

Total No. of Printed Pages—4

2 SEM TDC PHYH (CBCS) C 4

2 0 2 2

(June/July)

PHYSICS

(Core)

Paper : C-4

(Waves and Optics)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct option from the following :

1×5=5

(a) For a particle executing simple harmonic motion, its velocity $\frac{dy}{dt}$ at any instant is

(i) $a^2\sqrt{\omega^2 - y^2}$

(ii) $\omega\sqrt{a^2 - 1}$

(iii) $\omega\sqrt{a^2 - y^2}$

(iv) None of the above

- (b) If two simple harmonic vibrations of equal amplitude and frequency act simultaneously on a particle, then the resulting path of the particle will be
- (i) circular
 - (ii) elliptical
 - (iii) along a straight line
 - (iv) parabolic
- (c) The phase difference between two points on a wavefront separated by a distance λ is
- (i) 2λ
 - (ii) λ
 - (iii) 0
 - (iv) None of the above
- (d) In single-slit diffraction pattern when light of smaller wavelength is used, the width of central maximum
- (i) decreases
 - (ii) increases
 - (iii) remains unaffected
 - (iv) cannot be predicted

- (e) When the diameter of the objective of an astronomical telescope is doubled, its limit of resolution
- (i) is doubled
 - (ii) is quadrupled
 - (iii) is halved
 - (iv) remains unaffected

2. Answer the following questions : 2×5=10

- (a) Describe any one method for demonstrating interference of sound.
- (b) A note produces 4 beats/second with a tuning fork of frequency 512 Hz and 6 beats/second with a tuning fork of frequency 514 Hz. Find the frequency of the note.
- (c) Distinguish between the terms 'temporal coherence' and 'spatial coherence'.
- (d) Explain the term 'fringes of equal inclination'.
- (e) Describe Kirchhoff's integral formula.

3. Answer any *five* of the following questions : 6×5=30

- (a) Derive an expression for velocity of transverse vibration along a stretched string. A wire gives out a fundamental note of 256 cycles/s when it is under a tension of 10 kg wt. Under what tension, the string will emit a frequency of 512 cycles/s? 4+2=6

(Turn Over)

- (b) Discuss Newton's formula for velocity of sound and Laplace's correction to Newton's formula. What are the effects of density and pressure on the velocity of sound? 4+2=6
- (c) What are Newton's rings? Derive the radius of the n th dark ring. In a Newton's ring experiment, the diameter of the 10th dark ring due to wavelength 6000 \AA is 0.5 cm . Find the radius of curvature of the lens. 1+3+2=6
- (d) Describe the working of a Michelson's interferometer. Describe briefly how wavelength of light can be determined with a Michelson's interferometer. 3+3=6
- (e) Discuss plane transmission grating. Derive an expression for resolving power of a plane transmission grating. 3+3=6
- (f) Describe Fresnel's explanation of rectilinear propagation of light. Discuss Fresnel's diffraction at a straight edge. 3+3=6

4. Write short notes on any *two* of the following :

4×2=8

- (a) Lissajous figure
(b) Stokes' theorem
(c) Holography

★ ★ ★