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[Total No. of (i) Printed Pages 4 (ii) Questions 8]

Sub Code : 0343 (1048) **Exam Code :** 0004

Exam : B.A./B.Sc.(General), 4th Semester

Subject : Mathematics

Paper : Paper-III Dynamics

Time : 3 Hours ***Maximum Marks : 30***

Note: Attempt **five** questions, selecting at least **two** questions from each Unit. Each question will carry **6** marks.

UNIT - I

1. (a) A particle moving with uniform acceleration has velocity 20km/hr at A and 40km/hr at B. Find the velocity at the middle of the interval and also the velocity midway between A and B.

(b) A body is projected vertically upwords with a velocity of 24.5m/sec. (i) How high will it go ? (ii) At what time will it be 29.4m above the point of projection ? Explain double answer. (iii) How long will it take to return to the point of projection ?

P.T.O.

2. (a) An aeroplane is rising vertically with acceleration f. Two stones are dropped from it at an interval of time t. Show that the distance between them at time t' after the second is dropped is $\frac{1}{2}t\,(g+f)\,(t+t')$.

   (b) A particle moves in a straight line under a retardation kv^2. If the initial velocity be u, show that the space described in time t is $\frac{1}{k}\log(1+kut)$.

3. (a) Two masses m_1 and m_2 $(m_1>m_2)$ are suspended by light inextensible string over a smooth pulley. Find the acceleration of masses, tension in the string and pressure on the pulley.

   (b) A body is projected up a smooth inclined plane of length 20 metres and inclination 30^0 with a velocity just sufficient for it to reach the top. Divide the whole length into three parts so that each part is covered in same time.

4. (a) A particle moving under S.H.M. has amplitude 1 metre. If the magnitude of velocity is 2m/sec. When the particle is displaced .6 metre from the position of maximum velocity, find the magnitude of acceleration of particle at this position.

(b) A particle describes S.H.M. between two points $x=l$ and $x=-l$, the centre being at origin. Find the relation between v, l and x if the maximum acceleration is 1.

UNIT - II

5. (a) A particle describes the path $x = y^2 + 3$, where x and y are in metres. The y-components of the velocity of the particle is constant and is equal to 10m/sec. Assuming that the particle is at origin at time t=0, find expressions for velocity and acceleration of the particle.

(b) A shell explodes on contact with ground and its fragments are observed to fly in all directions with speed 49m/sec. Show that the difference between two times at which fragments may fall at a point 24g metres away is 2 seconds.

6. (a) A cyclist is riding on a circular track at the rate of 12km/hour. If the radius of the track is 60 metres, find his inclination to the vertical.

(b) To a man moving in a car at 66km/hr, the rain though falling vertically, appears to make an angle 60^0 with the vertical. Find the velocity of the rain.

7. (a) A train of mass M kg is ascending a smooth incline of 1 in n and when the velocity of train is v m/sec, its acceleration is f m/sec^2. Prove that the effective power of the engine is $\frac{mv(nf+g)}{n}$ watts.

(b) A bullet fired with a velocity of 1600m/sec. passes through three planks in succession. It if loses a velocity of 400m/sec in passing through each plank, find the ratio of their thickness to which the resistance is supposed to be proportional.

8. (a) A shell of mass m is projected from a gun of mass M by an explosion which generates kinetic energy E. Prove that the initial velocity of the shell is $\sqrt{\frac{2EM}{m(M+m)}}$, it is assumed that the gun is free to recoil.

(b) A ball moving with velocity u impinges directly on an equal ball moving with velocity v in the opposite direction. If the first ball is brought to rest by impact, Show that u : v =(1+e) : (1-e)