CLASS XI

UNIT- V SYSTEM OF PARTICLE AND RIGID BODY

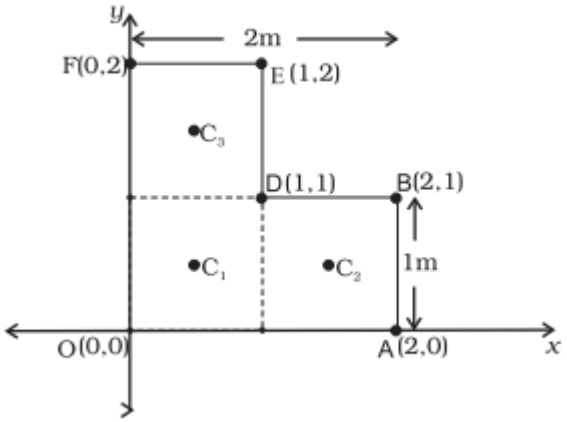
SECTION-A CONCEPTUAL & APPLICATION TYPE QUESTIONS

1. Does the centre of mass of a solid necessarily lie within body? If not, give an example.
2. Why a force is applied at right angles to the heavy door at outer edge while closing or opening it?
3. Standing is not allowed in double decker bus. Why?
4. A person is sitting in the compartment of a train moving with uniform velocity on smooth track. How will the velocity of C.M. of compartment change if person begins to run in compartment?
5. What is the physical significance of moment of inertia?
6. Is radius of gyration a constant quantity?
7. Why is it more difficult to revolve a stone tied to a large string than a stone tied to a smaller string?
8. While turning the page of book, we usually apply force perpendicular to the plane of the page at farthest end. Explain why?
9. The moments of inertia of two rotating bodies **A** and **B** are $\mathbf{I_A}$ and $\mathbf{I_B}$ ($\mathbf{I_A}$>$\mathbf{I_B}$) and their angular momenta are equal. Which one has a greater kinetic energy?
10. State the law of conservation of angular momentum.
11. Explain if the ice on polar caps of earth melts, how will it affect the duration of the day?
12. Torque and work is both equal to force times distance. Then how do they differ?
13. Explain why the speed of whirl wind in a tornado is alarmingly high?
14. State the theorem of perpendicular axes for moment of inertia.
15. State the theorem of parallel axes for moment of inertia.

SECTION-B NUMERICAL QUESTIONS

1. Three identical spheres each of radius R, placed touching each other on a horizontal table. Locate the position of the centre of mass of the system.
2. Three balls of masses 1, 2 and 3 kg respectively are arranged at the corners of an equilateral triangle of side 1m. What will be the M. I. Of the system about an axis through the centroid and perpendicular to the plane of triangle?
3. Calculate the ratio of radii of gyration of circular ring and a disc of same mass and radius about the axis passing through their centres and perpendicular to their planes.
4. A solid cylinder rolls down an inclined plane. Its mass is 2 Kg and radius 0.1. If the height of the inclined plane is 4m, what is its rotational kinetic energy when it reaches the foot of the plane?
5. A flywheel (like disc) of mass 25 kg has radius of 0.2 m. It makes 240 r.p.m. What is thetorque necessary to bring it to rest in 20 s? If the torque is due to a force applied tangentially on the rim of the flywheel, what is magnitude of the force?
6. A horizontal disc rotating about a vertical axis passing through its centre makes 180 r.p.m. A small piece of wax of mass 10 g falls vertically on disc and adheres to it at a distance of 8 cm from its axis. If the frequency is thus reduced to 150rpm,calculate the M.I. of disc.

7. A ring, a disc and a sphere all of the same radius and mass roll down an inclined plane from the same height 'h'. Which of the three reaches the bottom (i) earliest (ii) latest?
8. A disc of radius 0.5 m is rotating about an axis passing through its centre and perpendicular to its plane. A tangential force of 2000 N is applied to bring the disc to rest in 2 s. Calculate its angular momentum.
9. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass 5g are put one on top of the other at 12.0 cm mark, the stick is found to be balanced at 45.0 cm. What is mass of the metre stick?
10. Find the centre of mass of uniform L-shaped lamina (a thin flat plate) with dimensions as shown in figure. The mass of lamina is 3kg.



11. A solid sphere is rolling on a frictionless surface about its axis of symmetry. Find the rotational energy and the ratio of its rotational energy to its total energy.
12. A ring of diameter 0.4 m and of mass 10 kg is rotating about its axis at the rate of 2100 rpm. Find (i) moment of inertia (ii) angular momentum and (iii) rotational kinetic energy of the ring.