International University – VNUHCM
Department of Physics

Final Examination

Date: 11/01/2022; Duration: 120 minutes

Group 1

Open book; **Online**; Laptops, Calculators **are allowed**

SUBJECT: PHYSICS 1 (ID: PH013IU)	
Approval by Chair of Department of Physics Signature  Full name: Phan Bảo Ngọc	Lecturer: Signature  Full name: Đỗ Xuân Hội
Proctor 1 Signature Full name:	Proctor 2 Signature Full name:
STUDENT INFO	
Student name: **Student ID:**	

INSTRUCTIONS: the total of point is 100 (equivalent to 30% of the course)

1. *Purpose:*
   - Construct the basic knowledge of general Mechanics Physics (CLO1)
   - Solve problems in engineering environment by applying both theoretical and experimental techniques (CLO2)
   - Understand and acquire skills needed to use physical laws governing real process and to solve them in the engineering environment (CLO3)
   - Develop confidence and fluency in discussing physics in English (CLO4)
2. *Requirement:*
   - Read carefully each question and answer it
   - Write the answers and draw models CLEAN and TIDY

Student Name:……..…..……
Student ID:……

QUESTIONS

Q1. (20 marks) A 28-kg rock approaches the foot of a hill with a speed of 15 m/s. This hill slopes upward at an angle of 40.0° above the horizontal. The coefficients of static and kinetic friction between the hill and the rock are 0.75 and 0.20, respectively.

(a) Use energy conservation to find the maximum height above the foot of the hill reached by the rock.

(b) Will the rock remain at rest at its highest point, or will it slide back down the hill? If the rock does slide back down, find its speed when it returns to the bottom of the hill.

Q.2 (20 marks) Two objects of mass 90 kg and 82 kg move with velocity of 2.7 m/s and 3.1 m/s respectively, which form an angle of 32°. They make a collision and become entangled.

Find the magnitude of the common velocity after collision. Is this collision elastic or inelastic? Explain.

Q.3 (10 marks) Two identical springs of constant force *k* are attached to a mass *m* on a horizontal plane (Fig. 1). The unstretched length of each spring is *L* when the mass *m* is at the equilibrium position. Suppose there is no friction.

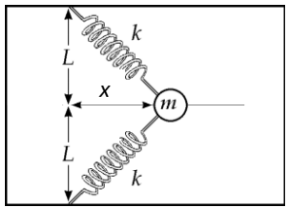

Fig. 1

Demonstrate that the expression of the net force of two springs applied on the mass is $F_x = -2kx + \frac{2kLx}{\sqrt{x^2 + L^2}}$ when the mass *m* is at the distance *x* from the equilibrium position. Find the formula of the potential energy of the system.

Q. 4 (20 marks) A solid, uniform cylinder with mass 8.25 kg and diameter 15.0 cm is spinning at 220 revolutions per minute on a thin, frictionless axle that passes along the cylinder axis. You design a friction brake to stop the cylinder by pressing the brake against the outer rim with a normal force. The cylinder comes to rest after it has turned through 5.25 revolutions. The coefficient of kinetic friction between the brake and rim is 0.333.

Find the angular acceleration of the cylinder and the magnitude of this normal force.

Given the moment of inertia of the cylinder with respect to the axis of rotation: $\frac{1}{2}MR^2$.

Q. 5 (20 marks) A flat uniform disk has a radius of 2.00 m and a total mass of 120 kg. The disk is initially rotating at 3.00 rad/s about a vertical axis through its center. Suddenly, a 70.0-kg person makes a soft landing on the disk at a point near the outer edge. Given the moment of inertia of the cylinder with respect to the axis of rotation: $\frac{1}{2}MR^2$. Assume that you can treat the person as a particle.

Find the angular speed of the disk after the person lands. Is this collision elastic? Explain.

Q. 6 (10 marks) A bar of mass *M* and of length *d* attached to a horizontal frictionless table by a pivot *P* rotates at an angular speed ω and its end strikes the ball of mass *m* initially at rest on a vertical line (Fig. 2). After the collision, the bar is stopped and the ball moves in the horizontal direction. The moment of inertia of the bar about pivot *P* point is $\frac{1}{3}Md^2$.

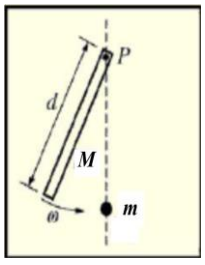

Fig. 2

(a) Write the expression of the initial velocity of the ball just after the collision.

(b) Assuming that this collision is elastic, calculate the numerical value of the ratio $\frac{m}{M}$.

– END –