PHYS 0000A - PREPARATION FOR CALCULUS-BASED PHYSICS

Catalog Description

Prerequisite: Completion of MATH 27 with grade of "C" or better
Advisory: Eligibility for ENGL 11 strongly recommended
Hours: 72 lecture
Description: Intended to provide stronger preparation for Physics 205 than Physics 105. Focuses on measurement and the development of the conceptual and mathematical frameworks necessary for problem-solving in physics. (not transferable)

Course Student Learning Outcomes

- CSLO #1: Apply algebra, geometry, and trigonometry to solve problems associated with Classical Physics.
- CSLO #2: Identify which physical concepts associated with Classical Physics explain physical phenomena.
- CSLO #3: Develop an overlying and rigorous process to aid in evaluating the behavior of physical systems obeying the laws of physics.
- CSLO #4: Evaluate the integrity of a data set provided by the instructor through error analysis, numerical computation, and/or graphical analysis and interpretation.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

144

Total Student Learning Hours

216

Course Objectives

It should be noted that a thorough understanding of physics requires the student to evaluate data and synthesize ideas to solve problems. The list of objectives below is intended to help the student in this endeavor. Thus, students in Physics A are expected to:
1. Explain the operational definition of length, mass and time.
2. Convert physical measurements between SI units and any other unit of measure.
3. Express the result of any arithmetic calculation involving physical quantities with the correct number of significant figures.
4. Describe and explain position, linear and angular displacement, average speed, average linear and velocity, instantaneous linear and angular speed, instantaneous linear and angular velocity, linear and angular acceleration, motion at constant acceleration, and freefall.
5. Solve numeric problems involving the concepts in item 4.
6. Graphically represent position, velocity, and acceleration for one dimensional motion.
7. Calculate the sum of two or more vectors using the component method of vector addition.
8. Describe and explain force, Newton's Laws, inertia, weight, tension, normal force, Hooke's law, friction.
9. Identify forces in a physical system.
10. Draw a free-body diagram for a physical system.
11. Apply Newton's laws to one and two dimensional systems.
12. Describe and explain projectile motion, uniform circular motion, centripetal acceleration, centripetal force, apparent weight.
13. Calculate the direction and horizontal and vertical coordinates of a projectile (under the influence of gravity only) at any moment in its flight.
14. Solve numeric problems involving centripetal acceleration and centripetal force.
15. Solve numeric problems applied to circular motion and gravitational force.
16. Describe and explain impulse, linear momentum, impulse-momentum theorem, conservation of momentum.
17. Solve numeric problems involving the impulse-momentum theorem and conservation of linear momentum in one dimension.
18. Describe and explain work, energy, work-energy-theorem, kinetic energy, potential energy, and conservation of mechanical energy.
19. Solve numeric problems applied to work and energy for translational and rotational motion.
20. Describe and explain concurrent and non-concurrent forces, torque, the first condition of equilibrium, and the second condition of equilibrium.
21. Describe and explain the following terms or concepts: rigid body, axis of rotation, moment of inertia, and rotational kinetic energy.
22. Describe the relation between torque and angular acceleration.
23. Solve numeric problems involving the relationship between torque and angular acceleration.
24. Solve static equilibrium problems involving concurrent and non-concurrent forces.
25. Develop rudimentary problem solving skills for given physical systems through the application of basic concepts and principles that include the use of diagrams, lists, equations, and/or words.
27. Evaluate the integrity of a data set provided by the instructor through error analysis, numerical computation, and/or graphical analysis and interpretation.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- Not Transferable

Methods of Evaluation

- Objective Examinations
  - Example: A box slides down an incline plane with constant velocity. The incline makes an angle of 30˚ above the horizontal. What is the coefficient of friction? a. 0.346 b. 0.296 c. 0.577 d. 0.206
- Problem Solving Examinations

- Example: 1. You are driving from Reno to Mount Rose on Highway 435. It's a narrow two-lane road that winds around the mountain. All of the sudden, an idiot driving at 55mph (17m/s) passes you on the wrong side of the road as you drive around a blind curve. The idiot's car hits an icy spot on the horizontal road and goes off the 153m high cliff at 17 m/s. a. What is the time of flight of the falling car? (5pts) b. How far does it travel in the horizontal direction? (5pts) c. Calculate the resultant velocity (magnitude and direction) of the car when it hits the ground below. Sketch a diagram indicating the x and y-components of the projectile's velocity, the direction of the resultant vector. (15pts) 2. A solid sphere of radius R=10.0cm is placed on an incline plane of angle 25.0 degrees and released from rest. The coefficients of kinetic and static friction of the plane are 0.3 and 0.5, respectively. a. Draw a free-body diagram indicating all the forces acting on the sphere. b. Sum the forces acting on the sphere. c. Sum the torques acting on the sphere. Indicate the reference point that was chosen. d. Calculate the frictional force acting on the sphere along with its acceleration.

