Exam Code: 0004
Sub. Code: 0343

2071
B.A./B.Sc. (General) Fourth Semester
Mathematics
Paper – III: Dynamics

Time allowed: 3 Hours

Max. Marks: 30

NOTE: *Attempt five questions in all, selecting atleast two questions each Unit.*

x-x-x

UNIT – I

I. a) A stone drops from the roof of a house. It is observed to fall fast a window 1 meter high in $\frac{1}{7}$ th of the second. How high is the roof above the window?

b) Two particles A and B distant 16m apart move towards each other. A moves with constant velocity of 5 m/sec. and B starts from rest with a constant acceleration of 3 m sec^{-2}. Find when and where they meet? (2x3)

II. a) An aeroplane is rising vertically with an acceleration f. Two stones are dropped from it at an internal of time t. Show that the distance between them at time t^1 after the second is dropped is $\frac{1}{2}.t(g+f)(t+t')$

b) A body is projected up a smooth inclined plane of length 20m and inclination 30^0 with a velocity just sufficient for it to reach the top. Divide the whole length in three parts so that each part is covered in the same time. (2x3)

III. a) A particle of unit mass begins to move from distance 's' towards a fixed center which repels it by the law μx. If its initial velocity is $\sqrt{\mu s}$, show that is will continuously approached the fixed center, but will never reach it.

b) A particle moving with SHM of period 12 seconds travels 10cm from position of rest in 2 seconds. Find amplitude, maximum velocity and velocity at the end of 2 seconds. (2x3)

P.T.O.

IV. a) A particle moves with SHM in a straight line. In the first second after starting from rest it travels a distance 'a' and in the next second, it travels a distance 'b'. Prove that the amplitude of motion is $\frac{2a^2}{3a-b}$.

b) Two light strings are fastened to a particle of mass m and their other ends to fixed points so that the strings are taut. The modulus of each is λ, the tension T and the length a and b. Show that the period of oscillation along the line of string is $2\pi\sqrt{\frac{mab}{(T+\lambda)(a+b)}}$ (2x3)

UNIT – II

V. a) For a particle mowing along the curve $x = 4t$, $y = 6t - t^2$. Find the tangential and normal acceleration when $t = 3$.

b) A particle moves down along the outside of a smooth vertical circle of radius r. If it starts from rest at depth $\frac{r}{2}$ below the highest point, Prove that it will leave the circle at a distance $\frac{r}{3}$ above the center. (2x3)

VI. a) Two seconds after its projection, a projectile is travelling in a direction inclined at 30^0 to the horizontal. After one more second, it is travelling horizontally. Determine magnitude and direction of initial velocity.

b) To a man moving in a car at 66 km/hour, the rain though falling vertically, appears to make an angle of 60^0 with the verticle. Find the velocity of rain. (2x3)

VII. a) A car weighting M kg starts from rest and attains a maximum speed of vm/sec. in in t sec. up an incline of 1 by n, the frictional resistance being m kg. weight for every kg weight of car. Find the power of engine.

b) A sphere of mass m impinges directly on an equal sphere at rest. Show that a fraction equal to $\frac{1}{2}(1-e^2)$ of the original K.E. is lost during the impact, where e is the coefficient of restitution. (2x3)

VIII. a) A man is drawing water slowly from a well with a light bucket which leaks uniformly, the bucket when full weight 10kg and when it arrives at the top, half the water remains. Find the work done if the depth of the well is 200 meter.

b) A bullet passes through two planks in succession, its original velocity is 120m sec^{-1} and it loses velocity of 20m/sec. in penetrating each plank. Find ratio of thickness of two planks, assuming that they offer same average resistance. (2x3)

x-x-x