PHYS-140: PHYSICS FOR SCIENTISTS & ENGINEERS 1

Effective Term
Fall 2026

CC Approval
12/05/2025

AS Approval
12/11/2025

BOT Approval
12/18/2025

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
140

Department
Physics

Division
Science and Engineering (SE)

Full Course Title
Physics for Scientists & Engineers 1

Short Title
Phys Scientists & Engineers 1

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 mechanics and wave motion. Topics include measurements, vectors, kinematics and dynamics, linear and circular motion, gravitation, work and mechanical energy, conservation of energy, linear and angular momentum, rotational motion, static equilibrium, oscillations, and fluid mechanics.

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 MATH-C2210 with a minimum grade of C.

Corequisite(s)
Concurrent enrollment in or previous completion of MATH-C2220 with a minimum grade of C.

Requisite Justification

Requisite Description
Course Not in a Sequence

Subject
MATH
Course #
C2210

Level of Scrutiny
Content Review

Upon entering this course, students should be able to:
1. Calculate the derivatives of simple physics equations.
2. Find the velocity or acceleration of vector quantities using derivatives.
3. Calculate the work done by a force by evaluating the area under the curve of force vs. distance...

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:
1. Solve equations for displacement, velocity, and accelerations in a plane.
2. Solve physics problems for work, volume, pressure, etc.
3. Find integrals for physics functions using tables or methods of calculus.

4. Show a Fourier series solution for harmonics in a wave.
5. Plot a graph using Mathematica for a laboratory report.

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 kinematics and dynamics processes within the realm of Newtonian mechanics and solve problems with qualitative reasoning.
2.	Solve quantitative calculus level mechanics problems while demonstrating a thorough understanding of the application of Newton's Laws of mechanics, conservation principles, and other concepts covered in the course content outline.
3.	Implement laboratory experiment techniques correctly during the investigation of mechanics and express the results clearly in writing.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1.	Use the units of metric measurement and be able to convert from one unit to another.
2.	Solve calculus problems in kinematics using the concepts of velocity and acceleration.
3.	Use the trigonometric functions to solve vector problems.

4.	Analyze force and motion using Newton's Laws of Motion.
5.	Draw free body diagrams to find unknown forces.
6.	Use the concepts of centripetal force and Kepler's Laws of satellite motion to solve problems.
7.	Use the conservation of energy and momentum in solving motion and collision problems.
8.	Analyze torque, angular motion, and gyroscopic motion problems.
9.	Solve complex statics problems involving multiple forces.
10.	Analyze and solve problems in simple harmonic motion.

Course Content

1. Mechanics
   a. Standards of length, mass, and time
   b. Density and atomic mass
   c. Dimensional analysis
   d. Conversion of units
   e. Order-of-Magnitude calculations
2. Vectors:
   a. Vectors and scalars
   b. Some properties of vectors
   c. Components of a vector and unit vectors
3. Motion in One Dimension
   a. Average velocity
   b. Instantaneous velocity
   c. Acceleration
   d. Freely falling bodies
4. Motion in Two Dimensions: translational kinematics
   a. The displacement, velocity, and acceleration vectors
   b. Motion in two dimensions with constant acceleration
   c. Projectile motion
   d. Uniform circular motion
5. The Laws of Motion: Dynamics
   a. The concept of force
   b. Newton’s first law and inertial frames
   c. Newton’s second law
   d. Weight
   e. Newton’s third law
   f. Forces of friction
6. Circular Motion and Other Applications of Newton’s Laws
   a. Newton’s second law applied to uniform circular motion
   b. Nonuniform circular motion
   c. Motion in accelerated frames
   d. Motion in the presence of resistive forces
7. Work and Energy
   a. Work done by a constant force
   b. The scalar product of two vectors
   c. Work done by a varying force
   d. Work and kinetic energy
   e. Power
8. Potential Energy and Conservation of Energy
   a. Conservative and nonconservative forces
   b. Potential energy
   c. Conservation of mechanical energy
   d. Gravitational potential energy near the earth’s surface
   e. Nonconservative forces and the work-energy theorem
   f. Potential energy stored in a spring
9. Linear Momentum and Collisions
   a. Linear momentum and impulse
   b. Conservation of linear momentum for a two-particle system

