GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: PHYS 4A DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Spring 2022 CURRICULUM APPROVAL DATE: 05/10/2022

SHORT TITLE: PHYS FOR SCI & ENG I

LONG TITLE: Physics for Scientists and Engineers - Mechanics

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	3	54
		Lab:	3	54
		Other:	0	0
		Total:	6	108

COURSE DESCRIPTION:

An introduction to the principles of physics using calculus. Topics include kinematics in one, two and three dimensions, vectors, equilibrium and non- equilibrium applications of Newton's Laws, work and energy, momentum, systems of particles, rotational kinematics and dynamics, properties of materials, and fluid mechanics. (C-ID: PHYS 205) (C-ID: PHYS 200S: Phys 4A + Phys 4B + Phys 4C) PREREQUISITE: Completion of MATH 1A with a grade of 'C' or better. CO- REQUISITE: MATH 1B. ADVISORY: A year of high school physics or PHYS 1 or PHYS 2A.

PREREQUISITES:

Completion of MATH 1A, as UG, with a grade of C or better.
AND Completion of MATH 1B, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
047 - Laboratory - LEH 0.7
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed
73 - Dist. Ed Internet Delayed LAB
737 - Dist. Ed Internet LAB-LEH 0.7

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Identify, describe, compare and contrast the various units of numbers and their significance.
2. Describe vectors and their manipulation and use them as problem solving tools.
3. Identify, describe, compare and contrast distance, displacement, speed, velocity and acceleration.
4. Identify, describe, compare and contrast various forces, Newton's Laws, conservation of momentum, conservation of energy, power and work.
5. Identify, describe, compare and contrast rotational kinematics and dynamics.
6. Identify and describe simple harmonic motion.
7. Identify and describe the role of calculus as a tool to describe the physical world.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Predict the future trajectory of an object moving in two dimensions with uniform acceleration.
2. Analyze a physical situation with multiple constant forces acting on a point mass using Newtonian mechanics.
3. Analyze a physical situation with multiple forces acting on a point mass or extended object using concepts of work and energy.
4. Demonstrate a basic conceptual understanding of the fundamental concepts and definitions needed to solve problems in classical Newtonian mechanics.
5. Analyze situations involving applications of Newtonian Mechanics: gravitation and fluids mechanics.
6. Analyze real-world experimental data, including appropriate use of units and significant figures, and relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 05/10/2022

LECTURE CONTENT:

3 HOURS

1. Units and Measurement

1.1 The Scope and Scale of Physics

1.2 Units and Standards

1.3 Unit Conversion

1.4 Dimensional Analysis

1.5 Estimates and Fermi Calculations

1.6 Significant Figures

1.7 Solving Problems in Physics

3 HOURS

2. Vectors

2.1 Scalars and Vectors

2.2 Coordinate Systems and Components of a Vector

2.3 Algebra of Vectors

2.4 Products of Vectors

3 HOURS

3. Motion Along a Straight Line

3.1 Position, Displacement, and Average Velocity

3.2 Instantaneous Velocity and Speed

3.3 Average and Instantaneous Acceleration

3.4 Motion with Constant Acceleration

3.5 Free Fall

3.6 Finding Velocity and Displacement from Acceleration

3 HOURS

4. Motion in Two and Three Dimensions

4.1 Displacement and Velocity Vectors

4.2 Acceleration Vector

4.3 Projectile Motion

4.4 Uniform Circular Motion

4.5 Relative Motion in One and Two Dimensions

6 HOURS

5. Newton's Laws of Motion

5.1 Forces

5.2 Newton's First Law

5.3 Newton's Second Law

5.4 Mass and Weight

5.5 Newton’s Third Law

5.6 Common Forces

5.7 Drawing Free-Body Diagrams

3 HOURS

6. Applications of Newton's Laws

6.1 Solving Problems with Newton’s Laws

6.2 Friction

6.3 Centripetal Force

6.4 Drag Force and Terminal Speed

3 HOURS
7. Work and Kinetic Energy
7.1 Work
7.2 Kinetic Energy
7.3 Work-Energy Theorem
7.4 Power
3 HOURS
8. Potential Energy and Conservation of Energy
8.1 Potential Energy of a System
8.2 Conservative and Non-Conservative Forces
8.3 Conservation of Energy
8.4 Potential Energy Diagrams and Stability
8.5 Sources of Energy
6 HOURS
9. Collisions and Momentum
9.1 Linear Momentum
9.2 Impulse and Collisions
9.3 Conservation of Linear Momentum
9.4 Types of Collisions
9.5 Collisions in Multiple Dimensions
9.6 Center of Mass
9.7 Rocket Propulsion
6 HOURS
10. Fixed-Axis Rotation
10.1 Rotational Variables
10.2 Rotation with Constant Angular Acceleration
10.3 Relating Angular and Translational Quantities
10.4 Moment of Inertia and Rotational Kinetic Energy
10.5 Calculating Moments of Inertia
10.6 Torque
10.7 Newton’s Second Law for Rotation
10.8 Work and Power for Rotational Motion
3 HOURS
11. Angular Momentum
11.1 Rolling Motion
11.2 Angular Momentum
11.3 Conservation of Angular Momentum
3 HOURS
12. Static Equilibrium and Elasticity
12.1 Conditions for Static Equilibrium
12.2 Examples of Static Equilibrium
12.3 Stress, Strain, and Elastic Modulus

