2020

PHYSICS (Honours)

Paper : PHSH - DC- 4

[CBCS]

Full Marks : 25 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

1. Answer any *five* of the following : 2×5=10

(a) Write down the mathematical expression for a progressive and a stationary wave.

(b) Define group velocity and phase velocity.

(c) Define bel, decibel and phon.

(d) Two simple harmonic motion's $x = a \sin \omega t$ and $y = b \sin(\omega t + \delta)$ acting on a particle in perpendicular directions. Show that the resultant motion is an ellipse.

(e) State Huygens' principle of propagation of light waves through a homogenous isotropic medium.

(f) What do you mean by coherent sources of light?

(g) What is the radius of the first zone in a zone plate of principal focal length 20cm for light of wave length 5000Å?

(h) Why a narrow source is required for bi-prism experiment but a broad source for Newton's ring set-up.

2. Answer any *three* of the following : 5×3=15

(a) A flexible string of uniform cross section and length l along x-axis is fixed at two ends under a tension T. Setup the differential equation for the transverse vibration of the string. 5

(b) For a stationary wave, solution of the equation, given displacement at a point x at a time t, is given by

$$y_{x,t} = \sum_{s=1}^{\infty} Y_s$$

$$= \sum_{s=1}^{\infty} \frac{A}{s^2} \sin\frac{s\pi a}{l} \sin\frac{s\pi x}{l} \cos\frac{s\pi ct}{l}$$

Where $x = a$, the point of excitation and c is velocity of propagation of wave in the string. Other notations have usual significance.

(i) Find the initial displacement for the fifth harmonic.

(ii) Calculate the frequency of wavelength of the second harmonic $\left(a = \frac{l}{2}\right)$.

(iii) The string excited at $x = a = \frac{l}{3}$, calculate the first two harmonics that are present. 1+2+2=5

(c) Derive an expression for the intensity of the fringe system formed by transmitted light in a Fabry-Perot interferometer. 5

(d) Derive an expression for the intensity due to Fraunhofer diffraction by single slit when mono chromatic light is incident normally on it. 5

(e) Give qualitative idea of formation and reconstruction of a hologram. 5
