

This question paper contains 2 printed pages]

GA—75/78—2023

FACULTY OF ARTS/SCIENCE

B.A./B.Sc. (Third Year) (Sixth Semester) EXAMINATION

APRIL/MAY, 2023

(New/Old CBCS Pattern)

MATHEMATICS

Paper XVII

[Mechanics–II (Dynamics)]

(Thursday, 4-5-2023)

Time : 10.00 a.m. to 12.00 noon

Time—Two Hours

Maximum Marks—40

N.B. :— (i) All questions are compulsory.

(ii) Figures to the right indicate full marks.

1. Define velocity and acceleration and find the expressions for velocity and acceleration in terms of vector derivatives. 15

Or

(a) Prove that the kinetic energy of particle of mass m moving with velocity : 8

$$\vec{V} \text{ is } \frac{1}{2} m V_2$$

(b) A particle is acted upon by a force :

$$\vec{F} = \frac{-K}{r^3} \vec{r}$$

where K is a constant. Find the potential energy of the particle at a distance r from the pole, where $r = a$ is some standard position where $|\vec{r}| = r$. 7

P.T.O.

2. Discuss the rectilinear motion of a particle moving in a straight line with a constant acceleration.. 15

Or

- (a) Prove that : 8

$$t_1 \cdot t_2 = \frac{2R}{g}$$

- (b) Prove that if the time of flight of a projectile over a given horizontal range R, is t and T seconds for two angles of projection α and β , then prove that : 7

$$t^2 \cot \alpha = T^2 \cot \beta.$$

3. Attempt any *two* of the following : 10

- (i) Find the Cartesian equation of the path of a projectile i.e. its trajectory.
- (ii) A particle of mass m moving with velocity \vec{v} picks up a mass M at rest. Find the velocity of the combined mass, the kinetic energy of the combined mass and the loss in K.E.
- (iii) Prove that the sum of the work done by any number of forces is equal to the work done by their resultant.
- (iv) A point moves in a curve so that its tangential and normal accelerations are equal and the tangent rotates with uniform angular velocity. Show that the intrinsic equation of path is of the form :

$$S = A \cdot e^{\psi} + B$$