PHYS 40 Course Outline as of Fall 2024

CATALOG INFORMATION

Dept and Nbr: PHYS 40 Title: CLASSICAL MECHANICS
Full Title: Classical Mechanics for Scientists and Engineers
Last Reviewed: 10/23/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	5.00	Lecture Scheduled	4.00	17.5	Lecture Scheduled	70.00
Minimum	5.00	Lab Scheduled	3.00	8	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	7.00		Contact Total	122.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 140.00 Total Student Learning Hours: 262.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	PHYS 4A

Catalog Description:
Students will use calculus, algebra, and trigonometry to apply physics laws and principles to solve problems involving translational and rotational motion, work and energy, conservation of energy and momentum, static equilibrium, and universal gravitation.

Prerequisites/Corequisites:
Completion of MATH 1A or higher (MATH)

Recommended Preparation:
One year of high school physics or PHYS 1

Limits on Enrollment:

Schedule of Classes Information:
Description: Students will use calculus, algebra, and trigonometry to apply physics laws and principles to solve problems involving translational and rotational motion, work and energy, conservation of energy and momentum, static equilibrium, and universal gravitation. (Grade Only)
Prerequisites/Corequisites: Completion of MATH 1A or higher (MATH)
Recommended: One year of high school physics or PHYS 1

Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 1982	
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 1982	
	B3	Laboratory Activity		
IGETC:	**Transfer Area**		Effective:	Inactive:
	5A	Physical Sciences	Fall 1982	
	5C	Fulfills Lab Requirement		

CSU Transfer:	Transferable	Effective:	Fall 1982	Inactive:
UC Transfer:	Transferable	Effective:	Fall 1982	Inactive:

CID:

CID Descriptor:PHYS 200S	Calculus-Based Physics for Scientists and Engineers: ABC
SRJC Equivalent Course(s):	PHYS40 AND PHYS41 AND PHYS42 AND PHYS43
CID Descriptor:PHYS 205	Calculus-Based Physics for Scientists and Engineers: A
SRJC Equivalent Course(s):	PHYS40

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Apply physical principles and laws of classical mechanics to analyze and solve physics problems in mechanics through critical thinking, mathematical modeling, and laboratory experimentation.
2. Design and assemble apparatuses to measure physical phenomena.
3. Analyze and make meaningful comparisons between experiment and theory.
4. Effectively communicate ideas and processes of physics.

Objectives:
At the conclusion of this course, the student should be able to:
1. Apply the Systeme International (SI) units and metric prefixes to the solution of problems in mechanics.
2. Use vectors to represent vector quantities in mechanics and use vector operations to solve mechanics problems.
3. Relate the kinematics concepts to graphs of displacement, velocity, and acceleration versus time using integration and differentiation.
4. Solve one- and two-dimensional kinematics problems including free fall, projectile, and circular motion.
5. Explain the concepts of force, inertia, and mass and apply Newton's laws to solve problems in linear and circular motion.

6. Describe the concepts of work, energy, kinetic energy, potential energy, and power, and use those concepts to solve translational and rotational mechanics problems.
7. Use the concepts of linear momentum and impulse to solve problems involving elastic, inelastic, and perfectly inelastic collisions in one and two dimensions.
8. Use the concepts of moment of inertia, torque, and angular momentum to solve problems involving rotating and rolling objects and systems.
9. Calculate moments of inertia for systems of particles and solids using the parallel axis theorem and integration.
10. Describe the conditions necessary for static equilibrium and solve problems involving static equilibrium of rigid bodies in two dimensions.
11. Apply Kepler's laws and Newton's law of universal gravitation to solve problems involving planetary motion and the launching and orbit of satellites.
12. Place the significant advancements in mechanics on an historical timeline and within a developmental context.

Lab-Related Objectives:
1. Develop and conduct experiments that apply the scientific method and error analysis to explore principles in mechanics.
2. Use manual and computerized data collection techniques to measure and analyze parameters related to mechanics.
3. Plot, curve fit, and interpret data using a spreadsheet or another analysis tool.

Topics and Scope:

Lecture-Related Topics and Scope:
I. Measurement and Units
   A. SI (Systeme International)
   B. Metric prefixes
   C. Common conversions
II. Vectors
   A. Vector components
   B. Vector addition
   C. Dot product
   D. Cross product
III. Motion in One and Two Dimensions
   A. Definitions of displacement, velocity, and acceleration
   B. Instantaneous and average values of quantities
   C. Motion graphs and integration and differentiation
   D. Free-fall, projectile, and circular motion
IV. Newton's Laws of Motion
   A. Newton's First law and static equilibrium
   B. Newton's Second law and linear and rotational dynamics
   C. Newton's Third law and the interactions of objects
V. Work and Energy
   A. Definitions of work, kinetic energy, and potential energy
   B. Conservative and non-conservative forces
   C. Conservation of energy
   D. Power
   E. Work-Energy Theorem
VI. Linear Momentum and Impulse
   A. Definitions
   B. Conservation of linear momentum

C. Elastic and inelastic collisions
D. Impulse-Momentum Theorem
VII. Rotational Motion
A. Angular position, velocity, and acceleration
B. Torque
C. Moments of inertia
D. Angular momentum
E. Conservation of angular momentum
F. Newton's Second law for rotational motion
VIII. Static Equilibrium of Rigid Bodies in Two Dimensions
IX. Universal Gravitation
A. Newton's law of universal gravitation
B. Kepler's laws
C. Gravitational field and potential energy
X. Historical Development of Physics
XI. Fluid Mechanics (optional, if time allows)
A. Pressure-depth relationship and Pascal's law
B. Buoyancy and Archimedes' Principle
C. Fluid dynamics and Bernoulli's Equation

Lab-Related Topics and Scope:
I. Laboratory Safety and Procedures
II. Writing Lab Reports
III. Measurement Techniques for Mechanical Systems
A. Manual data collection with tools such as calipers, stop watches, and meter sticks
B. Computerized data collection with tools such as motion detectors and force probes
IV. Data Processing and Graphing Results with Spreadsheets
V. Error Analysis

Assignment:

Lecture-Related Assignments:
1. Reading (20-30 pages per week)
2. Homework problem sets (12-30)
3. Quizzes (5-15)
4. Exams (3-5)

Lab-Related Assignments:
1. Laboratory experiments (8-15)
2. Lab reports (8-15)

Lecture- and Lab-Related Assignments:
1. Final exam

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab reports	Writing 5 - 10%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems sets; laboratory experiments	Problem solving 15 - 35%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes; exams; final exam	Exams 50 - 75%

Other: Includes any assessment tools that do not logically fit into the above categories.

Class participation	Other Category 0 - 5%

Representative Textbooks and Materials:
Physics for Scientists and Engineers with Modern Physics. 10th ed. Serway, Raymond and Jewett, John. Cengage Learning. 2019.
Physics for Scientists and Engineers: A strategic Approach with Modern Physics. 5th ed. Knight, Randell. Pearson. 2021.
Lab Manual and Instructor Prepared Materials

Open Educational Resource (OER) Material:
University Physics by OpenStax 1 vol, Ling, Samuel and Sanny, Jeff and Moebs, William https://openstax.org/details/books/university-physics-volume-1