

Uva Wellassa University, Sri Lanka
End Semester Examination – December 2009
PHY 201-2 General Physics



Time: Two (02) hours

Total 05 Questions
Answer four (04) questions only

1) I. Show that the radius of gyration K for a uniform solid cylinder of diameter D about its axis can be expressed as, $K = \frac{\sqrt{2}}{4} D$
Derive an expression for K if a hoop of diameter d is made in the above cylinder.

II. A pulley consists of two disks as shown in Fig Q1, 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 $\frac{Wag}{Wa^2 + \omega K^2}$

b. Tension in the string is $\frac{\omega WK^2 g}{Wa^2 + \omega K^2}$

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

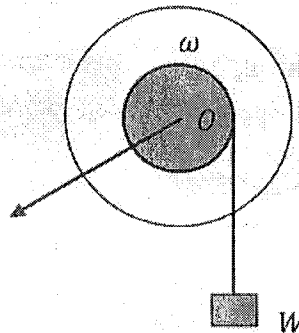


Fig Q1

(25 Marks)

2) I. What conditions are required for a system to have simple harmonic motion?

II. A mass m hangs from a uniform spring of spring constant k .

a. What is the period of oscillations in the system?

b. What would it be if the mass m were hung so that

i. It was attached to two identical springs hanging side by side (Fig Q2(a))

ii. It was attached to the lower of two identical springs connected end to end (Fig Q2(b))

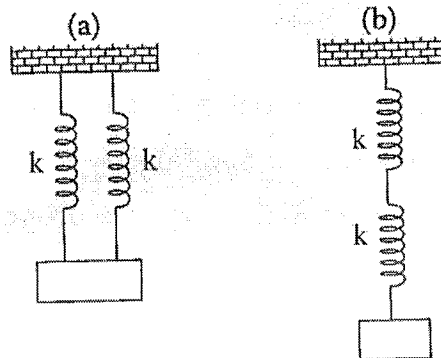


Fig Q2

III. a. What are Lissajou's figures?

b. Two vibrations at right angles to one another are described by the equations

$$x = 10 \cos(5\omega t) \text{ and}$$

$$y = 10 \cos(10\omega t + \pi/3).$$

Construct the Lissajou's figures of the combined motion.

(25 Marks)

3) Fig Q3 shows a section through two long concentric cylinders of radii a and b . The cylinders carry equal and opposite charges per unit length λ . Using Gauss's law prove electric field E ,

I. $E = 0$ for $r > b$

II. $E = 0$ for $r < a$

III. $E = \frac{1}{2\pi\epsilon} \frac{\lambda}{r}$ for $a < r < b$

- IV. A positive electron revolves in a circular path of radius r ($a < r < b$). What must be its kinetic energy? Assume $a = 2.0\text{cm}$, $b = 3.0\text{cm}$ and $\lambda = 3.0 \times 10^{-8}\text{C/m}$

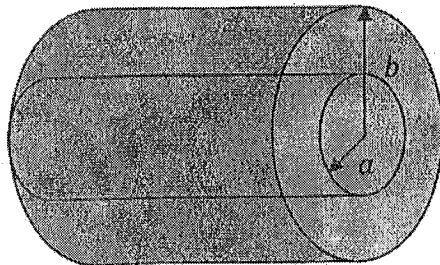


Fig Q3

(25 Marks)

- 4) I. 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 .

II. If radius of the earth is R and mass M , obtain expressions for

- a. Orbital velocity
- b. Period of revolution

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

III. A satellite is in a circular orbit at 600km above earth surface. The acceleration of gravity 8.21ms^{-1} at the altitude. The radius of the earth is 6380km . Determine

- a. The speed of the satellite
- b. Period of revolution around the earth.

(25 Marks)

- 5) Write short notes on any two (2) of the following topics.

- I. Young's double slit experiment
- II. Electrostatic precipitator
- III. Doppler effect and its application
- IV. Mass spectrometer

(25 Marks)

