BUTTE COLLEGE
COURSE OUTLINE

I. **CATALOG DESCRIPTION**

PHYS 43 - Physics for Scientists and Engineers III **4 Unit(s)**

Prerequisite(s): PHYS 41, MATH 31
Recommended Prep: NONE

Transfer Status: CSU/UC
51 hours Lecture
51 hours Lab

This course, intended for students majoring in physical sciences and engineering, is part of a three-semester course whose contents may be offered in other sequences or combinations. Core topics include optics and modern physics. (C-ID PHYS 43). Graded only.

II. **OBJECTIVES**

Upon successful completion of this course, the student will be able to:

A. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
B. Apply basic concepts of quantum mechanics to analyze basic physical setups, including a particle in a box and simple atomic models.
C. Analyze real-world experimental data, including appropriate use of units and significant figures.
D. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.

III. **COURSE CONTENT**

A. **Unit Titles/Suggested Time Schedule**

Lecture

Topics	Hours
1. Atomic Physics	5.00
2. Mechanical Waves	3.00
3. Geometrical Optics, Lenses, Mirrors, and Optical Instruments	3.00
4. Wave Optics / Physical Optics	3.00
5. Quantum Mechanics	9.00
6. Nuclear Physics	3.00
7. Particle Physics	3.00
8. Condensed Matter/Solid State	6.00
9. Kinetic Theory	3.00
10. Laws of Thermodynamics	5.00
11. Entropy	5.00
12. Heat Engines	3.00
Total Hours	51.00

Lab

Topics	Hours
1. Atomic Physics	6.00
2. Mechanical Waves	3.00

3.	Geometrical Optics, Lenses, Mirrors, and Optical Instruments	6.00
4.	Wave Optics / Physical Optics	6.00
5.	Quantum Mechanics	3.00
6.	Condensed Matter/Solid State	3.00
7.	Nuclear Physics	6.00
8.	Particle Physics	6.00
9.	Laws of Thermodynamics	3.00
10.	Heat Engines	3.00
11.	Kinetic Theory	3.00
12.	Entropy	3.00
Total Hours		51.00

IV. METHODS OF INSTRUCTION

A. Lecture
B. Instructor Demonstrations
C. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
D. Discussion
E. Problem-Solving Sessions
F. Laboratory Experiments

V. METHODS OF EVALUATION

A. The evaluation of student progress will be accomplished through the use of written examinations, tests, quizzes, homework assignments, and a final examination.
B. The evaluation of student laboratory progress will be through laboratory reports.

VI. EXAMPLES OF ASSIGNMENTS

A. Reading Assignments
   1. Read "Boltzmann's work in statistical physics". Prepare to participate in a discussion regarding connecting the macroscopic thermodynamics to the microscopic world of quantum mechanics.
   2. Read the article "A short history of atomic physics in the twentieth century" and prepare to discuss the seminal experiments performed that elucidated the structure of the atom.

B. Writing Assignments
   1. Produce a detailed solution of a quantum mechanical particle in a box. Include a summary relating standing waves on a string to the descreteness of the energy levels in this primitive model of the hydrogen atom and the connections to the spectrum of the Hydrogen atom.
   2. Write a detailed report on the Frank-Hertz experiment including a one page introduction, a brief description of the apparatus, annotated data sheet, calculations and error analysis.

C. Out-of-Class Assignments
   1. Research the methods for doping in semiconducting materials. Be prepared to give a overview of the steps requred to fabricate a pn junction.
   2. Practice the derivation of the ideal gas law using Newton's laws (Kinetic Theory). Prepare to reproduce the key steps of this derivation during a quiz.

VII. RECOMMENDED MATERIALS OF INSTRUCTION

Textbooks:

A. Halliday, D., Resnick, R., & Walker, J.. Fundamentals of Physics Extended. 9th Edition. wiley,

2011.

Materials Other Than Textbooks:

A. Eggert S. and Trento J., Physics 43 Lab manual , purchased at the bookstore
B. Miscellaneous graph paper will be required for experimental write-ups.
C. A scientific calculator is recommended.

Created/Revised by: Robert White
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