

This question paper contains 2 printed pages]

NA—57—2023

FACULTY OF ARTS/SCIENCE

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

NOVEMBER/DECEMBER, 2023

(New/CBCS Pattern)

MATHEMATICS

Paper-XVII(B)

(Mechanics-II-Dynamics)

(Wednesday, 13-12-2023)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

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

(ii) Figures to the right indicate full marks.

1. Find radial and transverse components of acceleration. 15

Or

(A) A bullet of mass m moving with velocity v strikes the block of mass M of thickness a , find the resistance of the block, supposed to be uniform, if the bullet can penetrate through the distance $a/2$. if the block is free to move, through what distance the bullet penetrates, the resistance remaining the same. 8

(B) Explain the principle of conservation of linear momentum. 7

2. Prove that in a conservative field of force, the sum of kinetic energy and potential energy of a particle at every point, is constant.

Also show that the velocity of a particle increases from \vec{V}_1 to \vec{V}_2 , then the

P.T.O.

gain in the K.E. is half the scalar product of impulse and the sum of V_1 and V_2 . 15

Or

(A) Derive the range on an inclined plane of a particle projected with velocity \vec{u} making an angle α with the horizontal. 8

(B) A particle projected at an angle of elevation $\sin^{-1}\left(\frac{4}{5}\right)$, and its range on the horizontal plane is 4 miles. Find the velocity of projection and velocity at the highest point of its path. 7

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

(i) A man can throw a cricket ball upto 160 meters and no more. With what speed, in metre per sec., must it be thrown ? (Take $g = 980 \text{ cm/sec}^2$)

(ii) Find the work done by the force $\vec{F} = 2xi + 2yj$ in moving a particle from P(1, 2) to Q (3, 2).

(iii) Prove that the change in kinetic energy of the particle is equal to the work done.

(iv) A point describes a cycloid $S = 4a \sin \psi$ with uniform speed v . Find its acceleration at any point in terms of v , a and s .