Lib   27/5/22 (M)

[This question paper contains 4 printed pages.] **2 7 MAY 2022**

Your Roll No...............
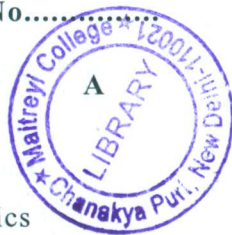
Instructions for Candidates

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

2. Attempt **five** questions in all.

3. Question no. **1** is compulsory.

1. Attempt any **FIVE** parts from the following :

   (a) The time period of tuning fork is $\dfrac{1}{256}$ and it produces 4 beats/second, when sounded with another fork. Calculate the frequency of the second fork.

P.T.O.

(b) If the phase velocity is given by, $v_p = \left(\dfrac{2\pi S}{\rho \lambda}\right)^{1/2}$

(Here, S and ρ are constant), then derive the relation between group velocity and phase velocity.

(c) Give three differences between travelling waves and stationary waves.

(d) Explain why the reverberation time is larger for an empty hall than for a crowded hall.

(e) What do you understand by wave front? Name one experiment each, which is based on division of wave front.

(f) Why do thin films appear colored in white light?

(g) How many orders will be visible if the wavelength of incident radiation is 4800 Å and the number of lines on a diffraction grating is 2500 per inch.

(5×3=15)

2. (a) What are Lissajous Figures? For the cases mentioned below, give the graphical as well as analytical representation of the Lissajous Figures

(with direction) for the motion of a particle which is subjected to two perpendicular simple harmonic motions given by,

$$x = 3 \cos(\omega t)$$

$$y = 2 \cos(2\omega t + \alpha), \text{ where } \alpha = 0$$

(b) Prove that the principle of superposition holds only for linear homogenous differential equation.

(10+5=15)

3. (a) Explain the formation of standing waves on a stretched string.

(b) For a stationary wave, the displacement (in cm) is given by,

$$y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$$

What is the distance between a node and the next anti-node? (10+5=15)

4. (a) What do you mean by Fresnel's half period zones? What are the radii of zones of a zone plate?

(b) Explain with the help of a diagram, the intensity distribution due to diffraction at a straight edge. (7+8=15)

P.T.O.

5. (a) State the principle of reversibility of light. Determine the Stokes' relation for reflection of light from an optically denser medium.

(b) Discuss the theory of interference due to two slits and find the expression for fringe width.

(5+10=15)

6. (a) Derive the expression for intensity distribution in case of Fraunhofer diffraction due to single slit.

(b) Show that the relative intensities of the successive maxim are in the ratio of,

$$1 : \left(\frac{2}{3\pi}\right)^2 : \left(\frac{2}{5\pi}\right)^2 \dots \quad (10+5=15)$$

7. (a) Show that electromagnetic waves are transverse in nature.

(b) Explain any two methods of polarizing an unpolarized beam of light. (9+6=15)