PHYSICS Paper-A

(Mechanics-II)

Time Allowed : 3 Hours] **[Maximum Marks : 22**

Note: (*i*) Attempt **five** questions in all, selecting at least **two** questions each from UNIT-I and UNIT-II and UNIT–III is compulsory.

(*ii*) All questions carry equal marks.

(*iii*) Use of non-programmable calculator is allowed.

UNIT–I

1. (*a*) Find the moment of inertia tensor for a solid cube of mass M and side a, rotating about a corner. 3

   (*b*) What is a gyroscope? Write down its two applications. 1½

2. (*a*) What is Coriolis force? Discuss its Effect of on a freely falling body. 3

   (*b*) Calculate the time, it will take to turn the plane of oscillation of Foucault's Pendulum through 90° at a point where latitude is 90°. 1½

3. Describe Michelson Morley Experiment and explain the physical significance of the results. 4½

UNIT–II

4. (*a*) Derive Lorentz space time transformation equations for two intertial frames. 3

   (*b*) Show by Lorentz transformation equation that :

   $x'^2 - c^2 t'^2 = x^2 - c^2 t^2$ 1½

5. (a) What do you understand by length contraction? What is proper intreval? Derive expression for it. 3

(*b*) How much younger an astronaut will apear to an eath observer, if he return afater 10 years having moved with a velocity 0.8c? $1\frac{1}{2}$

6. Set up transformation equations for relativistic momentum and energy. $4\frac{1}{2}$

UNIT–III

7. Attempt any all parts :

(*i*) Can a particle rotate without experiencing any torque? Explain.

(*ii*) What is Galilean Invariance and principle of Simultaneity?

(*iii*) What do you mean by four vector formulation?

(*iv*) What is relativistic Doppler Effect? How it is different from non-relativistic Doppler Effect? $4\times1=4$