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SB—97—2022

FACULTY OF SCIENCE

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

JUNE/JULY, 2022

(Old/CBCS Pattern)

MATHEMATICS

Paper-XVII

(Mechanics-II)

(Thursday, 16-6-2022)

Time : 10.00 a.m. to 12.30 p.m.

Time—2½ Hours

Maximum Marks—40

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

(ii) Figures to the right indicate full marks.

1. Find the radial and transverse components of acceleration. 15

Or

(a) Find the components of velocity and acceleration along rectangular cartesian axes. 8

(b) Prove that the acceleration of a point moving in a plane curve with uniform speed is $\rho\psi^2$. 7

2. State Newton's laws of motion and discuss their deductions. 15

Or

(a) Derive the principle of conservation of linear momentum. 8

(b) A particle is acted upon by a force $\vec{F} = \frac{-K}{r^3} \cdot \vec{r}$, where K is constant. Find the potential energy of the particle at distance r , from the pole, where $r = a$, is some standard position where $|\vec{r}| = r$. 7

P.T.O.

3. Attempt any *two* of the following :

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- (a) Find the greatest height attained by the particle, moving with initial velocity \bar{u} and making an angle α with the horizontal.
- (b) Show that for a given velocity of projection there are, for a given horizontal range, in general, two directions of projection which are equally inclined to the direction of maximum range.
- (c) 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 $t^2 \cot \alpha = T^2 \cot \beta$.
- (d) When a particle is projected at an angle α with the horizontal, the horizontal range is R and greatest height is H, prove that :

$$\alpha = \tan^{-1} \left(\frac{4H}{R} \right).$$