End Semester Examination, 2022

Semester - I

Physics

PAPER - CC-2T

Full Marks : 40

Time : 2 Hours

The Figures in the right hand margin indicate marks. Candidates are required to give their answers in their own words as far as practicable.

Group - A

1. ***Answer any five questions :***   **5x2=10**

a) Derive an expression for moment of inertia of rectangular lamina.   2

b) Define phase and amplitude of an oscillation. 2

c) What is escape velocity ? Find value of it in earth. 2

d) Explain gravitational mass and inertial mass. 2

e) Define streamline motion for fluid flow.   2

f) Displacement of a particle executing a simple periodic motion is given by $x = 4\cos^2 t/2 \sin 1000t$. Show that the motion is three independent harmonic motion.

g) Find the moment of inertia of a solid sphere (radius R and mass M) about the axis which is at a distance of R/2 from the centre.

(Turn Over)

h) Prove that $E = m_0 c^2 \sqrt{1 + \dfrac{p^2}{m_0^2 c^2}}$.

Group - B

Answer any four questions : 4x5=20

2. a) Define real fluid and ideal fluid.

b) "Co-efficient of viscosity of glycerine is 8.4 poise" explain.

c) Distinguish between laminar flow and tarbulent flow. 2+1+2

3. a) Obtain an expression for time period of compound pendulum.

b) For a given compound pendulum, show that the centers of oscillation and suspensions are inter change able. 3+2

4. What is a central force ? Prove that (a) The torque about the centre of force is zero. (b) The motion of the particle always confined in a plane.$2+1\frac{1}{2}+1\frac{1}{2}$

5. Find out total energy of a particle executing simple Harmonic Motion. 5

6. Differentiate centre of mass and centre of gravity. Find the centre of mass of a rod having mass density $\lambda = A\cos\left(\dfrac{\pi x}{2 l}\right)$ where 1 is the length of the rod. 2+3

7. Establish Poiseuilli's equation for the flow of liquid through a narrow capillary tube without Kinetic energy correction and length correction. 5

Group - C

Answer any one question : 1x10=10

8. a) Define half-power frequencies. How are they related to sharpness of resonance ? Why do soldiers break steps while crossing a bridge at the time of procession ?

b) Find the work done in twisting a steel wire of radius 1mm and length 25cm through an angle of 45^0, the modulus of rigidity of steel being $8 \times 10^{10} N/m^2 \cdot$ (1+4+1+1)+3

9. a) Prove that, Newton's law remains invariant under Galilean transformation.

b) Write down Lorentz transformation equations.

c) Two rockets each of rest length Lo are approaching the earth from opposite directions at the same speed 0.8c. Find the length of one rocket in the frame of the other rocket. 3+2+5