PHYS 4B Course Outline as of Spring 1983

CATALOG INFORMATION

Dept and Nbr: PHYS 4B Title: PHYS FOR SCI & ENGN
Full Title: Physics 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

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:

Catalog Description:
Heat, kinetic theory, thermodynamics, mechanical waves and sound, geometrical optics, interference, diffraction and polarization of light.

Prerequisites/Corequisites:
Phys 4A with a grade of "C" or better, Math 2A completed or in progress.

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: Heat & thermodynamics, waves & sound, light & optics. (Grade Only)
Prerequisites/Corequisites: Phys 4A with a grade of "C" or better, Math 2A completed or in progress.
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN PHYS14)(PHYS 4A+PHYS 4C+PHYS 4B=PHYS SEQ B)(PHYS 4D+PHYS 4A+PHYS 4C+PHYS 4B=PHYS SEQ C)

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:
Not Certificate/Major Applicable

COURSE CONTENT

Outcomes and Objectives:
Upon completion of the course, the student should be able to:
1. Explain what a wave is & define the terms: longitudinal, transverse, transverse velocity, wave velocity, frequency, wavelength, period, wave number, amplitude & angular frequency.
2. Write an equation for a one-dimensional harmonic wave traveling either in the positive or negative direction, differentiate to find velocity & acceleration, write equations relating wave velocity, angular frequency, frequency, wavelength, period, & wave number & solve problems using these equations & relationship.
3. Solve problems involving velocity, energy & power of waves in stretched strings.
4. Explain the concepts of superposition of waves, constructive interference, destructive interference, & beats; & solve problems involving the superposition of 2 or more waves traveling in the same or opposite directions & of equal or different frequencies & amplitudes.
5. Explain the Doppler effect & solve problems involving the Doppler effect for moving sources & observers.
6. Define what the intensity of a wave measures, describe how the intensity of a wave depends on its amplitude, relate the intensity of a sound wave in watts/square meter to its sound level expressed in decibels; & solve problems involving intensity of waves & sound levels in decibels.
7. Sketch standing wave patterns for vibrating strings & vibrating air

columns in open & closed pipes; explain what is meant by overtones & harmonics; describe the phenomenon of resonance; & solve problems involving standing waves in strings & air columns.

8. Explain what a temperature measurement is a measurement of; give values for the freezing & boiling points of water on the Celsius, Kelvin & Fahrenheit scales; & convert a temperature given on any temperature scale to any other temperature scale.
9. Describe what coefficients of linear, area, & volume expansion represent, & solve problems involving thermal expansion in 1, 2, & 3 dimensions.
10. Write the equation of state for an ideal gas & solve problems using the relationship.
11. Explain what constitutes internal energy & what heat is; explain the concepts of specific heat & latent heat; solve problems using specific heats, latent heats, & the first law of thermodynamics.
12. List the 3 methods of heat transfer; write an equation for heat transfer by conduction; explain the concepts of temperature gradient & thermal conductivity; & solve problems involving heat transfer by conduction, with a variety of geometries, & heat transfer by radiation.
13. Explain how the kinetic theory of gases can be used to relate translational kinetic energy to absolute temperature in an ideal gas; explain the concepts of equipartition of energy & degrees of freedom; & use these concepts to provide values for molar specific heats at constant volume & constant pressure for monatomic, diatomic & triatomic molecules at low, mid, & high temperatures.
14. Describe what occurs in isothermal, isobaric, isovolumic & adiabatic processes; sketch changes of state involving these processes on a P-V diagram; & solve problems involving these processes including calculating work done, changes in internal energy & heat gained by systems undergoing these processes.
15. Given a distribution of molecular speeds, such as the Maxwell distribution, calculate the average speed, most probable speed & root-mean-square speed.
16. State the second law of thermodynamics in a variety of ways; describe the Carnot cycle; solve problems involving various thermodynamic cycles including calculations of efficiency for heat engines & coefficients of performance for refrigerators & heat pumps.
17. Explain what entropy is, write an equation for change in entropy, & calculate changes in entropy for various thermal processes.
18. Give a value for the speed of light in a vacuum; state the approximate wavelength range of the visible spectrum; give an equation relating speed, frequency & wavelength for light waves & use the relationship in problem solving.
19. State 2 rules for reflection of light & explain the difference between specular & diffuse reflection.
20. Explain the refraction of light at the interface between 2 transparent media & the concept of index of refraction; write the equation for Snell's Law & use it in problem solving; explain the concepts of total internal reflection & the critical angle & use these concepts in problems solving.
21. Explain what dispersion is, why a prism forms a spectrum of colors for

incident white light, what the minimum angle of deviation is, & solve problems involving refraction of light through a prism.
22. Explain the terms real, virtual, erect & inverted as they apply to images formed by mirrors & lenses; describe the image forming properties of convex & concave spherical mirrors & of converging & diverging thin spherical lenses.
23. Write an equation relating object distance, image distance & focal length for spherical mirrors & thin lenses; write an equation for linear magnification for mirrors & thin lenses; state the conventions used for plus & minus signs on distances, focal lengths & magnifications; & solve problems using these relationships for single & multiple mirror/lens systems.
24. Draw ray diagrams to determine image locations & magnifications for single spherical mirrors & thin lenses as well as for systems of mirrors & lenses.
25. Solve problems using the lens maker's equation, problems involving refraction at spherical surfaces, & problems involving thick lenses.
26. Describe the configuration of lenses in a simple microscope, opera glass & astronomical telescope, draw ray diagrams & calculate image positions & magnifications.

Topics and Scope:

Topics covered include:
1. Waves in elastic media.
2. Sound waves.
3. Superposition of waves and standing waves in strings and air columns.
4. Temperature and conversion of temperature scales.
5. Thermal expansion.
6. The ideal gas law.
7. Specific heat, latent heat, & the first law of thermodynamics.
8. The kinetic theory of gases and molar specific heats.
9. Isothermal, isobaric, isovolumic, and adiabatic processes.
10. Heat engines, refrigerators, heat pumps and the second law of thermodynamics.
11. Entropy.
12. Reflection and refraction of plane light waves incident on plane surfaces.
13. Image forming properties of spherical mirrors and thin lenses.
14. Interference of light: double slit interference, thin film interference, diffraction gratings.
15. Single slit diffraction.
16. Polarization of light.

Lab work includes:
1. Learning to use a variety of measuring instruments.
2. Making measurements in thermal systems.
3. Making measurements in optical systems.
4. Error analysis.
5. Numerical and graphical analysis of data.

Assignment:

1. No less than 10 sets of homework problems (one for each chapter covered).
2. Twelve laboratory experiments (10 short lab reports, 2 formal lab reports).
3. No less than 3 mid-term exams.
4. Final exam.

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.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

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

Homework problems, Lab reports, Quizzes, Exams	Problem solving 8 - 20%

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.

Multiple choice, PHYSICS PROBLEMS TO SOLVE	Exams 55 - 72%

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

LAB REPORTS	Other Category 20 - 25%

Representative Textbooks and Materials:
PHYSICS FOR SCIENTISTS AND ENGINEERS by Serway.