

CHAPTER TEST

STD-XII

PHYSICS – WAVE OPTICS

TIME: 15 MIN. All the questions. Section A carries 1 mark, Section B carries 2 marks, Section C carries 3 marks, Section D carries 5 marks, Section E carries 4 marks.

SECTION – A

- A plane wave source is generated by.
 - point source
 - line source
 - extended source
 - Distance source
- What is the phase difference corresponding to a path difference λ between two waves reaching a point?
 - $\frac{2\pi\Delta x}{\lambda}$
 - $\frac{2\pi\lambda}{\Delta x}$
 - $\frac{\pi\Delta x}{\lambda}$
 - $\frac{\pi\lambda}{\Delta x}$
- Two slits in young's expression have widths in the ratio 1 : 25. The ratio of intensity at the maxima and minima in the interference pattern I_{max}/I_{min} is?
 - 4 : 9
 - 9 : 4
 - 125:49
 - 49:125
- A single-slit diffraction pattern is obtained using a beam of red light. What happens if red light is replaced by blue light?
 - The diffraction pattern becomes wider.
 - The diffraction pattern becomes narrower.
 - The diffraction pattern becomes unchanged.
 - The diffraction pattern disappears.
- Assertion (A): According to Huygens theory no back-ward wave front is possible
Reason (R): Amplitude of secondary wavelets is proportional to $1+\cos\theta$, where the θ is angle between the ray at the point of consideration and direction of secondary wavelet
 - Both A and R are true and R is correct explanation of A.
 - Both A and R are true and R is NOT correct explanation of A
 - A is true but R is false
 - A is false and R is true.
- Assertion (A): When a light wave travels from rarer to denser medium, its speed decreases. Due to this reduction of speed the energy carried by the light wave reduces.
Reason (R): Energy of wave is proportional to the frequency.
 - Both A and R are true and R is correct explanation of A.
 - Both A and R are true and R is NOT correct explanation of A
 - A is true but R is false
 - A is false and R is true

SECTION – B

- Define wave front. How is it related to the direction of the corresponding rays?



8. The wavelength of monochromatic light in air is 600 nm . The wavelength of this light in water is 450 nm . Find out :

- (i) frequency of light in water
- (ii) Speed of the light in water

9. Can two sodium vapour lamps act as coherent sources? Explain in brief.

10. State one similarity and one difference between interference and diffraction of light?

SECTION – C

11. State Huygens principle in the wave theory of light. Using the principle, prove that laws of reflection of light

12. (i) What are the coherent sources?

(ii) in young's double-slit experiment what is the path difference between the two light waves, forming 5th bright band (fringes) on the screen.

13. In young's double-slit experiment show that $\beta = \lambda D/d$. Where the terms have their usual meanings.

14. What is difference of light? Describe the diffraction of light at a single-slit

SECTION – D

15. Derive the Snell's law of refraction using Huygens Wave theory?

SECTION – E

16. Case Study based Question:

A group of Class XII students in their school laboratory use a monochromatic green laser (wavelength 540nm) in a Young's Double-Slit Experiment (YDSE). The two narrow, identical slits are separated by 0.4mm . They place a white screen 1.6m from the slits and observe the bright and dark fringe pattern formed due to interference of light.

After recording the pattern, the students conduct two changes in their experiment:

- First, they place a thin transparent sheet of refractive index 1.5 and thickness $6\mu\text{m}$ in front of one slit.
- Next, instead of the green laser, they use a blue laser (wavelength 450nm) with all original settings restored (i.e., no thin sheet in front of any slit).

Read the case and answer the following questions:

- i) State the principle behind the formation of bright and dark fringes in Young's Double-Slit Experiment.
- ii) Write the formula to calculate fringe width and identify all quantities.
- iii) Calculate the distance between adjacent bright fringes (fringe width) on the screen for the original setup (green laser, no transparent sheet).
- iv) Explain why distinct interference fringes are not observed when an ordinary (non-laser) white light source is used?