#### PHYS 40 Course Outline as of Fall 2006

## **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 | <b>Course Hours Total</b> |        |
|---------|------|-----------------------|------|--------------|---------------------------|--------|
| Maximum | 5.00 | Lecture Scheduled     | 4.00 | 17.5         | Lecture Scheduled         | 70.00  |
| Minimum | 5.00 | Lab Scheduled         | 3.00 | 17.5         | 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 scientists and engineers and will include measurement, vectors, translational and rotational motion, work and energy, conservation of energy and momentum, static equilibrium.

## **Prerequisites/Corequisites:**

Course Completion of MATH 1A

## **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 scientists and engineers and will include measurement, vectors, translational and rotational motion, work and energy, conservation of energy and momentum, static equilibrium. (Grade Only)

Prerequisites/Corequisites: Course Completion of MATH 1A Recommended: One year of high school physics or PHYS 1.

Limits on Enrollment:

Transfer Credit: CSU;UC. (CAN PHYS8)(PHYS 40+PHYS 42+PHYS 41=PHYS SEQ

B)(PHYS 43+PHYS 40+PHYS 42+PHYS 41=PHYS SEQ C) 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 SRJC Equivalent Course(s): CID Descriptor:PHYS 205 Calculus-Based Physics for Scientists and Engineers: ABC PHYS40 AND PHYS41 AND PHYS42 AND PHYS43 Calculus-Based Physics for Scientists and Engineers: A

SRJC Equivalent Course(s): PHYS40

## **Certificate/Major Applicable:**

Major Applicable Course

### **COURSE CONTENT**

### **Outcomes and Objectives:**

Upon completion of the course, the student should be able to:

- 1. State the Systems International (SI) units for length, time and mass, identify the powers of ten associated with the most common metric prefixes, and change a quantity from one set of units to another.
- 2. Explain the difference between scalar and vector quantities and give examples of each.
- 3. Use vector addition methods to determine the sum of two or more vectors, and use the vector dot product and vector cross product where applicable.
- 4. Define the concepts of displacement, velocity, and acceleration, and give one of the three as a function of time, differentiate or integrate to determine the other two.
- 5. Use graphs of displacement, velocity, and acceleration versus time to determine instantaneous and average values of these quantities.
- 6. Solve problems involving uniformly accelerated motion, including projectile motion.
- 7. Explain the concepts of tangential and radial acceleration in curvilinear motion and use the concepts in problem solving.
- 8. Define the concepts of force and mass, explain the difference between weight and mass, and give the units for force and weight.

- 9. State Newton's Laws of motion and give examples illustrating each.
- 10. Use Newton's second law to solve problems involving the acceleration of masses with one or more forces (including frictional forces) acting upon them.
- 11. Explain what a centripetal force is; give examples of centripetal forces; solve problems involving motion in a circular path.
- 12. Define the concepts of work, energy, kinetic energy, potential energy, and power, and give units in which each is expressed.
- 13. Distinguish between conservative and nonconservative forces; find potential energy functions/forces for conservative forces; use potential energy functions for conservative forces to locate equilibrium positions and determine the type of equilibrium.
- 14. State the work-energy theorem/principle of conservation of energy, and use the theorem/principle in problem solving (including translational and rotational motion).
- 15. Determine the location of the center of mass of a system of particles and of a continuous body; calculate the velocity and acceleration of the center of mass of a system of particles.
- 16. Define linear momentum and impulse; give units for each; state the principle of conservation of linear momentum; and solve problems involving momentum, impulse and conservation of linear momentum.
- 17. Describe what occurs in an elastic, partially elastic and perfectly inelastic collision; solve problems involving collisions in one and two dimensions.
- 18. Define angular displacement, angular velocity and angular acceleration; give units in which they are expressed; and solve uniformly accelerated angular motion.
- 19. Define the concept of moment of inertia; calculate the moment of inertia about a given axis for a system of particles; calculate the moment of inertia for solid objects using integration and parallel axis theorem.
- 20. Define torque and angular momentum; determine directions of torque, angular momentum, angular velocity and angular acceleration when considered as vectors; use torque and angular momentum vectors to determine the direction of precession of gyroscopes and tops.
- 21. State the principle of conservation of angular momentum; give examples illustrating the principle; and use the principle in problem solving.
- 22. Solve problems involving motion of rolling bodies both without and with slipping.
- 23. Describe the conditions necessary for static equilibrium and solve problems involving static equilibrium of a rigid body.
- Numbers 24 27 (fluid mechanics) are optional as time allows:
- 24. Define pressure, give units for pressure, explain the difference between gauge pressure and absolute pressure; calculate the pressure at a given depth in an incompressible fluid; calculate the force on a surface over which the pressure is not constant.
- 25. State Pascal's principle, give examples of its application, and use it to solve problems.
- 26. Define buoyant force, state Archimedes' principle, and use it in problem solving.
- 27. Give examples which illustrate the application of Bernoulli's

# **Topics and Scope:**

Topics covered include:

- 1. Measurement and units.
- 2. Vectors.
- 3. Motion in one and two dimensions.
- 4. Newton's Laws of motion.
- 5. Work and energy.
- 6. Conservation of energy.
- 7. Linear momentum and collisions.
- 8. Rotational motion.
- 9. Torque and angular momentum.
- 10. Equilibrium of rigid bodies.
- 11. Fluid mechanics. (Optional as time allows.)

Lab work includes:

- 1. Using calipers, stop watches, meter sticks, etc. to make measurements on mechanical systems.
- 2. Using computers and motion detectors, force probes, etc. to make measurements on mechanical systems.
- 3. Using computers and motion detectors, force probes, etc. to develop concepts of force and motion.
- 4. Using spreadsheets to record data and to calculate experimental results.
- 5. Constructing graphs using computer graphing programs.
- 6. Error analysis.
- 7. Numerical and graphical analysis of data.

### **Assignment:**

- 1. No less than twelve sets of homework problems.
- 2. Zero to fifteen quizzes.
- 3. No less than three mid-term exams.
- 4. No less than 12 laboratory experiments.
- 5. Final exam.
- 6. Lab Reports.

#### 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.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.

Writing 0 - 0%

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

Homework problems, 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.

Multiple choice, Physics problems to solve

Exams 50 - 70%

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

Attendance at problem sessions, Lab reports, group work in class.

Other Category 20 - 30%

## **Representative Textbooks and Materials:**

Physics for Scientists and Engineers by Serway & Beichner, 6th edition, Saunders 2003