Unique Paper Code : 32225310

Name of the Paper : Waves and Optics

Name of Course : B.Sc. Hons.-CBCS_GE

Semester : III - Semester

Duration : 3 Hours

Maximum Marks : 75

Attempt any four questions in all. All questions carry equal marks.

1) (a) A particle is subjected simultaneously to two simple harmonic motions of the same period but of different amplitudes and phases in perpendicular directions. Derive the expression for the resultant motion. For what conditions the path may be a straight line, ellipse or circle? Discuss the different important cases. (12)

(b) Calculate the resultant of two simple harmonic vibrations at right angles when their periods are in the ratio of 2:1 and there is a phase difference of 0 or $\pi/2$. (6.75)

2) (a) Prove that the wave equation for a transverse wave in a string is given by

$$\frac{\delta^2 y}{\delta x^2} = \frac{1}{c^2}\frac{\delta^2 y}{\delta t^2}$$

where c = $\sqrt{\frac{T}{\rho}}$, T being the tension and ρ the linear density of the string. (12)

(b) What are sound waves? How can they be produced? Write four properties of sound waves. (6.75)

3) (a) Giving the necessary theory, discuss the formation of Newton's rings by reflected light and explain how it can be used for determination of wavelength of monochromatic source of light. Why Newton's rings are circular? (14)

(b) In a Newton's ring experiment, the diameter of the 15^{th} ring was found to be 0.590 cm and that of the 5^{th} ring was 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of light used. (4.75)

4) (a) Describe Fresnel's half – period zones. Why are they so called? Show that the areas of the various half – period zones are independent of the order of the zone and are nearly equal. Also show that radii of these zones are proportional to $\sqrt{n}$ where n = 1, 2, 3... (12.75)

(b) Explain the approximate rectilinear propagation of light. (6)

5) (a) Distinguish between Fresnel and Fraunhofer class of diffraction. (3)

(b) Derive an expression for intensity distribution for Fraunhofer diffraction due a single slit. What happens when the width of the slit is gradually increased? (12.75)

(c) A single slit of width 1 mm is illuminated by light of wavelength 589 nm. Find the angular spread of the central maximum of diffraction pattern observed. (3)

6) (a) What do you understand by double refraction? What are ordinary and extra – ordinary rays? Describe the construction and working of Nicol prism. (12.75)

(b) What are beats? Give the necessary conditions for obtaining them. (6)