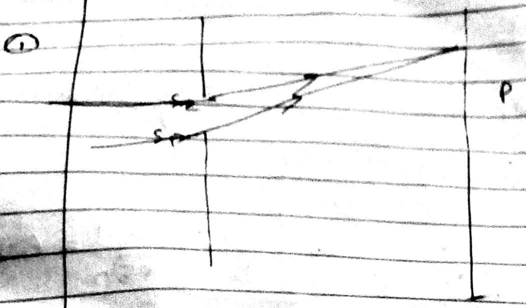
Physics

Date

(1)



$$\text{Intensity} = 4I_0 \cos^2 \frac{\Delta\phi}{2}$$

$$\Delta\phi = \frac{2\pi}{\lambda} \Delta x$$

$$\Rightarrow \frac{2\pi \times \lambda/3}{\lambda}$$

$$\text{Int} \Rightarrow 4I_0 \cos^2 \pi/3 \Rightarrow 4I_0 \times \frac{1}{4}$$

$$\Rightarrow I_0$$

At the Centre

$$\text{Intensity} = 4I \cos^2 \frac{\Delta\phi}{2}$$

$$\Delta\phi = 0$$

$$\Rightarrow 4I_0$$

$$\text{Ratio} \Rightarrow \frac{I_0}{4I_0} \Rightarrow \frac{1}{4} \text{ Ans}$$

(2)

$$\mu \Rightarrow 1.58$$

$$S_2 - S_1 = 0.1\,cm$$

(2) $S_2P - S_1P = \frac{x d}{D}$

After Introducing a slit of thickness t

$\frac{xd}{D} = t(\mu - 1)$

$t = \frac{x d}{D(\mu - 1)} \Rightarrow \frac{0.2 \times 0.1}{0.58 \times 50} = 6.8 \times 10^{-4} cm$

(3) $\underline{\mu = 1.5}$ $\quad \alpha = 1^\circ = 1 \times \frac{1}{180} \times \pi$ radian $\quad a = 0.1 m$

$d = 2(\mu - 1) a \alpha$
$= 2(0.5) \times 0.1 \times \frac{\pi}{180}$

$D = \cancel{d}\ a + 1 m$
$= 1 + 0.1 = 1.1 m$

$\beta = \frac{\lambda D}{d} = \frac{6900 \times 1.1 \times 180 \times 10^{-10}}{1.1 \pi}$
$= \underline{37 \times 10^{-5} m}$

$\beta = 0.087 mm$ slit to biprism distance (a)

Now It becomes 0.75a

$\boxed{\beta = \frac{\lambda D}{d}} \Rightarrow$

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$\frac{\lambda D}{d} \rightarrow 0.0877$

$\frac{\lambda D}{2(\mu-1)a\alpha} \rightarrow 0.0877$

$\frac{\lambda D}{\frac{2(\mu-1)a\alpha}{0.75}} \Rightarrow 0.0877 \times 0.75 \Rightarrow 0.116\,mm$

5) $n = 1.20$

Date

(3) $r_n^2 = \frac{n\lambda}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)}$

$r_{(n+20)}^2 = \frac{(n+20)\lambda}{\left(\frac{1}{R_1} + \frac{1}{\infty}\right)}$

$r_{(n+20)}^2 - r_n^2 = \frac{(n+20)\lambda - n\lambda}{\frac{1}{R_1}}$

$\Rightarrow (0.368)^2 - (0.162)^2 = 20\lambda R_1$

$R_1 = \frac{(0.368)^2 - (0.162)^2}{20 \times 420 \times 10^{-9}} = 1.30m$

(4) $y_1 = A_1 \sin \omega t \quad y_2 = A_2 \sin(\omega t + \pi/3)$

Net Resultant $= \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi}$

$\Rightarrow \sqrt{(1.60)^2 + (2.20)^2 + 2 \times 1.60 \times 2.20 \cos \pi/3}$

$= 3.30$

Interference maxima $= 478.8nm$

" minima $= 598.5nm$

(5) $2\mu t = $ λ minima $- \lambda$ maxim

$2\mu t = 119.7$

$t = \frac{119.7}{2\mu} = \frac{119.7}{2 \times 1.33} = 45n$

r+2

een by the

ial frame

r/3

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9

$2d = n\lambda$ (for bright fringe)

$d = 0.233 m$

$\frac{2d}{n} = \lambda$ $(n = 1110)$

$\frac{2 \times 0.233}{1110} = \lambda \Rightarrow 419.81 nm$

$\lambda = 420 nm$ (approx)

10

$\boxed{\mu = 1.50}$

for reflectiving surface

for minimum thickness
$r \sim 0$ $\cos r \sim 1$
$n \sim 1$

$2\mu t = (2n-1)\lambda/2$
$2\mu t = \lambda/2$

$t = \lambda/4\mu$

$\rightarrow \frac{500}{4 \times 2} \Rightarrow 62.5 nm$

$$\frac{d^2}{4R} = n\lambda$$

$$\frac{d^2}{n\lambda \times 4} = R$$

$$= \frac{0.5 \times 0.5 \times 10^{-4}}{10 \times 5.9 \times 10^{-5} \times 4} = R$$

