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2 SEM TDC PHYH (CBCS) C 4

2024

(May)

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 of the following : 1×5=5

(a) Beats are the result of

(i) diffraction

(ii) destructive interference

(iii) constructive and destructive interference

(iv) superposition of two waves nearly equal waves

(b) Two mutually perpendicular SHMs of same frequency, amplitude and phase when superposed, give

(i) circular motion

(ii) elliptical motion

(iii) linear SHM

(iv) None of the above

(c) Two light sources are said to be coherent if they emit waves

(i) of equal intensity

(ii) of equal frequency

(iii) having constant phase difference

(iv) having constant amplitude difference

(d) Thickness of Newton's rings

(i) is equal in size

(ii) increases with order number

(iii) decreases with order number

(iv) first increases and then decreases

(e) If the Young's double-slit experiment is performed in a liquid of refractive index, the fringe width β would

(i) change to $\frac{\beta}{\eta}$

(ii) change to $\frac{\eta}{\beta}$

(iii) remain same

(iv) None of the above

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

(a) Distinguish between standing wave and progressive wave.

(b) A tuning fork *A* of frequency 346 Hz produces 8 beats per second when sounded with another tuning fork *B*. On loading *B* with a little wax, the number of beats per second becomes 4. What is the frequency of *B*?

(c) Give two examples each of interference by division of wavefront and division of amplitude.

(d) What are fringes of equal thickness?

(e) Why is the zero-order fringe dark in case of a Lloyd's mirror?

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

(a) What are Lissajous figures? Obtain the Lissajous figure when the periods of vibrations of two simple harmonic motions are equal and phase difference is $\pi/2$. What are the uses of Lissajous figures? 2+3+1=6

(b) Write Newton's formula for velocity of sound. What are its limitations? Describe Laplace's correction to Newton's formula. 1+2+3=6

(c) What is Fresnel's biprism? Describe briefly how interference fringes can be obtained by it. How can wavelength of an unknown source be determined with the help of Fresnel's biprism? 1+2+3=6

(d) What are Newton's rings? Derive an expression for the *n*th dark ring in a Newton's ring pattern. 2+4=6

(e) What is a plane diffraction grating? Describe the action of the grating on a plane monochromatic wavefront. Write down the expression for resolving power of a grating. 2+3+1=6

(f) What is a zone plate? Describe the theory of a zone plate. Why is it said to be similar to a convex lens? 2+3+1=6

4. Write short notes on any *two* of the following : 4×2=8

(a) Transverse vibrations in a stretched string

(b) Huygens principle

(c) Fraunhofer diffraction at a single slit

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