PHYS 40 Course Outline as of Summer 2015

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:
This is a course intended for science and engineering students and will use vectors and calculus to investigate 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 (V2)

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

Limits on Enrollment:

Schedule of Classes Information:
Description: This is a course intended for science and engineering students and will use vectors and calculus to investigate 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 (V2)
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

Outcomes and Objectives:
1. Apply the SI (Systeme International) 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 and graphs of displacement, velocity, and acceleration versus time using integration, 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 them to solve translational and rotational mechanics problems for both conservative and non-conservative force situations,
7. Define linear momentum and impulse and use these principles to solve problems involving one and two dimensional, elastic, inelastic, and perfectly inelastic collisions.
8. Define the concepts of moment of inertia, torque, and angular momentum and use them 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 Law 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 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:

1. Measurement and units
   a. SI (Systeme International)
   b. Metric prefixes
   c. Common conversions
2. Vectors
   a. Vector components
   b. Vector addition
   c. Dot product
   d. Cross product
3. Motion in one and two dimensions
   a. Displacement, velocity, acceleration definitions
   b. Instantaneous and average values of quantities
   c. Integration and differentiation of motion graphs
   d. Free-fall, projectile and circular motion
4. 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
5. 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
6. Linear momentum and impulse
   a. Definitions
   b. Conservation of linear momentum
   c. Elastic and inelastic collisions
   d. Impulse-Momentum Theorem
7. 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 torques
8. Static equilibrium of rigid bodies in two dimensions
9. Universal gravitation

a. Newton's Law of Universal Gravitation
b. Kepler's Laws
c. Gravitational fields and potential energy
10. Historical development of physics
11. Fluid mechanics. (Optional as time allows.)
a. Pressure-depth relationship and Pascal's Law
b. Buoyancy and Archimedes' Principle
c. Fluid dynamics and Bernoulli's Equation

Lab Topics:
1. Laboratory safety and procedures
2. Writing lab reports
3. Measurement techniques for mechanical systems
a. Manual data collection with calipers, stop watches, meter sticks, etc.
b. Computerized data collection with motion detectors, force probes, etc.
4. Data Processing and graphing results with spreadsheets
5. Error analysis

Assignment:

1. 12 -30 sets of homework problems.
2. 0-15 quizzes.
3. 3-5 mid-term exams.
4. 12-16 laboratory experiments.
5. 2-4 formal lab reports.
6. 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.

Formal 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, Lab experiments.	Problem solving 10 - 30%

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.

Objective examinations, Quizzes, Final exam	Exams 50 - 75%

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

Participation and attendance	Other Category 5 - 10%

Representative Textbooks and Materials:
Physics for Scientists and Engineers by Serway & Jewett, 8th edition, Saunders 2010