[This question paper contains 5 printed pages.]

561 *Your Roll No.* .....

B.Sc./B.Sc. (Hons.)/I **A**

PH-101 – PHYSICS

(Admissions of 2008 and onwards)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **five** *questions in all including Question No.* **1**, *which is compulsory.*

1. Attempt any **five** questions :– (5×3=15)

(a) The maximum and minimum distances of a planet from the sun are 2.8×10^8 km and 1.4×10^8 km respectively. Calculate the velocity when the planet is nearest to the sun, if the velocity when it is farthest is 3×10^3 m/s.

(b) Show that for a central force field torque about origin is zero.

(c) What is the speed of particle whose kinetic energy is equal to its rest energy ?

(d) Show that $x^2 + y^2 + z^2 = e^2t^2$ is invarient under lorentz transformation.

P.T.O.

(e) A particle is executing simple harmonic motion with time period T. Calculate the time taken by the particle in completing $\left(\frac{3}{8}\right)$ oscillation starting from mean position.

(f) Suppose that a Young's double slit interferometer is immersed in water. What would be the effect on the fringe pattern ? Give reason for your answer.

(g) Draw the circuits of half adder and full adder using logic gates and write their truth tables.

(h) Calculate the mass of water flowing in 10 minutes through a capillary tube 0.1 cm in diameter and 40 cm long. There is a constant pressure head of 20 cm of water. The viscosity of water is 1.3×10^{-3} kg/m-sec.

2. (a) What is a central force ? Give examples of central forces. Show that under the action of central force

(i) the angular momentum is conserved

(ii) particle moves in a fixed plain (8)

(b) Show that Law of conservation of linear momentum is invarient under Galilean Transformation. (7)

3. Describe the Michelson Morley experiment. How is the null result of this experiment consistent with the postulates of special theory of relativity? (15)

4. (a) Find the torsional rigidity of a cylinder of radius r, length l, and modulus of rigidity η. Show that a hollow cylinder of internal radius r_1 and outer radius r_2 is stronger than a solid one of the same material, mass, and length, against a twisting couple. (10)

(b) π^+ mesons have half life of 2.5×10^{-8} sec. If they enter earth atmosphere at a speed of 0.9C, how far do they travel before decaying. (5)

5. (a) A point moves in a plane performing two orthogonal simple harmonic motions given by

$$x = a_1 \cos wt$$

$$y = a_2 \cos (wt + \phi)$$

Show that in general the point moves in an elliptic path.

Under what conditions will it move in (i) circle (ii) in a straight line. (7)

(b) A damped harmonic oscillator is described by equation

$$\ddot{x} + \lambda\dot{x} + w_0^2 x = 0$$

where λ and w_0^2 are constants.

Show that if $w_0 > \frac{\lambda}{2}$, the motion is

$$x(t) = x_0 e^{-\frac{\lambda t}{2}} \sin(w_1 t + \phi)$$

where x_0 and ϕ are arbitrary constants and

$$w_1 = \sqrt{w_0^2 - \frac{\lambda^2}{4}}.$$

Explain what happen when $w_0 < \lambda/2$. (8)

6. (a) What is the difference between Fresnel and Fraunhofer diffraction ? (2)

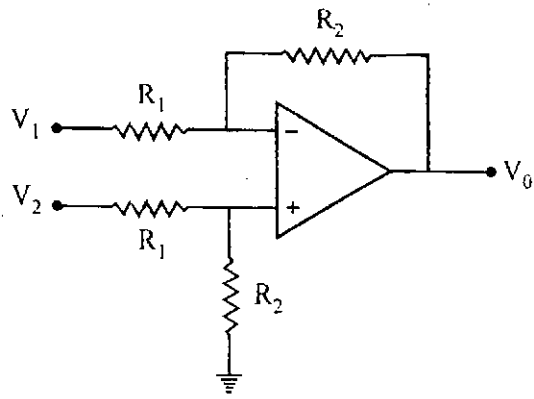
(b) Derive an expression for the intensity distribution of a single slit Fraunhofer diffraction. Show that the intensities of successive maxima are in the ratio of

$$1 : \left(\frac{2}{3\pi}\right)^2 : \left(\frac{2}{5\pi}\right)^2 : \ldots\ldots$$ (10)

(c) Describe Rayleigh's criteria resolution of two images. (3)

7. (a) Explain the working of a 555 timer in an Artable configuration. Derive an expression for pulse period. (8)

(b) Find the output of the circuit shown. (4)



(c) Explain how can a Zener diode be used as a voltage regulator ? (3)

8. (a) Give truth tables for half subtractor and full subtractor and realise their logic circuits. (8)

(b) What is Action Potential ? Discuss conduction of nerve impulse in a neuron. (4)

(c) Discuss size-dependent properties of nano-particles. (3)