

Assignment
PHYSICS (Honours)

Paper: 2026

Full Marks : 50

Time : 3 hours

Submission date: 10/08/2020

(Wave & Optics)

1. Answer the following questions:

1×5=5

(a) What do you understand by stationary wave?

(b) If two waves are represented by $x_1 = a \sin\left(\omega t + \frac{\pi}{5}\right)$ and $x_2 = a \cos\left(\omega t - \frac{\pi}{3}\right)$, then what is the phase difference between the two waves?

(c) What do you mean by grating element?

(d) In case of Young's double-slit experiment, if one slit is covered with green transparent paper and the other with blue transparent paper, what will be the effect on interference pattern?

(e) On what factors does the width of central maxima of a grating depend?

2. Answer the following questions:

2×3=6

(a) State the differences between transverse wave and longitudinal wave?

(b) Discuss about temporal and spatial coherence?

(c) Distinguish between phase velocity and group velocity?

3. Answer the following questions:

3×3=9

(a) A slit is situated at a distance of 9 cm from the Fresnel's biprism. Each angle of the prism is 2° and the refractive index of the materials of prism is 1.5. Calculate the fringe-width when the eyepiece is placed at a distance of 91 cm from the biprism and the wavelength of light is 6280 \AA . 3

(b) Calculate the speed of the wave whose representation in SI unit is $\psi(y, t) = A \cos \pi(3 \times 10^6 y + 9 \times 10^4 t)$? 3

(c) Three SHM of same frequency act on a particle simultaneously in the same direction. Their amplitudes are $a_1 = 1$ cm, $a_2 = 1.5$ cm and $a_3 = 2$ cm respectively. The phase angle of the second with respect to the first is 60° , that of the third with respect to the second is 30° . Find the resultant amplitude and phase. 3

4. Answer any *four* questions of the following: 5×4=20

(a) Derive the wave equation for a longitudinal wave? 5

(b) What do you mean by Fresnel half-period zone? Show that the radii of half-period zones are proportional to the square roots of natural number. 2+3=5

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

(d) Distinguish between single slit and a double slit diffraction pattern. How does the diffraction pattern due to double slit change if the distance between the slit centres is varied, keeping slit width constant? 2+3=5

(e) Light containing two wavelengths λ_1 and λ_2 falls normally on a plano-convex lens of radius of curvature R resting on a glass plate. If the nth dark ring due to λ_1 , coincides with the (n+1)th dark ring due to λ_2 , prove that the radius of the nth dark ring of λ_1 is $\sqrt{\frac{\lambda_1 \lambda_2 R}{\lambda_1 - \lambda_2}}$ 5

5. Answer any *one* question of the following: 10×1=10

(a) What is holography? What is the fundamental principle of a hologram? How is it produced and how is the image reconstructed from it? 2+3+5=10

(b) Explain the working of Michelson interferometer. How will you produce circular fringes with it? How will you measure the difference in wavelength between the D lines of sodium light? 4+3+3=10

N.B. – Mention your class roll no. and GU roll no. at the answer script properly. Upload the pdf version of answer script at the web portal adjacent to the view bottom of respective paper.