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.Mathematics - END SEMESTER EXAMINATIONS - NOV'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. Show that $\theta = 1200$, if a particle has two velocities of equal magnitudes inclined to each other at an angle θ. If one of them is halved, the angle between the other and the original resultant velocity is bisected by the new resultant.
2. A train moving at m/sec reduces its speed to 10m/sec in a distance of 240 m. At what distance will the train come to a stop? If the brake power is increased by 12.5%, Show that the train will stop in a total distance of 240 m.
3. Find period, amplitude, maximum velocity and maximum acceleration when $A = 3$, $B = 4$, $n = 2$, if 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 Simple Harmonic.
4. Prove that the period of small oscillation is $\pi\sqrt{\frac{2am}{\lambda}}$ The ends of an elastic string of natural length '**a**' are fixed at points A and B, distances $2a$ apart, on a smooth horizontal table. A particle of mass m is attached to the middle point of the string and slightly displaced along the direction perpendicular to AB.
5. If v_1 and v_2 are the velocities of a projectile at the ends of a focal chord of its path and v, the horizontal component of its velocity. Show that $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{v^2}$.
6. Two equal balls of mass mare in contract on a table. A third equal ball strikes both symmetrically and remains at rest after impact, show that $e = 2/3$.
7. Write a short note about impulsive force.
8. Show that the Moment of inertia of a rectangular lamina of mass M and sides $2a$ and $2b$ about a diagonal is $M = \frac{2a^2b^2}{3(a^2+b^2)}$.

Contd...

Section C

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

9. A vertical circular disc of radius a rolls on a ground without slipping along a straight line with a linear velocity u. Find the velocity of any point on its rim.

10. Show that the distance of m from the upper end of the string at time t is $a+b+c\ cos\sqrt{\frac{g}{b}}\ t$, if 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.

11. A ball is projected so as to just clear two parallel walls the first of height a at a distance b from the point of projection and the second of height b at a distance a from the point of projection. Supposing the path of the ball to lie in a plane perpendicular to the walls, find the range on the horizontal plane and show that the angle of projection exceeds $tan^{-1}(3)$.

12. A shell of mass m_1+m_2 is fired with a given velocity in a given direction. At the highest point of its path, the shell explodes into two fragments of mass m_1 and m_2. The explosion produces an additional kinetic energy E and the fragments separate in a horizontal direction. Show that , if the fragments strike the ground at A_1 and A_2 then $A_1A_2 = \frac{V}{g}\sqrt{2E\left(\frac{1}{m_1}+\frac{1}{m_2}\right)}$.

13. Find the moment of inertia of a square lamina of side l about one of its diagonals, the density at any point varying as the square of its distance from the diagonal.

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