Wave Optics Ch-10

NCERT Examples

Ex. 10.1(a) The frequency of light remains the same in both reflection and refraction because frequency depends only on the source of light which produces it. Frequency is independent of the medium through which wave travels. On changing medium speed of light and wavelength of light change but frequency remains same. By $v = \nu\lambda$, $\nu = \frac{v}{\lambda}$ $v \rightarrow$ speed, $\lambda \rightarrow$ wavelength

(b) No, reduction of speed does not imply reduction of energy because energy carried by a wave depends on the amplitude of wave, not on the speed of propagation.

(c) for a given frequency intensity of light in the photon picture is determined by the number of photons crossing an unit area per unit time.

$$\text{Intensity} = \frac{\text{Energy}}{\text{time}}$$

Ex. 10.2 Given,

$d = 1\ mm = 1 \times 10^{-3}\ m$

$D = 1\ m$

$\lambda = 500\ nm = 500 \times 10^{-9}\ m$

So $\beta = \frac{D\lambda}{d}$

$= \frac{1 \times 500 \times 10^{-9}}{1 \times 10^{-3}}$

$= 500 \times 10^{-9+3} = 500 \times 10^{-6}$

$= 0.5 \times 10^{-3}\ m = 0.5\ mm$ Ans

Ex. 10.3 In YDSE we know,

Fringe width $\beta = \frac{D\lambda}{d}$

$D \rightarrow$ Distance b/w double slits plane and screen

$\lambda \rightarrow$ Wavelength of light

$d \rightarrow$ Distance b/w the two slits

(a) If screen is moved away i.e D is increased, by $\beta \propto D$, β is also increased.

If $D \uparrow$ then $\beta \uparrow$

(b) If wavelength of light λ is decreased, by using shorter wavelength monochromic light by $\beta \propto \lambda$, β is also decreased.

If $\lambda \downarrow$ then $\beta \downarrow$

(c) If separation b/w two slits d is increased, by $\beta \propto \frac{1}{d}$, β decreases.

If $d \downarrow$ then $\beta \uparrow$

(d) If source is moved closes to the double slits plane then fringes are obtained as long as the condition $\frac{s}{S} < \frac{\lambda}{d}$ is followed.

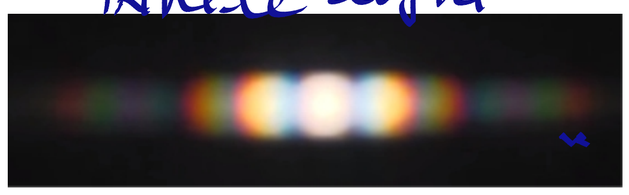
$s \rightarrow$ size of source slit, $S \rightarrow$ distance source slit and double slits. So if S is decreased pattern get less sharp.

(e) If width of source slit is increased the fringes are obtained till condition $\frac{s}{S} \leq \frac{\lambda}{d}$ is followed otherwise no pattern is seen.

(f) If monochromatic light is replaced by white light then no dark and bright fringes pattern

Monochromatic light

White light



is obtained as white light constitute 7 colours. We get central bright fringe and around it colours of VIBGYOR. As move away from centre bright colours get dim and disappear.