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2 SEM TDC PHYH (CBCS) C 4

2026

(May/June)

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 options of the following :
1×5=5

(a) In case of beats

- (i) slightly different amplitudes cause intensity variation of sound periodically
- (ii) slightly different frequencies cause intensity variation of sound periodically

(2)

- (iii) slightly different frequencies and amplitudes cause variation of sound periodically
- (iv) frequency variation does no matter
- (b) The resultant amplitude due to superposition of harmonic waves expressed by $y = a \sin(\omega t - kx)$ and $y = a \cos(kx - \omega t)$ will be
- (i) 0
- (ii) a
- (iii) $\sqrt{2} \cdot a$
- (iv) $2a$
- (c) Laplace proposed that the propagation of sound in air is an
- (i) isothermal process
- (ii) adiabatic process
- (iii) isobaric process
- (iv) isochoric process
- (d) If monochromatic light in Young's double-slit experiment is replaced by white light, then
- (i) no fringes are observed
- (ii) all bright fringes are coloured but central fringe is white
- (iii) all bright fringes are white
- (iv) alternate fringes are coloured

(3)

- (e) In case of zone plates, the area of the zones
- (i) increases with increased distance from the pole
- (ii) proportional to the radius of the zones
- (iii) is equal
- (iv) is infinite
2. Answer the following questions : $2 \times 5 = 10$
- (a) Show that two rectangular SHMs, $x = a \sin \omega t$ and $y = a \cos \left(\omega t + \frac{\pi}{2} \right)$, of equal frequency but having a phase difference of $\frac{\pi}{2}$ can generate a circular motion.
- (b) How many beats per second will be heard if two sources of frequencies 512 Hz and 516 Hz are sounded simultaneously? What will be the time interval between the sounds of successive maximum intensity?
- (c) What are Haidinger's and Fizeau's fringes?
- (d) Describe the principle of holography in brief.
- (e) Describe briefly Fresnel-Kirchhoff integral theorem.

(4)

3. Answer the following questions : $6 \times 5 = 30$

- (a) Find the resultant intensity of the diffracted beams when parallel rays fall normally on a plane diffraction grating. Hence, work out the conditions for principal maximum and secondary maxima. $3+3=6$
- (b) What are beats? Discuss the superposition of two collinear harmonic oscillations differing slightly in frequency. Show that the number of beats produced per second is equal to the difference of their frequencies. $1+3+2=6$
- (c) What are Lissajous figures? Show that the path of a particle acted upon by two simple harmonic motions at right angles to each other is elliptical. $2+4=6$
- (d) Describe how wavelength of an unknown light source be determined with the help of a Fresnel biprism. A thin sheet of a transparent material of refractive index μ is placed in the path of one of the interfering beams in the biprism experiment. If the central fringe (zero order fringe) shifts to a position originally occupied by 12th bright fringe, then calculate the thickness of the sheet (wave length of the light used is 5890 Å). $3+3=6$

(5)

- (e) Derive the expression for fringe width in Young's double-slit experiment. Show that the resultant intensity is maximum when phase difference is $2n\pi$ and minimum when phase difference is $(2n+1)\pi$ between the two interfering waves. (here n is an integer). $3+3=6$

4. Write short notes on any two of the following : $4 \times 2 = 8$

- (a) Michelson's interferometer
- (b) Energy of vibrating string
- (c) Standing waves in a string with free ends
