**B.A./B.Sc. (General) 4ᵗʰ Semester**

**(2042)**

# MATHEMATICS

### Paper : III (Dynamics)

**Time Allowed : Three Hours]** [**Maximum Marks : 30**

**Note :—** Attempt **FIVE** questions, selecting at least **TWO** questions from each unit. Each question carries **6** marks.

## UNIT—I

1.  (a) A bullet fired into a target loses half its velocity after penetrating 1/4 metre. How much further it will penetrate ?

    3

    (b) A particle starts with a velocity 30 m/sec. and moves in a straight line with constant acceleration. If its velocity at the end of 6 seconds be 18 m/sec. Find its acceleration.

    3

2.  (a) Two scale pans each of mass 4 kg are connected by a light string passing over a pulley. Divide a mass of 10 kg in two scale pans so as to produce an acceleration of g/9.

    3

(b) A body moves down a smooth inclined plane under the action of gravity. Discuss its motion. 3

3. A particle moves with an acceleration f given by $f = -kv$, where v is the velocity of particle and k is constant. Express v in terms of x. 6

4. (a) A particle moving with S.H.M. of period 30 seconds travels 15 cm from position of rest in 5 seconds. Find amplitude and maximum velocity of the particle. 3

(b) Prove that Simple Harmonic Motion is periodic. Find its period. 3

## UNIT—II

5. (a) A particle is projected with velocity 49 m/sec in a direction making an angle 45° with the horizontal. Find the time of flight. 3

(b) A body can throw a Cricket ball 100 m. How long is the ball in the air and what height does it attain ? 3

6. (a) Define conservative forces and conservative field. 3

(b) Find the work done against gravity when a particle of mass m at p s.t. op = h, where o is a point on the surface of earth. 3

7. (a) To a person going eastward with a velocity of 4 km/hr wind appears to blow form north. He doubles his speed and the wind seems to come from the north-east. What is the velocity of the wind ? 4

(b) Two Cars P and Q are moving at 50 km/hr and 30 km/hr on a road in opposite direction. What is the relative velocity of Q w.r.t. P ?

2

8. (a) A ball P moving with velocity u, impinges directly on an equal ball Q moving with velocity v in opposite direction. If P is brought to rest by the impact, show that u : v is (1 + e) : (1 − e).

3

(b) A bullet of mass m kg is fired into a fixed target of mass M kg and penetrates through a distance a metres. If the target was free to move, show that the distance penetrated would be $\dfrac{Ma}{M+m}$ metres and that K.E. lost would be $\dfrac{M}{M+m}$ of its initial distance.

3