2023

B.A./B.Sc.

Third Semester

GENERIC ELECTIVE – 3

PHYSICS

Course Code: PHG 3.11

(Waves & Optics)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

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

UNIT–I

1. (a) Discuss the production of beats and find the expression of beat frequency. 3+3=6
   (b) Describe Newton's formula to determine the velocity of sound in a gaseous medium. Discuss the Laplace's correction. 3+3=6
   (c) A particle executes simple harmonic motion given by the equation $y = 12\sin\left(\frac{2\pi t}{10} + \frac{\pi}{4}\right)$. Find the amplitude. 2

2. (a) Obtain an expression for the differential equation of a progressive wave. 6
   (b) Find the expression for the resultant of two simple harmonic motion perpendicular to each other having different amplitudes and phase, with frequencies in the ratio 1:2. 6
   (c) What is the speed of a transverse wave in a rope of length 1 m and mass 60 g under a tension of 1000 N? 2

UNIT –II

3. (a) Derive the relation between surface tension and surface energy. 5
   (b) What is the difference between stream line and turbulent flow? Define coefficient of viscosity. 2+2+2=6

(c) A soap bubble is closely enlarged from a radius of 1 cm to 2 cm. Calculate the work done in the process. Given surface tension of soap solution is 26×10^{-3} N/m. 3

4. (a) Derive the equation for excess pressure inside an air bubble in a liquid. 5

(b) What is the difference between intensity and loudness of sound? Define time of reverberation. 2+2+2=6

(c) Calculate the work done in balancing a soap bubble of radius 10 cm and surface tension 30 dynes per cm. 3

UNIT–III

5. (a) With a proper ray diagram, discuss the formation of fringes by Young's double slit experiment. 3+3+3=9

(b) What are Haidingers fringes and Fizcau fringes? 5

6. (a) With a proper ray diagram discuss the formation of fringes by Fresnel's bi-prism. 3+3+3=9

(b) Explain dispersive and non-dispersive medium. 5

UNIT–IV

7. (a) How would you analyse plane polarized, circularly polarized and elliptically polarized light? 3+3+3=9

(b) Discuss the theory of holography. 5

8. (a) Explain the transverse nature of light waves. 5

(b) Obtain an expression for optical path difference between reflected and transmitted beams in Michelson's interferometer. Hence write down the equation for obtaining bright and dark fringes. 9

UNIT–V

9. (a) What is the essential condition to obtain Fraunhofer diffraction? Discuss Fraunhofer diffraction pattern due to a single slit. What happen when the width of the slit is gradually increased? 2+6+2=10

(b) Explain the diffraction of multiple slits. 4

10. (a) Show that the amplitude due to complete wave front is half of the amplitude due to first half period zone. Hence explain rectilinear propagation of light on the basis of wave theory. 6+4=10

(b) Explain clearly the difference between interference and diffraction. 4