B.Sc. 2nd Semester (Honours) Examination, 2019 (CBCS)

Subject : Physics

Paper : CC-IV

Time: 2 Hours **Full Marks: 40**

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* questions. 2×5=10

(a) Two simple harmonic motions working on a particle along x-axis are described as

$x_1 = a_1 \sin \omega t$ and

$x_2 = a_2 \sin(\omega t + \phi)$

What will be the resultant amplitude if $\phi = \pi/3$ and $a_1 = a_2$?

(b) Write the relation between coherence length and coherence time.

(c) The displacement of a periodic motion along y direction is described as

$$y = 8\cos^2\left(\frac{t}{2}\right).\sin(1000\, t)$$

Find the frequencies of the independent harmonic motions.

(d) Two simple harmonic motions acting on a particle along two perpendicular directions are described by the equations given as

$$x = a \text{ Sin } (\omega t)$$
$$y = b \text{ Sin } (\omega t + 3\pi)$$

Draw the resultant displacement of motion in $x - y$ plane.

(e) Write an advantage of using laser light in holographic recording.

(f) What is the advantage of multiple beam interferometer over Michaelson interferometer and why?

(g) A monochromatic light of wavelength 500 nm is illuminating two parallel slits of 5 mm apart. Calculate the angular deviation of 4th order bright fringe in degree.

(h) A monochromatic light is incident on a slit of 0.01 mm wide. The 1st diffraction minimum is seen at an angle 2° from the direction of the incident beam. Find the wavelength of the light used.

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

(a) A wire having mass m and length l is made fixed at the top end, and is hanged freely under its own weight. Derive the expression of the time taken by the transverse wave to travel the length l of the wire. 5

(b) In a double slit experiment two elements move apart symmetrically with the relative velocity v, in the slit plane. Calculate the rate of passing the fringes at a point x from the centre of the fringe system created on the screen at the distance D from the double slit. 5

(c) A monochromatic and parallel beam having the wavelength 600 nm is incident normally on plane type of transmission grating having 5000 lines per cm. Obtain the highest order of the spectrum of the grating. If the wavelength is increased from 600 nm to 700 nm, find the percentage of decrease of the order. 3+2=5

(d) With a neat diagram discuss the method of reconstruction of the image of an object both in real and virtual forms from a recorded hologram. $2\frac{1}{2}+2\frac{1}{2}=5$

3. Answer *any two* of the following: 10×2=20

(a) Derive the conditions of maxima and minima in cases of the fringes formed by Michelson interferometer. Hence derive the expression of the distance between two consecutive bright fringes in this interferometer. (3+3)+4=10

(b) A particle is subjected by two simple harmonic motions as represented by the following equations:

$x = a_1 \sin \omega t$ and

$y = a_2 \sin(2\omega t + \delta)$ in a plane perpendicular to each other.

Derive the expression of the resultant motion.

Hence draw the Lissajous figures for $\delta = \pi/2$ and $\delta = 0$. 4+3+3=10

(c) Discuss the principle of working of Fresnel's biprism experiment and obtain the expression of distance between two virtual sources in this experiment. 6+4=10

(d) Derive the condition of forming bright and dark fringes due to a thin film for the reflected rays. What will be the conditions if the incidence of light is normal to the film? 8+2=10
