INTERFERENCE||

CHAPTER11||

SAMPLE QUESTIONS||

1. A.What do you mean by interference?

   Ans:: The interference of light is the phenomenon of non uniform distribution of light energy in a medium due to the superposition of light waves from two different coherent sources.

   B. Explain the constructive and destructive interference of light.

   Ans:: If the light waves from two coherent sources are in phase and superposed with each other then the interference is said to be constructive.
   If the light waves from two coherent sources are out of phase and superposed with each other then the interference is said to be destructive.

   C. In a young's experiment , light of wavelength 6.0×10^{-7}m is used. The slits are 0.6mm apart and the bright bands formed on the screen are 0.8 mm apart. Calculate the distance of the slits from the screen.

2. A. Define coherent sources of light.

   Ans:: The sources of light , which continuously emit light waves of the same wavelength or frequency and are always in phase or have constant phase differences are called coherent sources.

   B. Describe the young's double slit experiment to determine the wavelength of the monochromatic source of light.

   A double slit experiment is performed with the sodium light of wavelength 589.3nm and the interference pattern is observed on a screen 100 cm away. The tenth bright fringe has its centre at a distance of 12 mm from the central maximum. Find the separation between the slits.

SHORT QUESTIONS AND ANSWERS||INTERFERENCE||CHAPTER11||

1. A. State and explain the principle of superposition of light.

   Ans:: According to this principle, "when two or more wave motions travelling through a medium superimpose one another, a new wave is formed in which resultant displacement at any instant is equal to the vector sum of displacements due to individual displacement

vectors at that instant."

B. Show that the dark and bright fringes are equally spaced in Young's double slit experiment.

2. A. When two coherent sources are far apart, interference patterns cannot be detected. Why?

Ans:: As we know fringe width in double slit experiment, □=□D/d, where d is slit width. If the slits are far apart, "d" increases and fringe width decreases. Hence, interference patterns become crowded and cannot be detected.

B. Does interference of light waves obey the law of conservation of energy?

OR

If two light waves having the same amplitude meet at a point the resultant intensity is four times the intensity of the individual waves. Does it violate the principle of conservation of energy?

Ans:: For a single source of light, the distribution of energy is uniform. But, for two coherent sources, they produce a non uniform distribution of energy and vary from maximum to minimum intensity. At a point of maximum intensity, the energy is 4 times that from a single source whereas at a point of minimum intensity, energy is zero. However, the average energy is the same as if two sources acted separately without interference. Indeed, the energy which apparently disappears at minimum point is still present at maximum point. Therefore, the interference phenomenon obeys the law of conservation of energy.

A. If one of the slits in Young's double slit experiment is covered, is there any change in the intensity of the central fringe? Explain.

Ans:: Suppose the intensity from individual coherent sources be I_o and the total intensity of the central bright fringe be I. Again, we know that total intensity is,

$$I = I_1 + I_2 + 2\sqrt{(I_1 I_2}\cos\phi)$$

Here, the path difference between the waves for the central bright fringe is zero. So, $\cos\phi=1$ and also $I_1 = I_2 = I_o$. So that,

$$I = I_o + I_o + 2\sqrt{(I_o I_o)}$$
$$= 4 I_o.$$

If one of the slits in Young's double slit experiment is covered,then only a wave reaches the point of central bright fringe, so that

I = I_0 .
Hence, intensity decreases by 4 times.

B. If the Young's double slit experiment is performed with a source of white light, what will be the nature of fringes?

Ans:: **In Young's double -slit experiment performed with a source of white light, only black and white fringes are observed.**

NUMERICALS||INTERFERENCE||CHAPTER||

1. In a young's double slits experiment, the separation of the four bright fringes is 2.5 mm when the wavelength of light used is 6200Aº. The distance from the slits to the screen is 0.8m. Calculate the separation of the slits.

2.In a young's double slits experiment, using sodium light of the wavelength 5893Aº, 62 fringes are obtained in the field of view. How many fringes will be observed using violet light of wavelength 4358Aº?

3.In a young's double slits experiment, the fringes width of the fringes with the wavelength 6000 Aº is 2.0 mm. What will be the fringe width if the entire apparatus is immersed in the liquid with the refractive index 1.33?

4.In a young's double slits experiment, we observe the 10th maxima for x=6000 Aº, what order of maxima will be visible if the source of light is replaced by light of wavelength 5000 Aº?
Two slits spaced 0.45 mm apart are placed 75 cm from a screen. What is the distance between the second and third dark lines of the interference pattern on the screen when the slits are illuminated with monochromatic light of the wavelength 500 nm?

5.In a young's double slits experiment, separation of the 3rd bright fringe from the central maxima is 9.49mm. If the slits are separated by 0.2mm and the screen is kept 1.0 m away from the slits, what would be the wavelength of the light used?