SAN JUAN COLLEGE
Success Matters

PHYS-1310 CALCULUS-BASED PHYSICS I 3 CREDITS

SYLLABUS

CATALOG DESCRIPTION

A calculus level treatment of classical mechanics and waves, which is concerned with the physical motion concepts, forces, energy concepts, momentum, rotational motion, angular momentum, gravity, and static equilibrium. Recommended co-requisite: PHYS-1310L Calculus-based Physics I Laboratory.

Prerequisites or co-requisite: MATH 1510 Calculus I

Semester Offered: Spring

COMMON STUDENT LEARNING OUTCOMES

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to…

1. Describe the relationships among position, velocity, and acceleration as functions of time.
2. Use the equations of kinematics to describe motion under constant acceleration.

3. Analyze linear motion using Newton's laws, force, and linear momentum
4. Analyze rotational motion using torque and angular momentum
5. Analyze motion using work and energy.

SPECIFIC LEARNING OUTCOMES:

1. Apply dimensional/unit analysis to ascertain the consistency of mathematical expressions used to describe physical systems. Use vectors in describing physical systems.
2. Add vectors by three different methods. (i.e. graphical addition, trigonometric identities, and component addition.)
3. Evaluate "dot" and "cross" products of vectors and describe the significance role they play in modeling physical systems.
4. Derive the constant acceleration equations of kinematics by applying the principles of calculus.
5. Sketch and interpret the position and velocity versus time graphs for an object undergoing non-uniform acceleration.
6. Calculate the position, displacement, and velocity as a function of time for a projectile given its initial conditions.
7. Recognize the difference between tangential and radial acceleration.
8. Given a group of point masses, find the net gravitational force exerted on any one of the masses by using the principle of superposition and Newton's Law of Universal Law of Gravitation
9. Identify all the forces and torque's acting on an object and sketch a free body diagram for the object.
10. Calculate the acceleration, velocity, or displacement of an object when a constant net force or torque acts on the object.
11. Identify the difference between an elastic and inelastic collision.
12. Solve simple one- and two-dimensional collision problems using conservation of energy and momentum.
13. Given an impulse curve calculate the change in momentum.
14. Calculate the center of mass for a continuous mass distribution.
15. Distinguish between conservative and non-conservative forces.
16. Apply the work-energy theorem to an object changing its velocity or being lifted off the ground.
17. Use conservation of energy to find the speed of an object.
18. Describe how the gradient of potential relates to its associated vector field.
19. Employ gravitational potential to solve problems involving satellite motion.
20. Calculate the gravitational potential for a uniform spherical mass.
21. Explain the difference between translational vs rotational mass.
22. Show that the speed of an object rolling down a hill is independent of its mass and radius.
23. Solve the classic pulley and bucket problem using torque and angular momentum.
24. Calculate the moment of inertia about the center of mass for a continuous mass distribution.
25. Show that the total angular momentum of a system remains constant if the net torque on the system is zero.
26. Know the necessary conditions for a system to be in static equilibrium.
27. Explain the difference between elastic, shear, and bulk modulus.