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Exam. Code : 103206
Subject Code : 1222

B.A./B.Sc. Semester—VI

MATHEMATICS (Dynamics)

Paper–I

Time Allowed—3 Hours] [Maximum Marks—50

Note :— Attempt **FIVE** questions in all by selecting at least **TWO** questions from each Section. All questions carry equal marks.

SECTION-A

1. Define and discuss the SHM of a particle moving in a straight line.

2. A particle of unit mass begins to move from a distance 'a' towards a fixed centre which repels according to the law μx. If its initial velocity is $\sqrt{\mu a}$, show that it will continuously approach the fixed centre, but will never reach it.

3. A mass of 7 gm draws up a mass of 5 gm connected to it by a string passing over a smooth pulley. At the end of the first second, the string is cut. Find the velocity of the mass 7 gm at the end of the next second.

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4. A particle is dropped from the top of a tower h meter high and at the same time another particle is projected upwards from the bottom. They meet when upper one has described $\frac{1}{n}$ th of the distance. Show that their speeds when they meet are in the ratio 2 : (n – 2) and the initial speed of the lower is $\sqrt{\frac{1}{2}ngh}$.

5. Discuss the rectilinear motion of a particle when its acceleration is expressed as function of :

   (i) Time

   (ii) Distance.

SECTION–B

6. The equation $\ddot{x} + \mu x + 2k\dot{x} = 0$ represents damped harmonic oscillations of a particle moving in a straight line. Find the solution of this equation and interpret your result.

7. Define a conical pendulum. Show that the vertical depth of the particle in a conical pendulum, below the fixed point varies inversely as the square of the angular velocity and is independent of the length of the string.

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8. Define conservative system of forces. When a particle undergoes displacement under the action of a conservative system of coplanar forces, prove that the sum of K.E. and P.E. remains constant.

9. A seconds pendulum which gains 10 seconds per day at one place, loses 10 seconds per day at another. Compare the acceleration due to gravity at the two places.

10. A particle of unit mass is projected with velocity v and inclination α to the horizontal in a medium whose resistance is k × velocity. Show that if k is small, the equation of the path is approximately.

$$y = x \tan \alpha - \frac{gx^2}{2v^2 \cos^2 \alpha} - \frac{kgx^3}{3v^3 \cos^3 \alpha}.$$

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