

NOTE: 1) Numbers in the right indicate marks.

2) All questions are compulsory.

3) Use of non-programmable calculators is allowed.

Q.1) Answer the following:

(20 marks)

- A) Derive the equation of composition of two perpendicular SHMs of the same period. Obtain Lissajous figures for  $\delta=0, \frac{\pi}{2}$ . (8M)

OR

- B) Write down the equation of motion of Simple Harmonic Motion. Obtain its solution and expression for angular frequency. Why is SHM called sinusoidal motion? (8M)
- C) Three particles of masses 2kg, 3kg and 4kg are moving such that their position vectors are given by  $(4t^2, 3t, 0)$ ,  $(0, 6t, 0)$  and  $(0, 0, t^2)$ . Find the angular momentum of the system and the external torque acting on the system. (7M)

OR

- D) Derive an expression for angular momentum of a system of particle about a fixed point O in centre of mass co-ordinate system. (7M)
- E) Four masses 1kg, 2kg, 3kg and 4kg are located at  $(-1, -2, 2)$ ,  $(3, 2, -1)$ ,  $(1, -2, 4)$  and  $(3, 1, 2)$  respectively. Find the center of mass of this system. (5M)

OR

- F) What are Lissajous figures? What factor do their shapes depend upon? (5M)

Q.2) Answer the following:

(20 marks)

- A) Derive Lens maker formula. (8M)

OR

- A) Show that the spherical aberration is minimum if in a lens system, two thin lenses  $L_1$  and  $L_2$  of focal lengths  $f_1$  and  $f_2$  are at a distance  $d$  apart which is equal to the difference in their focii. (8M)
- B) Describe how will you determine angle of prism using a spectrometer and derive expression for it. (7M)

OR

- C) Describe Newton's ring experiment to find wavelength of incident light used in an experiment. (7M)
- D) A lens has one radius of curvature 30cm and other half of it. Find the refractive index if the focal length of a system. (5M)

OR

- E) Assuming an expression for radius of a dark ring, show that the rings are more and more crowded as one move away from the center. (5M)

P.T.O.