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Your Roll No . . . . .

**5161**

**B.Sc. /B.Sc. (Hons.)/I J**  
**PH-101 – PHYSICS**

**(NC – 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**

- (a) Show that the length of a rod is invariant under Galilean transformation.
- (b) Write postulates of special theory of relativity
- (c) What do you mean by the degree of freedom of coupled oscillators ?
- (d) What are the necessary conditions for observing interference fringes ?
- (e) Why is a NAND gate called a universal gate ? Draw a circuit diagram to obtain OR gate using NAND gates

- (f) What do you mean by nano-pollutants ?
- (g) Why is metastable state required to make a LASER ?
- (h) What do you understand by GPS ?  $5 \times 3$
- 2 (a) State and explain the work-energy theorem  $2 + 8$
- (b) A particle moves along one quarter of the circumference of a circle of radius 0.5 m. If the force applied is 0.2 N, inclined at an angle of  $60^\circ$  with the tangent to the circle at the point, calculate the work done  $5$
- 3 (a) Derive the expression for the relativistic Doppler effect based on the special theory of relativity  $10$
- (b) Two photons are moving in opposite directions in space. Find the relative velocity of one with respect to other  $5$
- 4 (a) What do you understand by the phenomenon of beats ? Explain with an example  $3$
- (b) Write the differential equation for a lightly damped oscillator assuming the damping force is directly proportional to the velocity of the oscillator. Solve the equation and show the variation of displacement with time graphically  $3 + 6 + 3$

5 (a) Discuss Fraunhofer diffraction due to a single slit. Explain what happens when the slit width is gradually increased and when the screen is gradually moved away from the slit. 10

(b) In Fraunhofer diffraction pattern due to a narrow slit, a screen is placed 2 m away from the slit to obtain the pattern. If wavelength of light is 5000 Å, find the width of the slit when the first minimum lies 5 mm on either side of the central maximum. 5

6 (a) Explain the working of a half-adder circuit. Give its truth table. 5

(b) How can an Op-amp be used as a comparator? Explain its working. 10

7 (a) Derive Poiseuille's formula for the volume rate of flow of liquid through a tube of circular cross-section. 10

(b) If two capillary tubes of length  $l_1$  and  $l_2$  and radii  $r_1$  and  $r_2$  are joined in series show that volume rate of flow "V" of liquid through the combination is given by

$$V = \frac{\pi P}{8\eta} \left[ \frac{l_1}{r_1^4} + \frac{l_2}{r_2^4} \right]^{-1}$$

(P = pressure difference across combinations and  $\eta$  = coefficient of viscosity) 5

8. Write short notes on any **three** of the following

(a) Lissajous Figures

(b) Light emitting diode and its applications

(c) Importance of Nanoparticles

(d) Young's double slit experiment

**3 × 5**

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