PHYS 2A: GENERAL PHYSICS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2025
Units:	5
Hours:	4 lecture, 3 laboratory per week (84 total per quarter)
Prerequisite:	MATH 48C or equivalent.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area 5: Natural Sciences w/ Lab
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Description

Lectures, demonstrations, and problems in mechanics; properties of matter.

Course Objectives

The student will be able to:

1. Explain basic kinematics and solve related problems.
2. Apply Newtonian dynamics and the three laws of motion.
3. Explain work, energy, and power, and solve related problems.
4. Derive momentum and impulse and apply these concepts to problems.
5. Apply their understanding of mechanics to rotational cases.
6. Apply their understanding of mechanics to the standard introductory topics of oscillators and universal gravity.
7. Assess the limitations of physical laws and make mathematical approximations in appropriate situations.
8. Discuss how physical laws are established and the role of scientific evidence as support.
9. Discuss historical and current barriers to access in physics.

Course Content

1. Explain basic kinematics and solve related problems
    a. Concept of position
    b. Concept of velocity
        i. Average velocity
        ii. Instantaneous velocity
    c. Concept of acceleration
        i. Average acceleration
        ii. Instantaneous acceleration
    d. Problems featuring constant acceleration
    e. Falling body problems
2. Motion in two or three dimensions
    a. Position, velocity, and acceleration as vectors
    b. Projectile motion
    c. Motion in a circle
3. Apply Newtonian dynamics and the three laws of motion
    a. Concept of a force
    b. Newton's first law
    c. Newton's second law
        i. The difference between mass and weight
        ii. Free body diagrams
    d. Newton's third law
    e. Special forces
        i. The spring force
        ii. Friction
        iii. The centripetal force
4. Explain work, energy, and power, and solve related problems
    a. The definition of work
        i. Work in one dimension as a result of a constant force
        ii. Work in one dimension as a result of a non-constant force
        iii. Work when the displacement and force are not in one dimension
    b. Kinetic energy
        i. Derivation from Newton's second law
        ii. The work-energy theorem
    c. Power
    d. Potential energy
        i. Derivation from work
        ii. Gravitational potential energy
        iii. Spring potential energy
        iv. Conservation of energy
            1. Conservative and nonconservative forces
            2. Conservation of energy-type problems with friction
5. Derive momentum and impulse and apply these concepts to problems
    a. Conservation of momentum from Newton's third law
    b. Definition of impulse
    c. Elastic and inelastic collisions
    d. The center of mass
6. Apply their understanding of mechanics to rotational cases
    a. Definitions of angular position, velocity, and acceleration
        i. Cases with constant angular acceleration
        ii. Relationship between linear and angular motion
    b. Energy considerations in rotational motion
    c. The moment of inertia
        i. Moment of inertia for collections of point particles
        ii. Moments of inertia for extended bodies
        iii. The parallel axis theorem
    d. Torque
    e. Angular momentum
7. Apply their understanding of mechanics to the standard introductory topics of oscillators and universal gravity
    a. Statics
        i. Equilibrium
        ii. Center of gravity
    b. Oscillators
        i. Simple harmonic motion
            1. Spring and a mass
            2. Pendula
            3. Damped oscillators

4. Forced oscillators
5. Resonance

c. Universal gravitation
   i. Newton's law of gravitation
   ii. Gravitational potential energy
   iii. Kepler's laws
      1. Historical development
      2. Motion of satellites

8. Assess the limitations of physical laws and make mathematical approximations in appropriate situations
   a. Physical laws as ideal models
   b. Methods of approximation
9. Discuss how physical laws are established and the role of scientific evidence as support
   a. Historical development of a sampling of physical laws
   b. Use of student-collected data in labs to confirm physical laws
10. Discuss historical and current barriers to access in physics
   a. Discuss that historically our field has had barriers to entry and advancement due to race, gender, sexuality, class, and other factors
   b. Discuss that many of these issues persist to the current day and detail efforts to address them
   c. Discuss "hidden figures" in our field

Lab Content

Suggested laboratory experiments (most experiments should rely on data generated by student's measurements of physical phenomena):

1. Measurements and experimental errors
2. Gravitational acceleration
3. Newton's second law of motion
4. Concurrent forces in equilibrium
5. Uniform circular motion
6. Conservation of energy
7. Collisions and conservation of momentum
8. Torque and center of mass
9. Hooke's law and simple harmonic motion
10. Archimedes' principle
11. Moment of inertia of a solid disk and ring
12. Experimental design

Special Facilities and/or Equipment

1. Physics laboratory with equipment for teaching introductory mechanics.
2. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Weekly assignments
Weekly quizzes
Mid-term test(s)
Laboratory
Project/presentation
Final examination
Students are evaluated using a variety of measures that can include written exams, project presentations, and discussions, in order to allow them to demonstrate their knowledge and skills by the end of the quarter

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture (may be live/interactive or in the form of pre-recorded videos)
Discussion
Cooperative learning exercises
Oral presentations
Laboratory
Demonstration
Students gain an understanding of physics through connecting new terms, concepts, and procedures to what they already know through small group and large group discussions, making predictions and correcting each other's assumptions on ranking tasks, and practicing problem solving methods with the support and guidance of peers and the instructor

Representative Text(s) and Other Materials

Urone and Hinrichs. OpenStax College Physics. 2012.

OpenStax is the main OER text in the field. The text itself has undergone regular updates since 2012, but the copyright/edition date remains 2012. Additionally, the content of this course was developed between the 1600s and the 1860s, so the material has not advanced.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Homework problems: Homework problems covering subject matter from text and related material ranging from 10-40 problems per week. Students will need to employ critical thinking in order to complete assignments.
2. Lecture: Four hours per week of lecture covering subject matter from text and related material. Reading and study of the textbook, related materials, and notes.
3. Labs: Students will perform experiments and discuss their results either in the form of a written lab report or via oral examination. Reading and understanding the lab manual prior to class is essential to success.

Discipline(s)

Physics/Astronomy