

Attempt **Five** Questions in all. **Section-A** is **Compulsory**. Attempt **Two** questions from **Section-B** and **Two** from **Section-C**.

SECTION-A

1. Answer any FOUR of the following:

2x4

- In long jumping, does it matter how high you jump? What factors determine the span of jump?
- You are flying a plane at constant attitude and you wish to make 90° turn, why do you bank in order to do so?
- In a tug of war, one team is slowly giving way to other. What work is done and by whom?
- A cylinder rotates with angular speed ω about an axis through one end. Choose an appropriate origin and show qualitatively the vector \vec{L} and \vec{W} . Are these vectors parallel? Do symmetry consideration enter here?
- What is original length of a bar, if its length is 65cm when moving with speed $0.8c$?

SECTION-B

- Define Projectile motion (without air resistance). Show that trajectory is parabola. 1, 1, 6
- Define rotational inertia of rotating body and find moment of inertia of bar about axis perpendicular to its length. 1, 1, 6
- State postulates of special theory of Relativity. Calculate relativistic momentum of system of particles. 2, 6

SECTION-C

- Two vectors are given $\vec{a} = 4\hat{i} - 3\hat{j}$ and $\vec{b} = 6\hat{i} + 8\hat{j}$
 Find magnitudes and direction along x-axis of (a) \vec{a} (b) \vec{b} (c) $\vec{a} + \vec{b}$. 7
- The moon revolves about the earth making a complete revolution in 27.3 days. Assume radius of orbit is 3.8×10^8 m. What is gravitational force on moon, if mass of moon is 7.4×10^{22} Kg. 7
- It is desired to place a communication satellite in to orbit so that it remain fixed about a given spot on equator of earth. What is height above the earth of such satellite? 7
- Two identical spheres of mass M and radius R are joined together and combination is rotated about an axis tangent to one sphere and perpendicular to line connecting them. Find rotational inertia? 7