2024
B.A./B.Sc.
Second Semester
CORE – 4
PHYSICS
Course Code: PHC 2.21
(Waves & Optics)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

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

UNIT–I

1. (a) Justify the Laplace's correction for Newton's formula in determination of velocity of sound in air. 4
   (b) Determine the pressure wave velocity of a longitudinal wave in fluid. 6
   (c) If the frequency of a tuning fork is 400 Hz and the velocity of sound in air is 300 m/s, calculate the distance traversed by the sound for 20 vibrations. 2+2=4

2. (a) Derive the wave equation of particle acceleration in progressive wave. 4
   (b) Determine the velocity of transverse wave in stretched string. 6
   (c) At normal temperature and pressure, the speed of sound in air is 332 m/s. Calculate the speed of sound in hydrogen. (Given, air is 16 times heavier than hydrogen). 4

UNIT–II

3. (a) Discuss the production of beats and formulate the beats frequency. 4+4=8
   (b) How does the principle of superposition apply to a system of colinear harmonic oscillator? 4

(c) The sound waves from a source of sound is allowed to travel along two paths and then they meet at a point. Silence occurs when the path difference are 12 cm and 36 cm. If the frequency of the body is 1375 Hz, calculate the velocity of sound. 2

4. (a) Obtain the Lissajous figure when two simple harmonic motions are acting at right angle to each other having same frequency (1:1) but different amplitudes and phase. 10

(b) Sound waves from a ship siren reached a point on the cliff at the shore directly as well as by reflection at the surface of the sea. When the path difference are 20 cm and 40 cm, there is silence at the point. Calculate the frequency of the siren if the velocity of sound in air is 330 m/s. 4

UNIT–III

5. (a) Find the expression for the resultant wave motion of a longitudinal stationary waves in a closed organ pipe at one end. Determine the modes of vibration. 6

(b) Derive the expression of particle and wave velocity. 4

(c) Explain the reflection of wave motion at a rigid support. 4

6. (a) Find the expression for the resultant wave motion of a longitudinal stationary waves in an opened organ pipe at both ends. Hence, determine the modes of vibration. 6

(b) State the law of vibrating stretched strings. 4

(c) Calculate the fundamental frequency for a string 0.45 m long of mass 0.5 g/m and tension 75 N. 4

UNIT–IV

7. (a) Discuss the working of Michelson's interferometer. How can it be used to measure the wavelength of monochromatic light? 5+5=10

(b) Write four properties of wave front. 4

8. (a) With a proper ray diagram, explain Young's double slit experiment on interference of light waves and obtain the condition of bright and dark fringes. 1+4+5=10

(b) Write a short note on Lloyd's single mirror. 4

UNIT–V

9. (a) Obtain the radius and area of the Fresnel's half period zones for diffraction of light waves. 8
   (b) Formulate the theory of zone plate. 6

10. (a) With a proper ray diagram, explain Fraunhofer diffraction pattern of light waves for the condition of maxima and minima position due to a single slit. 10
    (b) Explain the phenomenon of diffraction of light. 4
