PHYS 41 Course Outline as of Fall 2023

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	8	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

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:
In this course, students will use calculus, algebra, and trigonometry to apply physics laws and principles to solve problems involving oscillations, waves, sound, heat, kinetic theory, thermodynamics, geometrical optics, interference, diffraction, and polarization of light.

Prerequisites/Corequisites:
Course Completion of PHYS 40

Recommended Preparation:
Course Completion or Concurrent Enrollment in MATH 1B

Limits on Enrollment:

Schedule of Classes Information:
Description: In this course, students will use calculus, algebra, and trigonometry to apply physics laws and principles to solve problems involving 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: Course Completion or Concurrent Enrollment in MATH 1B

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		

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

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Analyze and solve problems by applying the laws of physics to oscillatory motion, wave propagation and interference, thermodynamics, and geometrical/wave optics.
2. Design and assemble apparati to measure physical phenomena.
3. Analyze and make comparisons between experiment and theory.
4. Effectively communicate ideas and processes of physics.

Objectives:
At the conclusion of this course, the student should be able to:
1. Describe waves and solve problems relating to their properties and propagation in various media.
2. Be able to convert between temperature scales, solve problems related to coefficient of expansion, thermal equilibrium, and heat transfer.
3. Use the laws of thermodynamics and the kinetic theory of gases to solve problems related to ideal gases and various heat engines.
4. Explain propagation of light in media including reflection, refraction, and dispersion.
5. Explain image formation and draw ray diagrams for various optical devices including lenses, mirrors, microscopes, and telescopes.
6. Explain the formation of interference patterns of light from a single slit, a double slit, a 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:

I. Oscillatory Motion
   A. Simple harmonic motion
   B. Wave equations
   C. Damped and forced oscillations
II. Wave Motion
III. Sound Waves
   A. Speed, frequency, power level, and intensity
   B. Doppler effect
IV. Superposition and Standing Waves
   A. Equations
   B. Interference and standing waves
   C. Beats
V. Temperature and the Zeroth Law of Thermodynamics
   A. Temperature scales
   B. Thermal expansion
   C. Ideal gas
VI. First Law of Thermodynamics
   A. Heat and thermal energy
   B. Specific heat and latent heat
   C. Work-heat relationship
   D. Thermal transfer methods
VII. Kinetic Theory of Gases
   A. Molecular and statistical models
   B. Molar specific heat of gas
   C. Thermal processes
   D. Equipartition theorem
VIII. Second Law of Thermodynamics
   A. Heat engines
   B. Entropy
IX. Light and Optics
   A. Nature of light
   B. Reflection and refraction of light
   C. Total internal reflection
X. Image Formation
   A. Mirrors and lenses
   B. Ray diagrams
   C. Optical instruments including the eye, camera, microscope, and telescope
XI. Interference of Light Waves
   A. Single and double slits
   B. Thin film interference
   C. Interferometers
XII. Diffraction
   A. Narrow single slit

B. Double slits
C. Diffraction gratings

All topics are covered in both the lecture and lab parts of the course.

Assignment:

Lecture-Related Assignments:
1. Homework problem sets (10-30)
2. Quizzes (5-15)
3. Exams (2-4)
4. Final exam

Lab and Lecture-Related Assignments:
1. Laboratory experiments and 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.

Lab reports	Writing 5 - 20%

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

Homework problems sets; lab experiments	Problem solving 15 - 35%

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

None	Skill Demonstrations 0 - 0%

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

Quizzes; exams; final exam	Exams 50 - 70%

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

Class participation	Other Category 0 - 5%

Representative Textbooks and Materials:
Physics for Scientists and Engineers. 10th ed. Serway, Raymond and Jewett, John. Cengage L. 2019.
Physics for Scientists and Engineers: A Strategic Approach with Modern Physics. 4th ed. Knight, Randell. Pearson. 2017 (classic).

Lab Manual and Instructor Prepared Materials

Open Educational Resource (OER) Material:
University Physics by OpenStax, S. J. Ling, J. Sanny, and W. Moebs, 2016 (classic).