PHYS-240: PHYSICS FOR SCIENTISTS & ENGINEERS 2

Effective Term
Fall 2026

CC Approval
12/05/2025

AS Approval
12/11/2025

BOT Approval
12/18/2026

SECTION A - Course Data Elements

Send Workflow to Initiator
No

CB04 Credit Status
Credit - Degree Applicable

Discipline

Minimum Qualifications	And/Or
Physics/Astronomy (Master's Degree)	

Subject Code
PHYS - Physics

Course Number
240

Department
Physics

Division
Science and Engineering (SE)

Full Course Title
Physics for Scientists & Engineers 2

Short Title
Phys Scientists & Engineers 2

CB03 TOP Code
1902.00 - Physics, General

CIP Code
40.0801

CB08 Basic Skills Status
NBS - Not Basic Skills

CB09 SAM Code
E - Non-Occupational

Rationale
Fractional units (dangling units) fixed by coding of problem solving discussion as lecture. See appended faculty comments. Updates to textbook, small language improvements throughout.

SECTION B - Course Description

Catalog Course Description
This is a calculus-based introduction to the principles of heat, electricity, and magnetism. Topics include temperature, kinetic theory of gases, heat, laws of thermodynamics, electric charge and electric field, Gauss's Law, electric potential, capacitance, resistance, electric current, DC circuits, magnetism, sources of magnetism, Faraday's Law, inductance, and AC circuits. Transfers to: CSU, UC.

SECTION C - Conditions on Enrollment

Open Entry/Open Exit
No

Repeatability
Not Repeatable

Grading Options
Letter Grade or Pass/No Pass

Allow Audit
No

Requisites

Prerequisite(s)
Completion of PHYS-140 and MATH-C2220 with a minimum grade of C.

Requisite Justification

Requisite Description
Course Not in a Sequence

Subject
PHYS
Course #
140

Level of Scrutiny
Content Review

Upon entering this course, students should be able to:
Completion of PHYS-140 and MATH-C2220 with a minimum grade of C.

Requisite Description
Course Not in a Sequence

Subject
MATH
Course #
C2220

Level of Scrutiny
Content Review

Upon entering this course, students should be able to:
Completion of PHYS-140 and MATH-C2220 with a minimum grade of C.

SECTION D - Course Standards

Is this course variable unit?
No

Units
4.00

Lecture Hours
36.00

Lab Hours
54.00

Activity Hours
36.00

Outside of Class Hours
90

Total Contact Hours
126

Total Student Hours
216

Distance Education Approval

Is this course offered through Distance Education?
Yes

Online Delivery Methods

DE Modalities	Permanent or Emergency Only?
Entirely Online	Permanent
Hybrid	Permanent
Online with Proctored Exams	Permanent

SECTION E - Course Content

Student Learning Outcomes

	Upon satisfactory completion of the course, students will be able to:
1.	Communicate the principles of thermodynamic, electrical and magnetic theory and how they relate to properties of materials and energy. Solve problems related to these topics using qualitative reasoning.
2.	Solve quantitative calculus level thermodynamic, electrical, and magnetic problems.
3.	Implement laboratory experiment techniques correctly during the investigation of thermodynamic, electrical and magnetic systems, interpret findings, and express the results clearly in writing.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1.	Use the Kinetic Theory of Gases to find the speed of a gas molecule.
2.	Solve calculus problems using the First and Second Laws of Thermodynamics.
3.	Find the efficiency of a Carnot Engine.
4.	Apply Newton's Laws to analyze the motion of charged particles in electric or magnetic fields.
5.	Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
6.	Use Kirchhoff's Laws to calculate all electric currents in a complex circuit.
7.	Given a charge distribution, apply Gauss's Law to derive the resulting electric fields.
8.	Analyze simple current distributions and calculate the resulting magnetic field.

9.	Use Faraday's Law of Induction to calculate the voltage generated by sinusoidal magnetic fields.
10.	Calculate the current in an RLC circuit.
11.	Predict the trajectory of charged particles in uniform electric and magnetic fields.
12.	Analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.

