2022

B.A./B.Sc.

Fourth Semester

GENERIC ELECTIVE – 4

PHYSICS

Course Code: PHG 4.11

(Waves & Optics)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) Obtain an expression for the resultant motion of two collinear harmonic oscillations with same frequency. Hence, discuss the resultant amplitude at any point. 6
   (b) What are Lissajous figure? Obtain the resultant of two SHM of the same period but different amplitude and phases acting in perpendicular direction. 6
   (c) A note produces 4 beats per second with a tuning fork of frequency 512 Hz and 6 beats per second with another tuning fork of frequency 514 Hz. Find the frequency of the note. 2

2. (a) Discuss the expression of stationary waves motion in a string fixed at its ends. Hence, obtain the different modes of vibration. 6
   (b) Find the relationship between phase velocity and group velocity of waves. 4
   (c) Distinguish between travelling and standing waves. 2
   (d) Calculate the velocity of sound in a gas in which two waves of wavelength 0.5 metre and 50.5 cm produce 6 beats per second. 2

UNIT–II

3. (a) Discuss the backward dragging force in determination of coefficient of viscosity. Write down the Poiseuille's equation. 6

(b) Explain Jaeger's method for determination of surface tension of water. 4

(c) What are synclastic and anti-elastic surface? 2

(d) A soap bubble is slowly enlarged from a radius of 10 cm to 100 cm. Calculate the work done in the process. Surface tension of soap solution is 26×10^{-3} N/m. 2

4. (a) Give the theory of forced vibration in sound waves. 4

(b) Find the expression of a square wave formation by the application of Fourier series. 4

(c) What are the requirements of a good auditorium? Derive Sabine's formula for reverberation time. 6

UNIT–III

5. (a) Derive the expression for the intensity at a point of interference of light wave. Give the conditions for maximum and minimum intensity. 3+2=5

(b) Discuss the formation of fringes by Llyod's mirror. Find the expression for fringe width. 4+2=6

(c) Give Stokes treatment to explain the change of phase in the case of reflection of light waves in a denser medium. 3

6. (a) Explain interference of light waves from division of wave front and division of amplitude. 2

(b) What are Newton's ring? How are they formed? Derive an expression for the radius of the n^{th} dark ring formed by reflection. 2+3+3=8

(c) Newton rings are formed with red light of $\lambda = 670$ nm. The radius of the 20th dark ring is found to be 1.1×10^{-2} m. Find the radius of curvatures of the lens and the radius of 30^{th} dark ring. 4

UNIT–IV

7. (a) With proper ray diagram, discuss the construction and working of Michelson's interferometer. How will you use it to measure the wavelength of monochromatic light? 2+3+3=2=10

(b) In Michelson's interference, a light shift of 150 fringes is found when all the air from tube is removed. If the wavelength of light used is 4000 Å in air and length of the tube is 30 cm, calculate the refractive index of air. 4

8. (a) Show that the plane polarized and circular polarized lights are special cases of elliptically polarized light. 8

(b) Discuss polarized and unpolarized light. 3+3=6

UNIT–V

9. (a) Explain half period zone of Fresnel diffraction pattern of light waves. Hence, obtain the radius and area for the half period zones. 6+2+2=10

(b) How many half period elements are there in a circular portion of 1/100 m radius of a plane wave front? Given that the wavelength is 6×10^{-7} m and the distance of the point of observation of the wave front is one metre. 4

10. (a) With proper ray diagram, explain Fraunhofer diffraction pattern of light waves for the conditions of maxima and minima position. 7

(b) Give the theory of zone plate in diffraction of light waves. 7
