**PHYS 41 Course Outline as of Fall 2011**

# CATALOG INFORMATION

Dept and Nbr: PHYS 41 Title: WAVES, OPTICS, THERMO
Full Title: Waves, Optics and Thermodynamics for Scientists & Engineers
Last Reviewed: 1/23/2023

| Units | | Course Hours per Week | | Nbr of Weeks | Course Hours Total | |
|---|---|---|---|---|---|---|
| Maximum | 4.00 | Lecture Scheduled | 3.00 | 17.5 | Lecture Scheduled | 52.50 |
| Minimum | 4.00 | Lab Scheduled | 3.00 | 17.5 | Lab Scheduled | 52.50 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 6.00 | | Contact Total | 105.00 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 105.00 Total Student Learning Hours: 210.00

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|---|---|
| Title 5 Category: | AA Degree Applicable |
| Grading: | Grade Only |
| Repeatability: | 00 - Two Repeats if Grade was D, F, NC, or NP |
| Also Listed As: | |
| Formerly: | PHYS 4B |

**Catalog Description:**
This is a course intended for science and engineering students and will include oscillations, waves, sound, heat, kinetic theory, thermodynamics, geometrical optics, interference, diffraction and polarization of light.

**Prerequisites/Corequisites:**
Course Completion of PHYS 40

**Recommended Preparation:**

**Limits on Enrollment:**

**Schedule of Classes Information:**
Description: This is a course intended for science and engineering students and will include oscillations, waves, sound, heat, kinetic theory, thermodynamics, geometrical optics, interference, diffraction and polarization of light. (Grade Only)
Prerequisites/Corequisites: Course Completion of PHYS 40
Recommended:
Limits on Enrollment:

Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

## ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

| | | | | |
|---|---|---|---|---|
| **AS Degree:** | **Area** | | Effective: | Inactive: |
| | C | Natural Sciences | Spring 1983 | |
| **CSU GE:** | **Transfer Area** | | Effective: | Inactive: |
| | B1 | Physical Science | Spring 1983 | |
| | B3 | Laboratory Activity | | |
| **IGETC:** | **Transfer Area** | | Effective: | Inactive: |
| | 5A | Physical Sciences | Spring 1983 | |
| | 5C | Fulfills Lab Requirement | | |

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|---|---|---|---|---|
| **CSU Transfer:** | Transferable | Effective: | Spring 1983 | Inactive: |
| **UC Transfer:** | Transferable | Effective: | Spring 1983 | Inactive: |

**CID:**
CID Descriptor: PHYS 200S Calculus-Based Physics for Scientists and Engineers: ABC
SRJC Equivalent Course(s): PHYS40 AND PHYS41 AND PHYS42 AND PHYS43

**Certificate/Major Applicable:**
Major Applicable Course

## COURSE CONTENT

**Outcomes and Objectives:**
1. Describe waves and solve problems relating to their properties and propagation in various media.
2. Be able to convert to and from various temperature scales, solve problems related to coefficient of expansion, thermal equilibrium and heat transfer.
3. Use the three laws of thermodynamics and the kinetic theory of gasses to solve problems related to ideal gasses and various heat engines.
4. Explain propagation of light in media including reflection, refraction and dispersion.
5. Explain image formation and draw the ray diagrams for various optical devices including lenses, mirrors, microscopes and telescopes.
6. Explain the formation of interference patterns of light from single slit, double slit, diffraction grating, and thin films.
7. Describe polarization with filters and by reflection.

Lab Objectives:
1. Develop and conduct experiments that apply the scientific method and error analysis to explore principles in waves, sound, thermodynamics and optics.
2. Use manual and computerized data collection techniques to measure and analyze parameters related to waves, sound, thermodynamics and optics.
3. Plot, curve fit, and interpret data using a spreadsheet or other analysis tools.

**Topics and Scope:**

1. Oscillatory motion

a. simple harmonic motion
b. wave equations
c. damped/forced oscillations

2. Wave motion
   a. travelling wave model/equation
   b. reflection and transmission
3. Sound waves
   a. Speed, frequency, power level and intensity
   b. Doppler effect
4. Superposition and standing waves
   a. equations
   b. interference and standing waves
   c. beats
   d. Fourier transformation of non-sinusoidal waves
5. Temperature and Zeroth law of thermodynamics
   a. temperature scales
   b. thermal expansion
   c. ideal gas
6. First law of thermodynamics
   a. heat and thermal energy
   b. specific heat and latent heat
   c. work-heat relationship
   d. thermal conduction methods
7. The kinetic theory of gases
   a. molecular and statistical models
   b. molar specific heat of gas
   c. adiabatic process
   d. equipartition theory
8. Second law of thermodynamics
   a. heat engines
   b. entropy
9. Light and optics
   a. nature of light
   b. ray, diagram, reflection and refraction of light
   c. total internal reflection
10. Image formation
   a. mirrors and lenses
   b. aberrations
   c. eye, camera, microscope and telescopes
11. Interference of light waves
   a. single and double slits
   b. thin film interference
   c. interferometers
12. Diffraction
   a. narrow single slit, double slits and diffraction gratings
   b. X-ray diffraction
   c. polarization of light

**Assignment:**

1. Homework problem sets (10-30)
2. Quizzes (5-15)

3. Laboratory experiments (12-16)
4. Mid-term exams (2-4)
5. Final exam
6. Written lab reports (12-16)

**Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

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| Written lab reports | Writing<br>5 - 10% |

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

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| Homework problems, lab experiments | Problem solving<br>10 - 30% |

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

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| None | Skill Demonstrations<br>0 - 0% |

**Exams:** All forms of formal testing, other than skill performance exams.

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| Objective examinations (multiple choice, etc.) that include essay questions, Quizzes, Mid-terms, Final exam | Exams<br>50 - 70% |

**Other:** Includes any assessment tools that do not logically fit into the above categories.

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| Participation and attendance | Other Category<br>5 - 10% |

**Representative Textbooks and Materials:**
PHYSICS FOR SCIENTISTS AND ENGINEERS by Serway and Jewett, 8th edition, Thomson, 2010