   c. Collisions
   d. Collisions in one dimension
   e. Two-dimensional collisions
   f. The center of mass
10. Rotation of a Rigid Body About a Fixed Axis
   a. Angular velocity and angular acceleration
   b. Rotational kinematics
   c. Rotational kinetic energy
   d. Calculations of moments of inertia
   e. Torque
   f. Work and energy in rotational motion
11. Rolling Motion (rotational dynamics), Angular Momentum, and Torque
   a. Rolling motion of a rigid body
   b. The vector product and torque
   c. Angular momentum of a particle
   d. Conservation of angular momentum
12. Statics: Static Equilibrium and Elasticity
   a. The conditions of equilibrium of a rigid object
   b. The center of gravity
   c. Elastic properties of solids
13. Oscillatory Motion
   a. Simple harmonic motion
   b. Energy of the simple harmonic oscillator
   c. The pendulum
   d. Damped oscillations
   e. Forced oscillations
14. The Law of Universal Gravitation
   a. Newton's Universal Law of Gravitation
   b. Measurement of the gravitational constant
   c. Weight and gravitational force
   d. Kepler's laws
   e. The law of universal gravitation and the motion of planets
   f. The gravitational field
   g. Gravitational potential energy
15. Fluid Mechanics
   a. States of Matter
   b. Density and pressure
   c. Variation of pressure with depth
   d. Pressure measurements
   e. Fluid dynamics
   f. Streamlines and the equation of continuity
   g. Bernoulli's Equation

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.
Lab	Physical and simulated laboratory experiments. Possible activities include: observation, use of equipment, data collection, data analysis, and interpretation of results.
Lecture	Presentation of course material using standard methods, for example but not limited to: speaking, work on the whiteboard, videos, lecture slides, and demonstrations.

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.
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.
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.

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	Multiple choice questions, conceptual questions, and symbolic and numerical problems.
Homework	Textbook problems.
Lab Activities	Complete lab experiments and analysis.
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 9 - Linear Momentum.

Sample Reading Assignment 2: Read Experiment 3 - Uniformly Accelerated Motion.

Writing Assignments

Example Lab Report Requirements:

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.

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Outside-of-Class Assignments

Homework Problems

Sample Problem 1:

A person jumps from the roof of a house 4.0 m high. When he strikes the ground below, he bends his knees so that his torso decelerates over an approximate distance of 0.71 m. If the mass of his torso (excluding legs) is 43 kg , find: (a) his velocity just before his feet strike the ground, and (b) the magnitude of the average force exerted on his torso by his legs during deceleration.

Sample Problem 2:

Water at a gauge pressure of 3.8 atm at street level flows into an office building at a speed of 0.70 m/s through a pipe 5.4 cm in diameter. The pipe tapers down to 2.8 cm in diameter by the top floor, 18 m above, where the faucet has been left open. (a) Calculate the flow velocity in the pipe on the top floor. (b) Calculate the gauge pressure in the pipe on the top floor. Assume no branch pipes and ignore viscosity.

SECTION F - Textbooks and Instructional Materials

Material Type

Open Educational Resource (OER)

Author

Senior editors W. Moebs, S. J. Ling, J. Sanny

Title

University Physics Volume 1

Edition/Version

Web version

Publisher

OpenStax

Year

2025

ISBN #

978-0137344888

Material Type

Textbook

Author
Knight, Randall

Title
Physics for Scientists and Engineers: A Strategic Approach

Edition/Version
5th

Publisher
Pearson

Year
2021

Rationale
This is a standard text in the field.

ISBN #
978-0137344888

Material Type
Manual

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

Title
Physics Laboratory Experiments 8th edition

Publisher
Cengage Learning

Year
2015

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
CCC000243442

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