8676/MH

BS-2057

DYNAMICS-VI

(Semester-IV)

Time Allowed : 3 Hours]   [Maximum Marks : 36

Note :   The candidates are required to attempt **two** questions each from Sections A and B carrying 5 marks each and the entire Section C consisting of 8 short answers type questions carrying 2 marks each.

SECTION-A

1.   The train starts it journey from rest with uniform acceleration for time 4 minutes to attain the velocity of 45 km/hour and the travel with this velocity for some time after which the train uniformly decelerates from this velocity to zero in 3 minutes.

Find the total time if the total distance travelled is 50 km.

Draw the velocity-time graph of the journey Covered.   5

2. A stone is released from the top of a tower prove That $v^2 = u^2 + 2gh$, where h is the displacement of the body after time t; u is initial velocity of projection in the vertically downward direction; v is final velocity of projection in the vertically downward direction after time t; g acceleration due to gravity.   5

3. A particle of mass 3 kg is projected up a smooth plane inclined at 30° to the horizontal at a speed of 2 m/sec, How far up the slope does the particle travel before it comes to instantaneous rest?   5

4. A particle is performing a Simple Harmonic Motion. When it is at the distance of 12.0 cm and 25.0 cm from the mean position, the velocitiés are 80 cm/sec and 45 cm/sec respectively,

Find :

(a)   The amplitude of oscillation

(b)   Time period of oscillation

(c)   The max velocity of the particle

(d)   Max acceleration of the particle.   2,1,1,1

SECTION—B

5.   A projectile is fired with an initial speed of 130
       meters/sec at an angle of 45° above the horizontal
       from the top of a cliff 52 meters high.

       Determine :

(a)   The time to reach maximum height.

(b)   Maximum height above the base of the cliff
        reached by the projectile.

(c)   Horizontal range of the projectile.

(d)   The total time it is in the air.   2,1,1,1

6. Three spherical balls of mass 3.0 kg, 9.0 kg and 18.0 kg are moving in the same direction with velocities 12 meters/sec, 4 meters/sec and 2 meters/sec respectively. The ball of mass 3.0 kg impinges with the ball of mass 9.0 kg which in turn impinges with the ball of mass 18.0 kg. Prove that the balls of mass 3.0 kg and mass 9.0 kg will be brought to rest by the impacts.

   Assume the balls to be perfectly elastic.   5

7. A gun of mass 4000 kg fires horizontally a shell of mass 60 kg with a velocity of 300 meters/sec. What is the velocity with which the gun will recoil? Also determine the uniform force required to stop the gun in 0.6 meter. Find the time for the gun to stop.   2,2,1

8. Determine the kinetic energy of a uniform rigid circular cylinder of mass 24 kg and radius 25 cm rolling without slipping on a horizontal surface

with its mass centre moving with a velocity of 24 meters/sec.

Find the radius of a uniform rigid sphere of mass a 10 kg to have the same the kinetic energy as of . above cylinder when the sphere rolled without slipping on a horizontal surface with its mass centre moving with the same velocity of 24 meters/sec.

5

SECTION—C

9.   Attempt all the parts :

(a)   Astone is released with zero velocity from the top of a tower reaches the ground in 4 second, wars find the height of the tower.

(b)   Acar moving in a straight line at 30 meters/ sec slows uniformly to a speed of 10 meters/ sec in 5 sec. Determine the acceleration of the car.

(c)   A stone of mass 12 kg is dropped from the height of 60 meters. Find the potential energy and the kinetic energy of the stone when it travelled a distance of 24 meters.

(d)   By what factor should the length of a simple pendulum be changed if the period of vibration were to be tripled?

(e)   Two balls, each with mass 2 kg, and velocities of 1.8 meters/sec and 2.7 meters/sec collide head of 1.8 meters/sec and 2.7 meters/sec collide head on. Their final velocities are 1.8 meters/sec and 0.9 meters/sec respectively. Is this collision elastic or inelastic?

(f)   Ship A is travelling in the south direction at the speed of 75 km per hour. Ship B is travelling in the west direction at the speed of 40 km per hour. If they start from the pert at the same time when will they be 30 km apart?

(g)　A particle of the mass m moves in a x-y plane. if
The coordinate of the particle at any instant ,
are given by :

$x = a \cos \omega t$

$y = b \sin \omega t$

where a, b and ω ware constant.

Determine the angular momentum of the
a particle with respect to the origin of the
coordinate system.

(h)　Find the time of fight and the range of the
object if it is thrown horizontally with a velocity
of 60 m/sec from the top of a hill of height of
175 meters.　　　　　　　　　　　2x8=16