GROSSMONT COLLEGE

Official Course Outline

PHYSICS 140 – MECHANICS OF SOLIDS

1. Course Number Course Title Semester Units Semester Hours

PHYC 140 Mechanics of Solids 4 3 hours lecture

3 hours laboratory

96-108 total hours

2. Course Prerequisites

A “C” grade or higher or “Pass” in Mathematics 180 or equivalent.

3. Catalog Description

This is the first course of a three-semester, calculus level sequence of physics courses designed for engineering, physics, mathematics, and science majors. The course assumes no previous physics study, but makes extensive use of algebra, trigonometry, geometry, and calculus, as appropriate. Topics include linear and rotational kinematics and dynamics with graphical analysis, energy and energy conservation, linear and angular momentum and their conservation laws, and gravitation. Applications include period motion, vibration, fluids, and wave propagation.

4. Course Objectives

The student will:

Describe basic concepts in mechanics of solids and define the laws and principles of fundamental physics related to these topics.

Recognize graphical and symbolic representations of position, velocity, and acceleration and their relationships in one, two, and three dimensions.

c. Analyze forces and torques in given physical situations, diagram them, and formulate equations to compute translational and rotational accelerations using Newton’s laws.

d. Comprehend the concept of conserved quantities, recognize when they occur in different physical situations and formulate approaches to problem solving using conservation techniques.

e. Analyze written problems on all topics to determine which physical laws and concepts are required for solutions.

f. Calculate solutions to physics problems using the fundamental principles of physics and algebraic, trigonometric, and calculus principles.

g. Employ basic measurement equipment and laboratory techniques to study the laws and principles used in the course.

h. Assess the importance of measurement errors in laboratory experiments and evaluate experimental results in terms of expected results.

5. Instructional Facilities

Standard classroom with computer connectivity and room for demonstrations.

b. Complete physics laboratory demonstration and experimentation equipment.

c. Laboratory work stations with electricity, gas, water, vacuum, air, and wireless computer connectivity

d. Laboratory room must include facility for darkening completely.

e. Classroom and laboratory room must include audiovisual equipment.

f. Computer lab.

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6. Special Materials Required of Student

Protractor and ruler.

Simple drawing instruments.

c. Scientific calculator.

d. Laboratory notebook.

7. Course Content

Lecture

Description of motion: one dimensional kinematics and two and three dimensional kinematics using vectors.

Newton’s laws of motion.

Applications of Newton’s laws to circular motion and interactions with solids and fluids.

Work and energy.

Center of mass and momentum.

f. Computation of the moment of inertia.

g. Rotational kinematics and dynamics.

h. Angular momentum.

i. Newton’s law of gravity and gravitational potential energy.

j. Static equilibrium.

k. Fluids.

l. Oscillatory systems and simple harmonic motion.

j. Techniques of problem solving using dynamical equations or conservation principles, as appropriate.

Laboratory

1. Use of basic and advanced equipment to perform experiments illustrative of the topics covered in lecture.
2. Analysis of experimental data, including appropriate use of error propagation, units, and significant figures.

8. Method of Instruction

Lecture and demonstrations

b. Collaborative learning and group discussion.

c. Instructor guided problem solutions and individualized instruction.

d. Multimedia presentations.

e. Computer-aided instruction in lecture hours

f. Student-performed laboratory experiments.

9. Methods of Evaluating Student Performance

Final grade will be determined based on student performance of two or more of the following. In all areas, students will demonstrate critical thinking application skills based on the concepts studied in class.

Lab reports and personal observation of laboratory technique.

Quizzes and written or multiple choice exams including a written final exam, requiring application of principles and laws to specific problems, including diagrams.

c. Written and/or online homework assignments

d. Practical laboratory exams.

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10. Outside Class Assignments

a. Required reading in the text.

b. Completion of pre-class and post-class exercises and pre-lab and post-lab exercises.

c. Library and internet research.

d. Completion of homework assignments and completion of written laboratory work.

11. Texts

Required text(s):

Tipler, Paul and Gene Mosca. Physics for Scientists and Engineers. 6th edition Gordonsville, VA: W. H. Freeman & Co., 2004.

(2) Halliday, David, Resnick, Robert, and Walker, Jearl, Fundamentals of Physics, 9th edition, Hoboken, NJ, John Wiley & Sons, Inc., 2011

(3) Knight, Randall, Physics for Scientists and Engineers - a Strategic Approach, 3rd edition, Upper Saddle River, NJ, Pearson Education, 2012.

(4) Young, Hugh D., Freedman, Roger A., and Ford, A. Lewis, University Physics, 13th edition, Upper Saddle River, NJ, Pearson Education, 2012

(5) Physics 140 Lab Experiments. El Cajon, CA: Grossmont College.

b. Supplementary texts and workbooks:

None.

Addendum: Student Learning Outcomes

Upon completion of this course, our students will be able to do the following:

* 1. Apply Newton's Laws to static and dynamic systems of particles.
  2. Apply Newton’s laws to static and dynamic systems of rigid bodies.
  3. Distinguish between conservation principles and apply them appropriately to physical systems.
  4. Employ laboratory equipment and techniques to acquire experimental measurements, interpret the data, and communicate the results in a coherent manner.

Date approved by Governing Board: May 21, 2013