Course Content

1. Temperature
   a. Thermometers and temperature scales
   b. The Constant-Volume Gas Thermometer and the Kelvin Scale
   c. Thermal expansion of solids and liquids
   d. Macroscopic description of an ideal gas
2. Heat and the First Law of Thermodynamics
   a. Heat capacity and specific heat
   b. Latent heat
   c. The first law of thermodynamics
   d. Heat transfer
3. The Kinetic Theory of Gases
   a. Molecular model of an ideal gas
   b. Adiabatic processes for an ideal gas
   c. The equipartition of energy
   d. The Boltzmann Distribution Law
4. Heat Engines, Entropy, and the Second Law of Thermodynamics
   a. Heat engines and the second law of thermodynamics
   b. The Carnot engine
   c. Heat pumps and refrigerators
   d. Entropy
5. Electric Fields (Electrostatics)
   a. Coulomb’s Law
   b. The electric field
   c. Electric field lines
   d. Motion of charged particles in a uniform electric field
6. Gauss’s Law
   a. Electric flux
   b. Gauss’s Law
   c. Application of Gauss’s Law to charged insulators
   d. Conductors in electrostatic equilibrium
7. Electric Potential
   a. Potential difference and electric potential
   b. Electric potential and potential energy due to point charges
   c. Energy stored in a charged capacitor
   d. Capacitors with dielectrics
8. Current and Resistance
   a. Electric current
   b. Resistivity, Resistance and Ohm’s Law
   c. Superconductors
   d. Electrical energy and power
9. DC (Direct Current) Circuits
   a. Electromotive force
   b. Resistors in series and in parallel
   c. Kirchhoff’s Rules
   d. RC circuits
10. Magnetic Fields
    a. Magnetic force on a current-carrying conductor
    b. Torque on a current loop in a uniform magnetic field
    c. Motion of a charged particle in a magnetic field
    d. The Hall effect
11. Sources of the Magnetic Field: A. The Biot-Savart Law

a. Ampere's Law
b. Displacement current
c. Magnetism in matter

12. Faraday's Law
    a. Faraday's Law of Induction
    b. Lenz's Law
    c. Induced EMFs and electric fields
    d. Generators and motors
13. Inductance
    a. Self-inductance
    b. RL circuits
    c. Mutual inductance
    d. Oscillations in an LC circuit
14. AC (Alternating Current) Circuits
    a. AC sources and phasors
    b. The RLC Series circuit
    c. Resonance in a Series RLC circuit
    d. The transformer and power transmission
15. Maxwell's Equations

Methods of Instruction

Methods of Instruction

Types	Examples of learning activities
Discussion	Classroom discussion of example problems. This may include demonstration by the instructor or student presentations on the whiteboard.
Lecture	Presentation of course material using standard methods, for example but not limited to: speaking, work on the whiteboard, videos, lecture slides, and demonstrations.
Lab	Physical and simulated laboratory experiments. Possible activities include: observation, use of equipment, data collection, data analysis, and interpretation of results.

Online Adaptation

Types	Examples of learning activities
Discussion	Synchronous or asynchronous class discussion of example problems. This may include discussion posts, demonstration of solved problems by the instructor, or students working in groups to solve problems.
Lecture	Synchronous or asynchronous video lecture using standard methods which may include but are not limited to: speaking, lecture slides, demonstrations, and video footage of physical phenomena.
Lab	Participation in lab simulations and/or analysis and observation of video experiments. Possible activities include: observation, simulated use of equipment, data collection, data analysis, and interpretation of results.

Instructor-Initiated Online Contact Types

Announcements/Bulletin Boards
Chat Rooms
Discussion Boards
E-mail Communication
Video or Teleconferencing

Student-Initiated Online Contact Types

Chat Rooms
Discussions
Group Work

Course design is accessible

Yes

Methods of Evaluation

Methods of Evaluation

Types	Examples of classroom assessments
Exams/Tests	Exams may consist of, for example, multiple choice questions, fill in the blank, conceptual questions, and symbolic and numerical problems.
Homework	Textbook problems. These include qualitative and quantitative solving of questions on the course material.
Lab Activities	Complete lab experiments and analysis. Examples of activities include observation, operation of real or simulated equipment, data collection, data analysis, and interpretation of results.
Projects	Projects may include submitted example problem solving generated in groups, review of student note taking, and submitted practice exam drafts.

