CHAPTER-10
Wave Optics
ASSIGNMENT-2
1 MARK QUESTIONS

Q1. What is interference of light? Give an example of interference of light in everyday life.

Q2. Why are coherent sources necessary to produce a sustained interference pattern?

Q3. State the path difference between two waves of constructive interference.

Q4. Draw a diagram to show refraction of a plane wave front incident in a convex lens and hence draw the refracted wave front.

Q5. How would the angular separation of interference fringes in Young's double slit experiment change when the distance between the slits and screen is doubled?

Q6. In a single-slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band. (CBSE 2012]

Q7. Define the term 'coherent sources' which are required to produce interference pattern in Young's double slit experiment.

Q8. One of the slits of Young's double-slit experiment is covered with a semi-transparent paper so that it transmits lesser light. What will be the effect on the interference pattern?

Q9. Draw a graph showing the intensity distribution of fringes due to diffraction at a single-slit. [CBSE 2018]

MCQ

Q10. A single slit diffraction pattern is obtained using a beam of red light What happened the red light is replaced by the blue light?

A) There is no change in diffraction pattern

B) Diffraction fringes become narrower and crowded

C) Diffraction fringes become broader and farther apart

D) The diffraction pattern disappears

Q11. In Young's double slit experiment, a maximum is obtained when the path difference between the interfering waves is:

A) $n\lambda$ B) $n\ \lambda/2$ C) $(2n + 1)\ \lambda/2$ D) $(2n - 1)\ \lambda/4$

Q12. For sustained interference, we need two sources which emit radiations :

A) of the same intensity

B) of the same amplitude

C) having a constant phase difference

D) None of these

Q13. Two sources of light are said to be coherent when both give out light waves of the same:

A) amplitude and phase

B) intensity and wavelength

C) speed

D) wavelength and a constant phase difference

Q14. The intensity of light emerging from the two slits, in Young's experiment is in the ratio 1 : 4. The ratio of the intensity of the minimum to that of the consecutive maximum will be:

A) 1 : 4 B) 1 : 9 C) 1 : 16 D) 2 : 3

Q15. Which of the following is conserved when light waves interfered?

A) phase B) intensity C) amplitude D) none of these

Q16. In Young double slit experiment, a minimum is obtained when the phase difference of the superposing waves, is :

A) $n\pi$ B) $(n + 1/2)\pi$ C) $(2n + 1)\pi$ D) zero

Q17. The fringe width (β) of a diffraction pattern and the slit width d are related as:

A) $\beta \propto d$ B) $\beta \propto 1/d$ C) $\beta \propto \sqrt{d}$ D) $\beta \propto 1/d^2$

Q18. In Young's double slit experiment, the central point on the screen is:

A) bright B) dark C) first bright and later dark

D) first dark and later bright

Q19. In Young's double slit experiment the distance between the slit and the screen is doubled and the separation between the slit is reduced to half. The fringe width:

A) is doubled B) become four time C) is halved D) remain unchanged

2 MARKS QUESTIONS

Q20. Write two points of difference between interference and diffraction?

Q21. Draw the shape of the reflected wavefront when a plane wavefront is an incident on
(a) a concave mirror.
(b)a prism.

Q22. What is a sustained interference pattern? State the necessary conditions forobtaining a sustained interference of light.

Q23. State with reason how would linear with of central maxima change if
(i) monochromatic yellow light is replaced with red light and
(ii) distance between the slit and the screen is increased.

Q24. How is the width of central maxima affected if
(i)width of the slit is doubled
(ii) the wavelength of the light is increased
What happens to the width of central maxima if the whole apparatus is immersed in water and why?

3 MARKS QUESTIONS

Q25. A parallel beam of light of wavelength 600nm is incident normally on a slit of width 'a'. If the distance between the slit and the screen is 0.8m and the distance of second order maximum from the centre of the screen is15mm, calculate the width of the slit.

Q26. A beam of light consisting of two wavelengths 6500 A^o and 5200 A^o is used to obtain interference fringes. The distance between the slits is 2.0 mm and the distance between the plane of the slits and the screen is 120 cm.

(a) Find the distance of the third bright fringe on the screen from the central maxima for the wavelength 6500A^o

(b) What is the least distance from the central maxima where the bright fringes due to both the wavelengths coincide?

Q27. Monochromatic light from a narrow-slit illuminates two narrow slits 0.3 mm apart producing an interference pattern with bright fringes 1.5 mm apart on a screen 75 cm away. Find the wavelength of the light. How will the fringe width be altered if-

i) the distance of the screen is doubled

ii) the separation between the slits is doubled.

5 MARKS QUESTIONS

Q28. (a) Using Huygens's construction of secondary wavelets explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a monochromatic beam of light is incident normally.

(b) Show that the angular width of the first diffraction fringe is half that of the central fringe.

(c) Explain why the maxima at $\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}$ become weaker with increasing *n*.

Q29. (a) Write three characteristic features to distinguish between the interference fringes in Young's double slit experiment and the diffraction pattern obtained due to a narrow single slit.

(b) A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. Find the width of the slit.

Q30. (a) Distinguish between interference and diffraction.

(b) A monochromatic light of wavelength 500 nm is incident normally on a single slit of width 0.2 mm to produce a diffraction pattern. Find the angular width of central maximum obtained on screen.