

- (b) Show how to divide a mass of 10 kg. in two scale pans, each of which has a mass of 4 kg. so that the heavier pan may descend 2.18 metres in first 2 seconds. **2.5**

5. (a) A man is drawing water from a well with a light bucket which leaks uniformly. The pail when full weights 50 lbs. and when it arrives at the top, half of the water remains. Find the work done if the depth of the well is 100 feet. **2.5**

- (b) A particle of mass ' m ' falls from rest at a height h above the ground. Show that the sum of K.E. and P.E. (potential energy) is constant through the motion. **2.5**

Section III

6. (a) Two particles are let drop from the cusp of a cycloid down the curve at an interval of time t . Prove that they will meet in

$$\text{time } 2\pi\sqrt{\frac{a}{g}} + \frac{t}{2}. \quad \mathbf{2.5}$$

32508

B.A. & Hons. (Subsidiary)

EXAMINATION, 2025

(Sixth Semester)

(Regular & Re-appear)

MATH

BM-363

Dynamics

Time : 3 Hours]

[Maximum Marks : 27

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. 1 is compulsory.

1. (a) State Newton's law of motion. 1
- (b) Define relative acceleration. 1
- (c) Define kinetic energy and potential energy. 2
- (d) Find the uniform force that will move 1 kg. mass from rest through 1 meter in 1 second. 2
- (e) Define Central Force and Central orbit. 1

Section I

2. (a) An insect crawls at a constant rate u along the spoke of a cart wheel of radius a and the cart is moving with velocity v . Find the accelerations along and perpendicular to the spoke. 3
- (b) A particle moves along the curve $x = 4t, y = 6t - t^2$. Find the tangential and normal acceleration at $t = 3$. 2

3. (a) A particle moving with S.H.M. of period 12 seconds travels 10 cm from the position of rest in 2 seconds. Find the amplitude, the maximum velocity and the velocity at the end of 2 seconds. 3
- (b) The mass m hangs from a fixed point by means of an elastic string and is given a vertical displacement. If n is the number of oscillations per second in the ensuing SHM and l is the equilibrium length of the string, show that the natural length of the string is $l - \frac{g}{4\pi^2 n^2}$. 2

Section II

4. (a) A mass of 10 kg. falls freely a distance of 10 m from rest and is then brought to rest after penetrating through 1 m in sand. Find the average force exerted by the sand on it. 2.5

- (b) A particle describes the equiangular spiral $r = ae^{\theta \cos \alpha}$ under a force to the pole. Find the law of force. **2.5**

9. (a) The greatest and least velocities of a certain planet in its orbit round the sun are 30 km/sec. and 29.2 km/sec. respectively. Find the eccentricity of the orbit. **2.5**
- (b) To find the acceleration of a particle in terms of cylindrical polar coordinates. **2.5**



- (b) A particle slides down a rough curve under gravity in a vertical plane. Discuss the motion. **2.5**

7. (a) If the forces of a trajectory lies as much below the horizontal plane through the point of projection as the vertex is above it, prove that the angle of projection is given by $\sin \alpha = \frac{1}{\sqrt{3}}$. **2.5**
- (b) A particle is thrown over an isosceles right angled triangle ABC, right-angled at B, from one end A of the horizontal base AC and grazing the vertex B falls at C. Show that the angle of projection is $\tan^{-1}(2)$. **2.5**

Section IV

8. (a) Derive the differential equation of central orbit in pedal form. **2.5**