$= 1.06\,cm = R$ (Radius of curvature) —(1)

$$\frac{d^2}{4R} = 2t$$

$\Rightarrow 2t = n\lambda$

$\Rightarrow 2t = 10 \times 5.9 \times 10^{-5}$

$t = 2.95 \times 10^{-4}$ cm —(2)

(12). we have $\frac{d_1^2}{4R} = n\lambda_1$

$$\frac{d_2^2 \mu}{4R} = n\lambda_1$$

$$\frac{d_1^2}{d_2^2} = \mu \Rightarrow \frac{0.3 \times 0.3}{0.2 \times 0.2} \times 10^{-4} = \mu = 1.4$$

$= \frac{3\times10^{8}}{1.44}$

$= 2.08\times10^{8}$ m/s

(4) $\frac{\Delta\lambda}{\lambda_1\lambda_2} = 4$ ($\Delta\lambda = \lambda_2 - \lambda_1 = 4886 - 4882 = 4$)

$\lambda_1\lambda_2 = \lambda^2 = 23{,}853{,}456$

$= \Delta\lambda = \frac{\lambda^2}{2d}$

$= 4 = \frac{23{,}853{,}456\ (A^{\circ})^2}{2d}$

$d = \left[\frac{23{,}853{,}456\ (A^{\circ})^2}{2\times 4}\right]$

$= 2{,}98{,}1682 \times 10^{-20}$

$= 0.298$ nm

(15)

$\xleftarrow{1.25}$ 1.50 $= 2\mu d\cos\theta = (n - 1/2)\lambda$

for Nonreflecting case $= 2\mu d = (n + 1/2)\lambda$

for min. thickness $= 2\mu d = \left(\frac{1}{2}\lambda\right)$

$= 2 \times 1.25 \times d = \frac{1}{\cancel{2}} \times \cancel{6000}\ 3000$

$= \frac{3000}{2.5}$

$= 1200 \mathring{A}$

by the bob

$x = 0 \quad y = 20t$

the motion seen from

(16) $(\sin \theta_i) \mu_1 = \mu_2 (\sin r)$

$1 \times \frac{1}{\sqrt{2}} = 1.33 \times \sin r$

$\frac{1}{\sqrt{2}} \times \frac{1}{1.33} = \sin r \qquad r \Rightarrow 32^\circ$

$\cos r = 0.84 \qquad (r = 32^\circ)$

$2 \mu d \cos r = n\lambda \qquad (n = 1) \qquad$ [minimum thickness condit

$2 \mu d \times 0.84 = \lambda$

$d = \frac{5890}{0.84 \times 2 \times 1.33}$ Å

$= 2.614 \times 10^{-7}$ m

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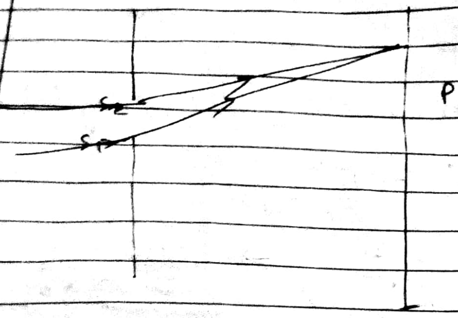

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Fabry Perot interferometer:

i) Fabry Perot interferometer consists of two glass plates A and B seperated by distance 'd'. the inner surfaces of the plates are optically plane, exactly parallel and fairly silvered so that about 70% of incident light gets reflected etc. the outer faces of setup are also parallel to each other but inclined to their respective inner faces.

ii) Monochromatic light of wavelength λ from a broad source S is incident on a collimating lens L1 which renders the incident rays parallel. A ray of light entering the air film b/w plate undergoes multiple reflection, and rays coming from from plate B are made to interfere by converging lens them at F.

The fringes are concentric circles with O_2 as centre having equal inclination (Haidinger fringes).

path difference is $2\mu d \cos\theta$

due to same kind of reflection we have

$2\mu d \cos\theta = n\lambda$ for bright fringes.

the distance 'd' b/w two plates is decreased, θ decreases for a given fringe "when d is decreased by λ/2 one fr... dissappears."

In this interferometer, the radius of the ring is a function of the wavelength of light used and very sharp fringes are produced hence it is used for resolving two wavelength and analysis of spectral line (single).

$$I = \frac{T^2}{(1-R)^2\left[1 + \frac{4R}{(1-R)^2}\sin^2\delta/2\right]}$$

$$\frac{I_{max}}{I_{min}} = \left[\frac{1+R}{1-R}\right]$$

[intensity of light reflected = R]