- Reports
  - Example: Two students individually and separately measure the length, width, height, and mass of a copper block 20 times. One student measured the dimensions with a ruler and the other with a Vernier caliper. Both students used the same electronic balance to determine the mass of the block. The attached below contains a data set obtained by each student. For each data set, calculate the average value of the measured quantities along with their standard error. Use this information to calculate the copper block's average density and standard error for each data set. Write a brief 1-2 page report that contains an analysis of this data. In your report, you must answer the following questions: 1. Are the average densities obtained from the two measurements in agreement? 2. Do the two measured densities agree with the accepted value?

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. (In Class or Distance Learning)
2. A multimedia presentation is used to discuss motion in one dimension (in class or online). The presentation includes graphics and video clips for emphasis and clarity. The instructor solves example problems in great detail at appropriate times throughout the presentation. Students are always encouraged to ask questions in class or in the LMS discussion board throughout the presentation. (In Class or Distance Learning)
3. Demonstrations illustrating uniform motion and accelerated motion are used at appropriate times to elucidate this topic. Students are always encouraged to ask questions in class or in the LMS discussion board throughout the presentation.

Distance Learning

1. (In Class or Distance Learning)
2. Using an audience response system, students are asked to answer conceptual questions on one dimensional motion (other examples free-body analysis, energy conservation etc.) to assess their learning and develop critical thinking skills. In the online modality this can be accomplished synchronously using polling software or asynchronously using a discussion board. (In Class or Distance Learning)
3. In class, group problem solving activities are administered to assess student learning. The activities are also designed to get students to verbalize physical concepts to each member in the group, identify concepts that affect a physical system, and to illustrate how to build physical models. The instructors role is to facilitate the activity. In the online modality this can be accomplished asynchronously using virtual groups or synchronously using a breakout groups feature of a live meeting software. Example: An object is undergoing uniform circular motion of radius 54 meters and period 56 seconds. If the initial coordinates of the object at t=0s are (x,y)=(0,54m) determine the position, velocity, and acceleration vectors at t= 21s assuming it moves clockwise. What are the average velocity and average acceleration vectors in this time interval?

Typical Out of Class Assignments

Reading Assignments

1. Read the textbook chapter on Newton's Laws and be prepared to identify forces on simple systems using free-body analysis. 2. Read the document "Significant Figures" located on the Physics A LMS page and be prepared to apply the rules for significant figures on the worksheet to be handed out in class.

Writing, Problem Solving or Performance

1. Complete homework assignment on unit conversion. This is an assignment created by the instructor using an online homework service that accompanies the course textbook. Sample Problem: If we could fill the Earth with beer, how many barrels of beer would it hold (1 barrel of beer=36 gallons; earth=6370km;V=(4/3)(pi)r^3)? 2. Plot the position, velocity, and acceleration, vs. time graphs for the problem solved in class today. Turn in your graphs at the beginning of the next lecture. The problem: A rock is thrown upward from a cliff. The initial speed of the rock is 22m/s. The cliff is 32m above the ocean. a. What is the acceleration of the rock at its highest point? b. What is the speed of the rock when it reaches the ocean below? c. How long does it take to reach the ocean below? Remember the plots must cover the entire flight of the rock.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- College Physics
  - Author: Serway/Vuille
  - Publisher: Cengage
  - Publication Date: 2018
  - Text Edition: 11th
  - Classic Textbook?:
  - OER Link:
  - OER:
- College Physics

    - Author: Urone/Hinricks
    - Publisher: Openstax
    - Publication Date: 2016
    - Text Edition: 2nd
    - Classic Textbook?:
    - OER Link:
    - OER:
- College Physics
    - Author: Young/Adams
    - Publisher: Pearson
    - Publication Date: 2020
    - Text Edition: 11th
    - Classic Textbook?:
    - OER Link:
    - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.