

**2024/TDC (CBCS)/EVEN/SEM/
PHSHCC-202T/088**

TDC (CBCS) Even Semester Exam., 2024

PHYSICS

(2nd Semester)

Course No. : PSHCC-202T

(Waves and Optics)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

1. Answer any two of the following questions : $2 \times 2 = 4$

(a) State superposition principle and write the mathematical expression for superposition of two oscillations having equal and different frequencies.

(b) What is Lissajous figure? Explain how Lissajous figures are formed when two harmonic oscillators with equal frequencies are in phase and out of phase.

- (c) Distinguish between plane and spherical waves.

2. Answer any one of the following questions : 6

- (a) A particle is subjected simultaneously to two SHMs of the same period but of different amplitudes and phases in perpendicular direction. Find the expression for the resultant motion. For what condition the path may be straight line, ellipse and circle? $3+3=6$
- (b) Explain how the pressure variations are generated and transmitted in longitudinal waves. Explain the characteristics and behaviour of water waves, ripples and gravity waves highlighting their differences and similarities. $3+3=6$

UNIT—II

3. Answer any two of the following questions : $2 \times 2 = 4$

- (a) Explain the basic difference between stationary wave and progressive wave.
- (b) Distinguish between phase velocity and group velocity.
- (c) Write the mathematical expression for the fundamental frequency produced in open and closed pipe, and also write their relationship.

4. Answer any one of the following questions : 6

- (a) Establish the expression for velocity of sound as given by Newton. Why was Laplace's correction required and how was it corrected? Write the mathematical expression for velocity of transverse wave in stretched string. $2+2+2=6$
- (b) Describe Melde's experiment on the transverse vibration of a stretched string. Also write down the significance of the experiment in the wave behaviour and resonance phenomenon.

UNIT—III

5. Answer any two of the following questions : $2 \times 2 = 4$

- (a) What are meant by temporal coherence and spatial coherence?
- (b) Explain in brief how Lloyd's mirror demonstrates interference phenomena.
- (c) Write the basic difference between Haidinger fringe and Fizeau fringe.

6. Answer any one of the following questions : 6

- (a) Explain the formation of Newton's rings in reflected monochromatic light. How can we determine the refractive index of a liquid using Newton's ring? $4+2=6$

- (b) Explain Stokes' law for the phase change when reflection takes place at the surface of a denser medium. Explain Young's double-slit experiment and its significance in understanding the wave nature of light. Also discuss about the interference pattern formed on the screen.

3+3=6

UNIT—IV

7. Answer any *two* of the following questions : $2 \times 2 = 4$

- (a) What are Fraunhofer and Fresnel class of diffraction?
 (b) Write the principle of Fabry-Perot interferometer. Distinguish it with other interferometers.
 (c) What is a grating? Discuss the factors that affect the resolving power of a grating.

8. Answer any *one* of the following questions : 6

- (a) What are meant by resolving power and limit of resolution of an optical instrument? Find the expression for resolving power of a telescope.

- (b) Explain how Michelson interferometer can be used to measure (i) the wavelength of monochromatic light and (ii) the difference in wavelengths between the D-lines of sodium light.

UNIT—V

9. Answer any *two* of the following questions : $2 \times 2 = 4$

- (a) Discuss Fresnel's half-period zones for plane wave.
 (b) Explain what you understand by a point source hologram.
 (c) Distinguish between photography and hologram.

10. Answer any *one* of the following questions : 6

- (a) What is a zone plate? briefly explain the theory, principle and working of a zone plate. Explain how it differs from a convex lens. $4+2=6$
 (b) Explain the principle of holography. Also explain the recording and reconstruction method involved in it. Briefly describe the formation of real and virtual image from a recorded hologram.
