

Serial No. : 12771
Unique Paper Code : 42224412
Name of the Department : Department of Physics and Astrophysics
Name of the Course : B.Sc. Prog.-CBCS_Core
Name of the Paper : Waves and Optics
Semester : IV
Duration : 3 Hours Maximum Marks : 75

Attempt five questions in all. Question no. 1 is compulsory.

Q 1 Answer any five of the following. (5X3 = 15)

- a) Discuss the difference between a zone plate and a convex lens.
- b) What are Lissajous figures?
- c) What is Rayleigh's criterion for limit of resolution?
- d) Give differences between Fresnel's biprism and Lloyd's mirror interference fringes.
- e) How wavelength of a light can be determined using Newton's ring experiment?
- f) Explain the factors that affect the quality of sound.

Q 2 a) Find the resultant of two perpendicular simple harmonic motions whose amplitude are in the ratio 1:2 and the phase difference is 90° . 12

b) What are beats? Discuss various applications of beats. 3

Q 3 a) What do you mean by wave velocity and group velocity? Derive the relation between them in a dispersive medium. 9

b) Two colinear simple harmonic motions acting simultaneously on a particle are given by $x_1 = 0.3 \cos 2\omega t$ and $x_2 = 0.2 \sin(2\omega t - \pi/3)$. where x is expressed in cm and t in seconds. Write down the expression for the resultant displacement as a function of time. 6

P.T.O.

Q 4 a) Give the theory of formation of Newton's rings by reflected monochromatic light and prove that radii of these rings are proportional to the square root of natural numbers. 9

b) State the principle of superposition and prove that it holds only for linear differential. 6

Q 5 a) A diffraction phenomenon is observed using a double slit with a monochromatic light ($\lambda = 5890 \text{ \AA}$), slit width = 0.01 mm and spacing between two slits = 0.10 mm. Distance between slit and screen is 1.5 m. Calculate fringe width? 9

b) Two glass plates enclose a wedge shaped air film touching at one edge are separated by a wire of 0.04 mm diameter at a distance of 16 cm from the edge. Monochromatic light of wavelength 6000 $\text{\AA}$ from a broad source falls normally on the film. Calculate the fringe width 6

Q 6 a) Give the theory of plane transmission grating and hence derive the grating equation. 12

b) The diameter of first ring of a zone plate is 1.2 mm. If plane waves of wavelength 6000 $\text{\AA}$ falls on the zone plate, where should the screen be placed so that the light is focussed to a brightest spot. 3

Q 7 a) Describe Fraunhofer diffraction by a single slit using a well labelled diagram. Also draw the intensity diagram. 9

b) Discuss how circularly and elliptically polarized light can be produced and detected? 6