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Wellassa University, Sri Lanka
End Semester Examination – March 2010
~~PHY~~ 251-1 Physics I (Repeat)
SCT

Time: One (01) hour

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Total 04 Questions
Answer All questions

1. a. State and prove law of conservation of momentum.

   b. A 20 kg block of mass is held stationary by a cord with negligible mass on a frictionless plane inclined at an angle of 30^0 to the horizontal.

      i. Draw a free body diagram for the block showing all the forces acting on it.
      ii. What are the magnitudes of the forces on the block from the cord and the plane?
      iii. Does the block accelerate as it slides down the inclined plane if we now cut the cord? If so what is its acceleration?

(25 marks)

2. a. State the Newton's law of gravitation and derive the dimensions of the gravitational constant G in terms of mass M, length L and time T.

   b. If radius and mass of the earth are R and M respectively, obtain expressions for

      i. Orbital velocity
      ii. Period of revolution.

      Where a satellite of mass m revolving at height h above surface of the earth.

   c. A satellite is in a circular orbit at 600km above earth surface. The acceleration of gravity $8.2 ms^{-2}$ at the altitude. The radius of the earth is 6400km. Determine;

      i. The speed of the satellite
      ii. Period of revolution around the earth

(25 marks)

3. A pulley consists of two disks as shown in Fig Q3, is free to rotate about a fixed horizontal axis through the center O. A weight W is suspended from a string wound around the smaller disk. Show that;

   a. Angular acceleration of the pulley is $\dfrac{Wag}{Wa^2 + \omega K^2}$

   b. Tension in the string is $\dfrac{\omega W K^2}{Wa^2 + \omega K^2}$

   Where a is the radius of the inner disk, K is the radius of gyration and ω is the weight of the pulley system.

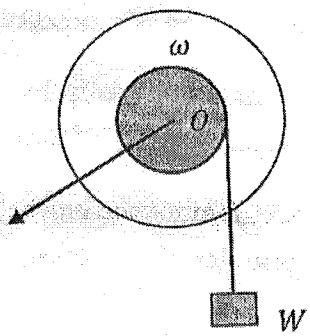

Fig Q3

Hint:

$K = \sqrt{\frac{I}{M}}$; Where I = moment of inertia

M = mass

(25 marks)

4. a. Using the principle of conservation of angular momentum, show that the line joining a planet and the satellite sweeps equal areas at equal times when the satellite moves in an elliptical orbit around the planet.

   b. Determine the ratio between the greatest and the least distances between the satellite and the planet. The maximum and the minimum velocities of a satellite which is moving on an elliptical orbit around the planet are 13.2kms^{-1} and 8.2kms^{-1} respectively.

   c. Determine the least distance between the satellite and the planet, if the greatest distance is 53900km.

(25 marks)