VA—57—2024

FACULTY OF ARTS/SCIENCE

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

NOVEMBER/DECEMBER, 2024

(CBCS/New Pattern)

MATHEMATICS

Paper–XVII

(Mechanics–II)

(Tuesday, 10-12-2024) **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 the tangential and normal components of velocity and acceleration. 15

Or

(a) Discuss the conservation of Linear momentum. 8

(b) A particle of mass m moving with velocity $\bar{v}$ 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. 7

2. Discuss the motion of a projectile and derive an equation of its trajectory. 15

P.T.O.

Or

(a) Prove the necessary and sufficient condition for a force F to be conservative is that the line integral over a closed path C in a conservative field is zero that is : 8

$$\int_C \vec{F} \cdot d\vec{r} = 0.$$

(b) Prove that in a conservative field of force, the sum of kinetic energy and potential energy of a particle at every point is constant. 7

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

(i) Prove that the acceleration of a point moving in a plane curve with uniform speed is $\rho \Psi^2$

(ii) Prove that the sum of the work done by any number of force is equal to the work done by their resultant

(iii) Show that the velocity of a particle increases from $\vec{v_1}$ to $\vec{v_2}$, then the gain in the K.E. is half the scalar product of impulse and the sum of $\vec{v_1}$ and $\vec{v_2}$

(iv) A man can throw a cricket ball upto 160 metres and no more. With what speed, in metre per sec, must it be thrown ?

Take $g = 980 \text{ cm/sec}^2$.