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V—67—2017

FACULTY OF ARTS/SCIENCE

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

OCTOBER/NOVEMBER, 2017

MATHEMATICS

Paper XVIII (B)

[Mechanics—II (Dynamics)]

(Saturday, 11-11-2017) **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. Attempt any *five* of the following : 2 marks each

   (*a*) What are the tangential and normal components of velocity.

   (*b*) Define Angular Speed.

   (*c*) Define Mass and write unit of mass in F.P.S. system.

   (*d*) Write the units of power in C.G.S. and F.P.S. system.

   (*e*) Define angle of Projection.

   (*f*) Define Time of Flight.

2. Attempt any *two* of the following : 5 marks each

   (*a*) Explain curvature and principal normal.

   (*b*) Find radial and transverse components of acceleration.

   (*c*) 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.

3. Attempt any *two* of the following : 5 marks each

   (*a*) Write three Newton's Laws of Motion.

P.T.O.

(*b*) Prove that 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 :

$$\int_{\mathbf{C}} \vec{\mathrm{F}} \cdot d\vec{r} = 0.$$

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

4. Attempt any *two* of the following : 5 marks each

(*a*) Explain motion of a projectile and derive the derivation of equation of its trajectory.

(*b*) Prove that the relation $t_1 \cdot t_2 = 2\mathrm{R}/g$.

(*c*) T is the time of flight of a bullet when the horizontal range is R. Prove that the inclination of the direction of projection with the horizontal is :

$$\tan^{-1}\left[\frac{g\mathrm{T}^2}{2\mathrm{R}}\right].$$