (4th Edition)

- 2.1 *Oscillations (1.5 weeks)* (Chapter 16)
- 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 oscillators (spring and mass, simple pendulum, torsional pendulum)
- 2.2 *Waves (2.5 weeks)* (Chapter 17)
- 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 strings (including the wave speed)
  - 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* (2.0 weeks) (Chapter 18)

- 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 (4th Edition)**

3.1 *Interference* (1.5 weeks) (Chapter 36)

- 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* (1.5 weeks) (Chapter 37)

- 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