

Exam. Code : 103206

Sub. Code : 1222

**B.A./B.Sc. 2nd Semester
MATHEMATICS
-VI
(Dynamics)**

Time : 3 Hours]

[Max. 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 ux . [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.

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 $\sqrt{\frac{1}{2} n gh}$.
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.

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 $k \times$ velocity. Show that if k is small, the equation of the path is approximately.

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