SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc. Maths - END SEMESTER EXAMINATIONS APRIL - 2024
SEMESTER - V
20UMACT5011 - Dynamics

Total Duration : 2 Hrs. 30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. A man can swim perpendicularly across a stream of breadth 100m in 4 minutes when there is no current and in 5 minutes when there is a downward current. Find the velocity of the current.
2. Show that the resultant of two simple harmonic motions of same period along the same straight line is also simple harmonic with the same period.
3. Verify, in the case of a projectile, K.E + P.E = a constant.
4. Obtain the maximum range on an inclined plane.
5. Find the velocities of two smooth spheres after a direct impact between them.
6. Two equal balls of mass m are in contact on a table. A third equal ball strikes both symmetrically and remains at rest after impact. Show that e $= 2/3$.
7. Obtain the moment of inertia of the whole sphere.
8. Obtain the moment of inertia of the parabolic lamina.

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. i) A particle moves along a straight line with a constant acceleration a. then show that
   a) v = u + at b) s = ut + 1/2at^2 c) v^2= u^2 + 2as
   where u is the initial velocity of the particle, v is the velocity of the particle at time t, s is the distance of the particle at time t from a chosen fixed point on the line.
   ii) A vertical circular disc of radius a roll on a ground without slipping along a straight line with a linear velocity u. Find the velocity of any point on its rim.

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10. i) The displacement x of a particle moving along a straight line is given by x = A cos nt + B sin nt, where A, B, n are constants. Show that its motion is S.H. if A = 3, B = 4, n = 2, find its period, amplitude, maximum velocity and maximum acceleration.
    ii) Two bodies of masses m and m' are attached to the lower end of an elastic string whose upper end is fixed and hang at rest m', falls off. Show that the distance of m from the upper end of the string at time t is $a + b + c\cos\sqrt{\frac{g}{b}}t$ where a is the unstretched length of the string and b and c are the distances by which it would be stretched when supporting m and m'

11. A particle projected with a speed u strikes at right angles a plane through the point of projection, inclined at an angle β to the horizon. If α, T and R are the angle of projection, the time of flight and the range on the inclined plane, show that
    Cot β = 2 tan (α – β)
    Cot β = tan α – 2 tan β
    $T = \dfrac{2u}{g\sqrt{1+3sin^2\beta}}$
    $R = \dfrac{2u^2 sin\beta}{g\left(1+3sin^2\beta\right)}$

12. A shell of mass m is moving with velocity v. An internal explosion generates an energy E and breaks the shell into two portions whose masses are in the ratio a : b. They continue to move in the original line of motion. Show that their velocities after explosion are
    $v + \sqrt{\dfrac{2bE}{am}}$ $v - \sqrt{\dfrac{2aE}{bm}}$
13. Show that the M. I of a rectangular lamina of mass M and sides 2a and 2b about a diagonal is $M\dfrac{2a^2b^2}{3\left(a^2+b^2\right)}$

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