Physics 123: Waves, Light and Heat (5 credits)

Overview

Phys 123 is the third of a three-quarter sequence of introductory calculus-based physics. Upon successful completion of this course, you will be able to develop calculus-based models to describe the physical world pertaining to simple harmonic motion, wave propagation, wave interference and diffraction, optics, heat transfer, and converting heat to work.

The course consists of lecture (3 hours per week), tutorial (1 hour per week), and laboratory (2 hours per week) components.

Evaluation

The final course grade is based on the following grade weightings.

- **60 %:** two midterms and one final exam. A better option is chosen from the two below.
    1. 40 % midterms and 20 % final
    2. 20 % midterm (better of 2) and 40 % final
- **12 %:** Lab assignments
- **12 %:** Tutorial assignments
- **16 %:** Lecture assignments

A grade of 0 for the entire course would be given if a student receives less than 2/3 of the possible points on the lab assignments or participates in less than 6 out of 8 labs. Otherwise, the final weighted percentage is converted to a grade point using the following thresholds.

grade point	course score	grade point	course score	grade point	course score	grade point	course score
4.0	91	3.0	74	2.0	57	1.0	40
3.9	89.3	2.9	72.3	1.9	55.3	0.9	38.3
3.8	87.6	2.8	70.6	1.8	53.6	0.8	36.6
3.7	85.9	2.7	68.9	1.7	51.9	0.7	34.9
3.6	84.2	2.6	67.2	1.6	50.2		
3.5	82.5	2.5	65.5	1.5	48.5		
3.4	80.8	2.4	63.8	1.4	46.8		
3.3	79.1	2.3	62.1	1.3	45.1		
3.2	77.4	2.2	60.4	1.2	43.4		
3.1	75.7	2.1	58.7	1.1	41.7		

Texts

- **Required:** *Physics for scientists and engineers, a strategic approach*, Knight (Pearson, 5th edition, 2022)

Lecture Topics (Textbook chapters)

- **Ch. 15 (3 lectures):** Oscillations
- **Ch. 16 (3 lectures):** Traveling waves
- **Ch. 17 (3 lectures):** Superposition
- **Ch. 33 (3 lectures):** Wave optics
- **Ch. 34 (3 lectures):** Ray optics
- **Ch. 35 (2 lectures):** Optical instruments
- **Ch. 14 (2 lectures):** Fluids and elasticity
- **Ch. 18 (2 lectures):** A macroscopic description of matter
- **Ch. 19 (3 lectures):** Work, heat, and the first law of thermodynamics
- **Ch. 20 (2 lectures):** The micro/macro connection
- **Ch. 21 (2 lectures):** Heat engines and refrigerators

Tutorial Topics (7, 8, or 9 of the following depending on the quarter)

- Simple harmonic motion
- Superposition and reflection
- Two-source interference
- Wave properties of light
- Light and shadow
- Plane mirrors
- Pressure
- Ideal gas law
- First law of thermodynamics

Lab Topics

The lab component of this course focuses on experimental design and data analysis techniques in the context of waves.