3 HOURS
13. Gravitation
13.1 Newton's Law of Universal Gravitation
13.2 Gravitation Near Earth's Surface
13.3 Gravitational Potential Energy and Total Energy
13.4 Satellite Orbits and Energy
13.5 Kepler's Laws of Planetary Motion
4 HOURS
14. Fluid Mechanics
14.1 Fluids, Density, and Pressure
14.2 Measuring Pressure
14.3 Pascal's Principle and Hydraulics
14.4 Archimedes? Principle and Buoyancy
14.5 Fluid Dynamics
14.6 Bernoulli’s Equation
14.7 Viscosity
2 HOURS
Final Exam
Total 54 Hours

LAB CONTENT:
The Lab activities for the course will be divided as:
(a) Experimental activities or educational simulations (50%)
(b) Problem-Solving activities using computational tools and programming (50%)
6 HOURS
LAB: Basic Introduction to a high order programming language such as MATLAB or Octave.
3 HOURS
LAB: Free-fall determination of g.
3 HOURS
LAB: Moving Man: One Dimensional Kinematics
3 HOURS
LAB: Finding resultant vectors.
3 HOURS
LAB: Projectile motion.
3 HOURS
LAB: Acceleration of a system subjected to unbalanced forces.
3 HOURS
LAB: Frictional forces
3 HOURS
LAB: Centripetal acceleration and uniform circular motion.
3 HOURS
LAB: Conservation of energy using springs
3 HOURS
LAB: Conservation of energy using pendulum
3 HOURS
LAB: Conservation of momentum - collisions
3 HOURS
LAB: Angular acceleration of rotating objects.

3 HOURS
LAB: Equilibrium of a rigid bar subjected to torques.
3 HOURS
LAB: Conservation of momentum for multi-particle systems.
3 HOURS
LAB: Stress-strain behavior of solids.
3 HOURS
LAB: Gravity and Orbits
3 HOURS
LAB: Buoyancy and Torricelli's Tower.
Total 54 Hours

METHODS OF INSTRUCTION:
Lecture/discussion. Laboratory exercises. Group projects.

OUT OF CLASS ASSIGNMENTS:
Required Outside Hours 54
Assignment Description
Regularly assigned homework that requires students to analyze and study pertinent text material, solved examples and lecture notes.

Required Outside Hours 54
Assignment Description
Regularly assigned homework that requires students to apply the principles and skills covered in class by solving related problems using analytical and computational methods.

METHODS OF EVALUATION:
Objective examinations
Evaluation Percent 60
Evaluation Description
In-class written exams.

Writing assignments
Evaluation Percent 20
Evaluation Description
Lab reports.

Problem-solving assignments
Evaluation Percent 20
Evaluation Description
Homework, quizzes, projects.

REPRESENTATIVE TEXTBOOKS:

University Physics Volume 1, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-20-4
Rationale: Open Source.
12 Grade Verified by: David Argudo

University Physics Volume 2, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-21-2
Rationale: Open Source
12 Grade Verified by: David Argudo

University Physics Volume 3, Ling, Moebs and Sanny, OPENSTAX, 2021.
ISBN: ISBN-10: 1-947172-22-0
Rationale: Open Source
12 Grade Verified by: David Argudo
Loyd, David. Physics Lab Manual 4th Edition, Cengage Learning (ISBN: 9781285650043)

RECOMMENDED TEXTBOOKS OR OTHER MATERIALS:

UCD: Physics 9A ? Classical Mechanics by Tom Weideman :https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Physics_9A__Classical_Mechanics

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

GAV B1, effective 201270

GAV B3, effective 201270

CSU GE:

CSU B1, effective 201270

CSU B3, effective 201270

IGETC:

IGETC 5A, effective 201270

IGETC 5C, effective 201270

CSU TRANSFER:

Transferable CSU, effective 201270

UC TRANSFER:

Transferable UC, effective 201270

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: XXXXXX
CAN Sequence: PHYS SEQ B
CSU Crosswalk Course Department: PHYS
CSU Crosswalk Course Number: 205
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000292018
Sports/Physical Education Course: N
Taxonomy of Program: 190200