Assignments

Reading Assignments

Textbook chapters.

Laboratory Manual experiments.

Sample Reading Assignment.

1: Read Chapter 18 - Kinetic Theory of Gases Sample Reading Assignment.

2: Read Experiment 11 - The Thermal Coefficient of Linear Expansion.

Writing Assignments

Example Lab Report:

1) Cover Page (Typed): Include Your Name, Lab Exp. #, Lab Title, Date, and list of Lab Partners.

2) Procedure (Typed): In your own words describe the general procedure(s) for this experiment. The procedure can be in an outline format, paragraphs, or any other way that can best convey the procedure used to carry out the experiment, make measurements, and obtain the required results. Please: Do Not Just Copy the Procedure from the Lab Manual.

3) Data Sheet(s) Section: Include your recorded lab data sheets. Do Not Forget to include units, correct number of significant figures, and make sure your entries are legible.

4) Graph Section: Any graphs assigned are to be done on the computer with software that includes Regression Analysis by the method of least squares. The regression equation must be printed on the top of the graph. Each graph must be labeled with a Title and Axes description with units.

5) Calculations Section: Hand calculations, which includes providing units for each factor, term and results. Any conversions or geometric calculations are to be included. Intermediate calculations are to be provided. Your goal should be to write up your calculations so someone else can understand them.

6) Question Answer Section (Typed): Answers to assigned lab questions must be typed and spell checked.

7) Analysis and Conclusion (Typed): In this section, you must critically analyze your results, experiment procedure, measurement techniques, and include a conclusion that explains if the experiment objectives were met or not. Explain why or why not. You are expected to show clear logic and understanding of the final results and their physical meaning.

Outside-of-Class Assignments

Homework Problems.

Sample Problem 1:

The 1.20 kg head of a hammer has a speed of 5.5 m/s just before it strikes a nail and is brought to rest. Estimate the temperature rise of a 15-gram iron nail generated by 10 such hammer blows done in quick succession. Assume the nail absorbs all the energy.

Sample Problem 2:

Two resistors when connected in series to a 110 V line use one-fourth the power that is used when they are connected in parallel. If one resistor is 2.0 Ohms, what is the resistance of the other?

SECTION F - Textbooks and Instructional Materials

Material Type

Textbook

Author

Knight, Randall

Title
Physics for Scientists and Engineers: A Strategic Approach

Edition/Version
5th

Publisher
Pearson

Year
2022

Rationale
This is one example of a standard text.

ISBN #
978-0137344888

Material Type
Manual

Author
Wilson, D.P., Hernandez, C.A.

Title
Physics Laboratory Experiments 8th edition

Publisher
Cengage Learning

Year
2015

Material Type
Open Educational Resource (OER)

Author
Senior editors Samuel J. Ling, William Moebs, and Jeff Sanny

Title
University Physics Volume 2

Edition/Version
Web Version

Publisher
OpenStax

Year
2025

ISBN #
ISBN-13: 978-1-938168-16-1

SECTION G - Diversity, Equity and Inclusivity

How does your course and/or course outline of record reflect strategies for accommodating and engaging diverse student populations, advancing equitable outcomes, and fostering inclusion for all students?

Multiple types of activities and content delivery are included. Courses include policies for flexible deadlines and/or lowest scores dropped. In class, students are referred to student support services.

Course Codes (Admin Only)

CB00 State ID

CCC000341596

CB10 Cooperative Work Experience Status

N - Is Not Part of a Cooperative Work Experience Education Program

CB11 Course Classification Status

Y - Credit Course

CB13 Special Class Status

N - The Course is Not an Approved Special Class

CB23 Funding Agency Category

Y - Not Applicable (Funding Not Used)

CB24 Program Course Status

Program Applicable

Allow Pass/No Pass

Yes

Only Pass/No Pass

No