Interference

Waves and optics

Q.1. A Plane light wave falls on fresnel with an angle $\alpha = 2.0'$ between them. Determine the wavelength of light if the width of fringe on screen $\Delta x = 0.55$ mm.

Solution

$$\Delta x = \frac{(a+b)\lambda}{2\alpha b} \qquad \Delta x = 0.55 \text{ mm}, \quad \alpha = 2.0'$$

$$\therefore \lambda = 2\alpha \Delta x = 0.64 \mu m.$$

Q.2. The distance from fresnel biprism to narrow slit and a screen are equal to $a = 25$ cm and $b = 100$ cm. respectively. The refracting angle of glass biprism is equal to $\theta = 20'$. Find the wavelength of light if the width of the fringe on the screen is $\Delta x = 0.55$ mm.

Solution :- $$\Delta x = \frac{l\lambda}{d}$$

$l = a + b$,

$d = 2(n-1)\theta a$,

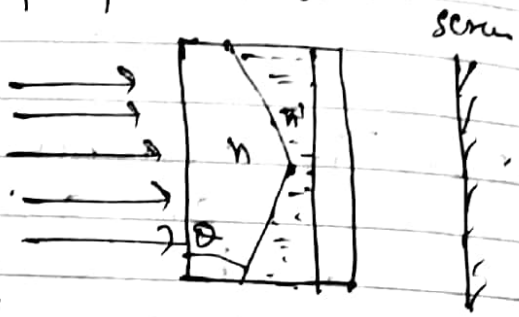
$\delta = (n-1)\theta$,

$d = 2\delta a$

$n =$ refractive index of glass.

then $$\lambda = \frac{2(n-1)\theta a \Delta x}{a+b} = 0.64 \mu m.$$

Q.3. A Plane light wave with wavelength $\lambda = 0.70$ μm falls normally on the base of biprism made of glass $n = 1.520$ with refracting angle $\theta = 5.0^\circ$ behind the prism there is plane-parallel plate, with the distance between filled with other liquid of refractive index $n' = 1.50$. Find the space between ~~from~~. Find the width of fringe on screen



Solution

It will be assumed the space between biprism and glass plate with other liquid constitute the complementary prism then the deviation

$$\delta = (n-1)\theta - (n'-1)\theta$$

$$= (n-n')\theta$$

$$d = 2a\delta$$

$$\Delta x = \frac{(a+b)\lambda}{2a\theta(n-n')}$$

$$\Delta x = \frac{\lambda}{2\theta(n-n')} = \frac{0.70}{2 \times 5 \times (1.520-1.50)}$$

$$= 0.2 \text{ mm}.$$

Q.4. A Plane monochromatic light wave falls normally on a diaphram with two narrow slit seperated by distance $d = 2.5\ mm$ a fringe pattern is formed on screen placed at a distance $l = 100\ cm$ behind the diaphram. So what distance and in which direction will there fringes be displaced when one of the slit is covered by glass plate of thickness $h = 10\ \mu m$.

Ans. Extra phase difference produced by glass plate is

$$= \frac{2\pi}{\lambda}(n-1)h$$

this will cause shift equal to

$$\frac{(n-1)h}{\lambda} \text{ fringe width.}$$

by $\frac{(n-1)h}{\lambda} \times \frac{l\lambda}{d} = \frac{(n-1)hl}{d} = 2m.$