(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 8 Sub. Code : 1 7 3 4 3

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B.A./B.Sc. (General) 4th Semester

(2055)

MATHEMATICS

Paper : III Dynamics

Time Allowed : Three Hours] [Maximum Marks : 30

Note :— Attempt *five* questions, selecting at least *two* questions from each Section. All questions carry equal marks.

SECTION—I

1. (a) A particle straight from rest with uniform acceleration described 9.8 meter in the 10th second of its motion. Find its acceleration.

   (b) A particle projected vertically upwards with velocity u. Find the time to reach a given height h (less than the maximum height). Explain the double answer.

2. (a) A train of mass 20 metric tons moves at the rate 72 km per hour. After the steam is shut off, it is brought to rest by the brakes in 500 meters. Find the force of resistence exerted, assuming it to be uniform.

   (b) Show how to divide a mass of 10 kg in two scale pans, each of which has a mass of 4 kg, so that the heavier pan may descend 2.18 meter in the first two seconds.

3. (a) A particle starts with a velocity u and moves under a retardation equal to k times the space described. Show that the distance moved before it comes to rest is $\frac{u}{\sqrt{k}}$.

(b) A particle is released from rest at a distance R above the surface of the earth, where R is the radius of the earth. Determine the velocity of the particle as it strikes the surface of the earth. Given $g = 9.8$ m/sec$^2$ and $R = 6370$ Km.

4. (a) A particle moves in a straight line such that its acceleration is always directed towards a fixed point in the line and is proportional to the displacement of the particle from the fixed point. Find the expressions for the velocity and position of the particle at any time.

(b) A particle of mass m is attached to a light wire which is stretched tightly between two fixed points under tension T. If a and b be the distances of the particle from the two ends, prove that the period of transverse oscillation is $2\pi\sqrt{\frac{mab}{T(a+b)}}$.

## SECTION—II

5. (a) Find the expressions for velocity and acceleration of a particle moving in a plane in rectangular co-ordinate system.

(b) Find the velocity and direction of motion of a projectile after a given time t, if u is velocity of projection and $\alpha$ is angle of projection.

6. (a) A particle is projected up an inclined plane of inclination $\beta$ at an elevation $\alpha$ to the horizon, show that $\tan \alpha = 2 \tan \beta$, if the particle strikes the plane horizontally.

(b) A particle is projected from the lowest point with velocity u and moves along the inside of the arc of a smooth vertical circle. Discuss the motion.

7. (a) A body of mass 5 kg takes 2 seconds to fall from the top of a tower to the ground. Find the work done by gravity.

(b) A rifle bullet loses $\frac{1}{20}$ th of its velocity in passing through a plank, find how many such planks it would pass through before coming to rest, assuming the resistance of the plank to be uniform.

8. (a) Two particles A and B are moving along concentric circles of radii 2 meters and 8 meters respectively with constant angular velocities 4 radians per sec. and 2 radians per sec. Obtain their relative acceleration when their angular distance apart is $\frac{2\pi}{3}$.

(b) A body of mass 2m is split into two parts of equal masses by an internal explosion which generates energy E. Show that if after explosion the two parts move in the same line as before, their relative speed is $2\sqrt{\frac{E}{m}}$.