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R—70—2017

FACULTY OF ARTS/SCIENCE

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

MARCH/APRIL, 2017

MATHEMATICS

Paper XVIII

[Mechanics—II (Dynamics)]

(Saturday, 1-4-2017) **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 each

(*a*) Define radial and transverse direction.

(*b*) Define Angular velocity.

(*c*) Define Linear momentum.

(*d*) Write the units of work in M.K.S. and F.P.S. systems.

(*e*) Define velocity of projection.

(*f*) Define Horizontal range of projectile.

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

(*a*) Explain tangent and unit vector along the tangent at given point.

(*b*) Find tangential and normal components of acceleration.

(*c*) A point describes the equiangular spiral $r = ae^{\theta}$ with constant angular speed w about 0, 0 being the pole. Find the radial and transverse components of acceleration.

P.T.O.

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

(*a*) Prove that the principle of angular momentum.

(*b*) Prove that the kinetic energy of particle of mass m moving with velocity $\vec{v}$ is $\frac{1}{2}mv^2$.

(*c*) A particle of mass 0.1 lb has the velocity $2i + 3j$ ft/sec. at $t = 2$ sec. It is subjected to a force $3t^2i + \cos(\pi t)j$. Find the impulse of the force over the interval $2 \leq t \leq 3$. Also find the velocity at $t = 3$ sec.

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

(*a*) Find the vertex and the latus rectum of the parabola.

(*b*) Prove that Range on an inclined plane is :

$$\frac{u^2\left[\sin\left(2\alpha - \beta\right) - \sin\beta\right]}{g\cos^2\beta}.$$

(*c*) If the greatest heights attained by two particles are h_1 and h_2, then prove that the angle of projection is given by :

$$\alpha = \tan^{-1}\left[\sqrt{\frac{h_1}{h_2}}\right].$$

And also prove that $u^2/4g$ is the arithmetic mean between h_1 and h_2 and R/4 is the geometric mean between them, where R is the horizontal range.