Santa Monica College

Course Outline for
PHYSICS 21, Mechanics With Lab

Course Title: Mechanics With Lab		Units: 6.00
Total Instructional Hours (usually 18 per unit):	144.00	
Hours per week (full semester equivalent) in Lecture:	5.00	
In-Class Lab:	3.00	
Arranged:	0.00	
Outside-of-Class Hours	180.00	

Date Submitted:	May 2011
Date Updated:	April 2014
C-ID:	
Transferability:	Transfers to CSU Transfers to UC

IGETC Area:

IGETC Area 5: Physical and Biological Sciences (mark all that apply)
- A: Physical Science
- C: Physical or Biological Science LABORATORY

CSU GE Area:

CSU GE Area B: Scientific Inquiry and Quantitative Reasoning (mark all that apply)
- B1 - Physical Science
- B3 - Laboratory Sciences

SMC GE Area:

GENERAL EDUCATION PATTERN (SMC GE)
- Area I: Natural Science

Degree Applicability:	Credit - Degree Applicable
Prerequisite(s):	MATH 7
Pre/Corequisite(s):	None
Corequisite(s):	None
Skills Advisory(s):	None

I. Catalog Description

This course is a calculus-based study of the mechanics of rigid bodies, emphasizing Newton's laws and its applications. This course includes an introduction to fluids. It is designed for engineering, physical science, and computer science majors.

II. Examples of Appropriate Text or Other Required Reading: (include all publication dates; for transferable courses at least one text should have been published within the last five years)

1. University Physics with Modern Physics, 13th , Young & Freedman, Addison Wesley ©

2012, ISBN: 0321675460;
2. Physics for Scientists and Engineers, Serway & Jewett, Cengage Learning © 2014, ISBN: 1133947271;
3. Fundamentals of Physics, 10, Halliday, Resnick, Walker, Wiley © 2013, ISBN: 978-1-118-23072-5;
4. Mastering Physics, computer-based homework management and tutoring program to accompany text.
5. Heuvelen, Alessandris, Braun, Wozny. Study Guide with ActivPhysics 1, Volume 1.
6. Student Solution Manual to accompany textbook.

III. Course Objectives

Upon completion of this course, the student will be able to:

1. Use the basic concepts in physics to qualitatively explain physical phenomena.
2. Compile data from a physical problem and synthesize these data into a mathematical problem.
3. Take the mathematical problem to a successful conclusion using mathematical principles of algebra, trigonometry, and calculus.
4. Operate, adjust, and use the equipment necessary in laboratory experiments to obtain quantitative measurements.
5. Estimate the uncertainty of a measurement and calculate the uncertainty in the results obtained from such measurements.
6. Use the mathematical tools of the computer, such as spreadsheets and graphing programs, to analyze data.
7. Write laboratory reports including statement of purpose, compilation of data, theory involved in the experiment, method of measurements, samples of calculations, tabulation of results, and analyses of sources of error.
8. Continue their science education by having the skills to succeed in more advanced physics courses.

IV. Methods of Presentation:

Other (Specify), Lab, Lecture and Discussion
Other Methods: The primary methods of presentation are the lecture and the lecture-demonstration. These are supplemented with audiovisual materials such as computer simulations, CD-ROMS, laser discs, and transparencies. Cooperative learning between students is utilized as much as possible. The interest of the student is often stimulated by demonstrations, so many demonstrations exhibiting physical phenomena are shown.

V. Course Content

% of Course	Topic
20.00%	Kinematics: Introduction & Vectors, Motion in 1 and 2 Dimensions
25.00%	Dynamics: Force, Motion and Newton’s Laws, Circular Motion, Gravitation
25.00%	Conservation Principles: Work, Energy, Power, Conservation of Energy, System of Particles, Conservation of Momentum

25.00%	Rotations and Oscillations: Rotational Dynamics, Angular Momentum, Static Equilibrium, Simple Harmonic Motion
5.00%	Introduction to Fluids
100.00%	Total

Vb. Lab Content:

% of course	Topic
8.00%	Measurement and Errors
8.00%	Addition of Vectors
8.00%	Graph Matching and Motion
8.00%	Projectile Motion
8.00%	Circular Motion
8.00%	Newton's Second Law
8.00%	Non-conservative Forces
8.00%	Energy
10.00%	Ballistic Pendulum
10.00%	Rotational Inertia
8.00%	Rigid Equilibrium
8.00%	Physical Pendulum
100.00%	Total

VI. Methods of Evaluation: (Actual point distribution will vary from instructor to instructor but approximate values are shown.)

Percentage	Evaluation Method
55 %	Exams/Tests - 3 or 4 Unit Exams
25 %	Final exam
15 %	Lab Reports - 8 to 12 Laboratory Activities
5 %	Written assignments - Problem Homework Assignments
100 %	Total

VII. Sample Assignments:

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Roughly weekly homework consisting of approximately 20 problems and questions similar to the following examples:
1. A model rocket (30.0 kg) is launched from the ground into the air at an angle of 60.0° at an initial speed of 25.0 m/s. Once it leaves the ground, the rocket feels a constant thrust force of 180 N, directed horizontally forward. (Even though the rocket’s velocity changes direction, the engines always provide horizontal thrust.) This thrust acts on the rocket until it reaches its highest point. At that point it breaks into two pieces (m1 = 10.0 kg and m2 = 20.0 kg). The 10.0 kg piece (m1) is momentarily at rest after the explosion and then drops straight down to the ground. Calculate where the other piece (m2) hits the ground.
2a. A motor applies a tangential force of 120 N to the outer edge of a 10.0 kg disk of radius 0.800 m. It accelerates from rest to 300 rad/s in a time of 12.0 s. Some unknown frictional torque also acts on the disk while it spins. Calculate the frictional torque (not the frictional force) acting on the disk
2b. The motor is turned off when the disk is moving at 300 rad/s. The friction still acts from part a. How many revolutions will the disk make as it comes to a stop?
3. Two identical satellites are in circular orbits around the Earth, one is at a height of 6370 km and the other is at a height of 12,740 km above the Earth’s surface. Which satellite has the greatest speed and which has the greatest angular momentum about the Earth? How much energy would have to be added to or removed from the higher satellite to move it to the same orbit as the lower satellite. Explain/show your reasoning.

VIII. Student Learning Outcomes

1. When presented with a physical situation and asked to solve a particular problem in mechanics (i.e. two masses connected via a string passing over a pulley), the student will follow a logical process based on well-established physics principles (i. e. Newton¿s laws) and demonstrate ability to use basic mathematical techniques including calculus.
2. When conducting a laboratory experiment and writing a lab report, the student will demonstrate understanding of the basics of the scientific method by being able to state a clear and testable hypothesis, taking careful measurements, estimating uncertainties, and drawing appropriate conclusions based on gathered data and on sound scientific principles.

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