MAY 2024 **U/ID 32511/UCM4B**

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. If two forces P and Q act on a particle in the same direction what is the resultant?

2. State Polygon law of forces.

3. Write the necessary and sufficient condition for a system of coplanar forces to keep a rigid body in equilibrium?

4. Define centre q mass.

5. Define simple harmonic motion.

6. Define Angular velocity.

7. A boat which can stream in still water with velocity of 48 km.ph is streaming with its bow pointed due east. When it is carried by a current which flows northward with a speed of 14 km.ph. Find the actual distance it would travel in 12 minutes.

8. What is the maximum horizontal range of a projectile?

9. What is the frequency of simple harmonic motion?

10. Find the change in kinetic energy due to direct impact of two smooth spheres.

11. Write the number of revolution of a particle of a conic pendulum in a second.

12. Write the law of central force.

PART B — ($5 \times 5 = 25$ marks)

Answer any FIVE questions.

13. State and prove Lami's theorem.

14. If E is the mid point of the side CD of a square $ABCD$. Forces 16, 20, $4\sqrt{5}$, $12\sqrt{2}$ act along $\overline{AB}$, $\overline{AD}$, $\overline{EA}$, $\overline{CA}$, respectively. Show that they are in equilibrium.

15. Find the centre of mass of a solid hemisphere of radius 'a'.

16. A particle move along a straight line with a constant acceleration 'a'. Show that

(a) $v = u + at$

(b) $s = ut + \frac{1}{2}at^2$

(c) $v^2 = u^2 + 2as$.

17. A Mass 'm' suspended from a spring causing an extension 'a'. If a mass 'm' is added to m find the periodic time of the ensuing motion and the amplitude of the oscillation.

18. Obtain the velocity of two smooth spheres after a direct impact between them.

19. Find the M-I of a solid right circular cone whose distance from the vertex is x and radius is $\frac{ax}{h}$.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. If 'O' is the orithocentre of the triangle ABC. If forces of magnitude P, Q, R acting along OA, OB, OC are in equilibrium show that $\frac{P}{a} = \frac{Q}{b} = \frac{R}{c}$.

21. ABCD is a regular hexagon. Forces P, 2P, 3P, 2P, 5P, 6P act along AB, BC, DC, ED, EF, AF respectively. Show that the six forces are equivalent to a couple and find the moment of the couple.

22. State and prove principle of energy and principle of conservative energy.

23. A particle is projected from the top D of a wall, AD, 50 m height, at an angle of 30° above the horizon, strikes the level ground through A at B at an angle of 45°, show that the angle of depression of B from O is $\tan^{-1}\left(\frac{\sqrt{3}-1}{2\sqrt{3}}\right)$.

24. State and prove perpendicular axis theorem for moment of inertia.
