B.Sc. DEGREE EXAMINATION,NOVEMBER 2018
III Year V Semester
Core Major - Paper XI
DYNAMICS

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. A particle has two velocities $\bar{v}_1$ and $\bar{v}_2$. Its resultant velocity is equal to $\bar{v}_1$ in magnitude. Show that, when the velocity $\bar{v}_1$ is doubled, the new resultant is perpendicular to$\bar{v}_2$.
2. Define angular velocity.
3. Show that in a simple harmonic motion, the sum of the K.E. and P.E. is a constant.
4. Define phase and epoch.
5. For a projectile find the greatest height attained by a particle.
6. Find the time of flight of a projectile.
7. Define an Impulsive force.
8. State the laws of impact.
9. State parallel axes theorem.
10. Find the moment of inertia of a rod about the line through the mid point and perpendicular to the rod.
11. If a point moves so that its angular velocity about two fixed points are the same, prove that it describes a circle.
12. Define 'amplitude' and 'period' with reference to a simple harmonic motion.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. The two ends of a train moving with a constant acceleration pass a certain point with velocities u and v respectively. Show that the velocity with which the middle of the train passes the same point is$\sqrt{\frac{1}{2}(u^2 + v^2)}$.
14. A particle moving with a simple harmonic motion has speeds v_1 and $v_2(v_1 > v_2)$ and acceleration with magnitude $\alpha_1$and α_2 at the points A and B which lie on the same side of the mean position O. Show that $AB = \frac{v_1^2 - v_2^2}{\alpha_1 + \alpha_2}$.

15. 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$\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{v^2}$.
16. To find the velocities of two smooth spheres after a direct impact between them.
17. Show that the moment of inertia of a rectangular lamina of mass $M$and sides $2a$ and $2b$ about a diagonal is $M\frac{2a^2b^2}{3(a^2+b^2)}$.
18. 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 $\cot\beta = 2\tan(\alpha-\beta)$.
19. State and prove the perpendicular axis theorem.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. If a particle moves along a straight line with a constant acceleration a then show that

    (i) $v = u + at$ (ii) $s = ut + \frac{1}{2}at^2$ (iii) $v^2 = u^2 + 2as$, where u is the initial velocity of the particle and 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.
21. The ends of an elastic string of natural length a are fixed at points A and B, distance $2a$ apart, on a smooth table. A particle of mass m is the attached to the middle point of the string and slightly displaced along the direction perpendicular to AB. Show that the period of small oscillation is $\pi\sqrt{\frac{2am}{\lambda}}$.
22. A particle is projected from a point O on the ground with a velocity u inclined to the horizontal at an angle α. It hits the ground at A. Find the following.

    (i) Maximum height H attained by the particle

    (ii) Time taken to attain the maximum height

    (iii) Time of flight from O to A

    (iv) Horizontal range R

    (v) Velocity at time t
23. A particle is projected from a point in a smooth fixed horizontal plane with velocity u at an elevation α. Show that the particle ceases to rebound from the plane at the end of time $\frac{2u\sin\alpha}{g(1-e)}$ and that the total horizontal distance described in this period is $\frac{u^2\sin 2\alpha}{g(1-e)}$, where e the coefficient of restitution.
24. Find the moment of inertia of solid right circular cone about axis of the cone.

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