HANDWRITTEN NOTES

BY~

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WAVE OPTICS

SINGLE SLIT

θ → Angular Displacement

Dark $(n=1,2,3\ldots)$

$a\sin\theta = n\lambda$

$\theta_{nD} = \frac{n\lambda}{a}$

$y_{nD} = \frac{n\lambda D}{d}$

BRIGHT $(n=1,2,3\ldots)$

$a\sin\theta = \frac{(2n+1)\lambda}{2a}$

$\theta_{nB} = \frac{(2n+1)\lambda}{2a}$ $\quad y_{nB} = \frac{(2n+1)\lambda D}{2a}$

$(CB)_\theta = 2(\text{Bright})_\theta$

$(CB)_\theta = 2(\text{Dark})_\theta$

Angular width (CB) $= 2\theta = 2\lambda/a$

Linear width (CB) $= 2y = \frac{2\lambda D}{d}$

BREWSTER'S ANGLE

$\mu = \tan i_p$ (Critical)

$\mu = 1/\sin c \rightarrow \angle$ le

MALUS LAW

Intensity, $I' = I_0\cos^2\theta$

Amp., $A' = A\cos\theta$

$I = I_0\left(\frac{\sin\beta}{\beta}\right)^2$

$\beta = \frac{\pi a\sin\theta}{\lambda}$

velo. → Rarer < Denser (Air < Water) — Focault Proved $V_{air} > V_{water}$

Huygen → DOP ⊥ wavefront

$\Delta\phi = \frac{2\pi}{\lambda}\cdot\Delta x$ → Check by units → Same phase $\Delta\phi = 2n\pi$ $(n=0,1,2,\ldots)$ / Opp. phase

rad. / m

$(n=0,1,2\ldots) \leftarrow \Delta\phi = (2n+1)\pi$ or $\Delta\phi = (2n-1)\pi$ $\rightarrow (n=1,2,3\ldots)$

Interference

CI → $\Delta\phi = 2n\pi$; $I \rightarrow$ max $\propto (a_1+a_2)^2 \propto (\sqrt{I_1}+\sqrt{I_2})^2$; $A \rightarrow$ max.; $\Delta x = n\lambda$

DI → $\Delta\phi = (2n+1)\pi$ or $(2n-1)\pi$ → odd multiple of π; $I \rightarrow$ max $\propto (a_1-a_2)^2 \propto (\sqrt{I_1}-\sqrt{I_2})^2$; $A \rightarrow$ Min.; $\Delta x =$ odd multiple of $\lambda/2$

$I \propto (\text{amp})^2$ amp → a

$I_R = I_1 + I_2 + 2\sqrt{I_1}\sqrt{I_2}\cos\phi$

$R^2 = a_1^2 + a_2^2 + 2a_1a_2\cos\phi$

$a_1 = a_2 = a$

$I_1 = I_2 = I$

$R = 2a\cos\phi/2$

$I' = 4I\cos^2\phi/2$

YDSE

$D \approx 1m$ $\quad d \approx 1mm$ $\quad \lambda << d$

$\tan\theta = \frac{y}{D}$

$\sin\theta = \frac{\Delta x}{d}$

$\sin\theta \approx \tan\theta$ $\quad \frac{\Delta x}{d} = \frac{y}{D}$

$y_{nB} = \frac{n\lambda D}{d}$ $\quad y_{nD} = \frac{(2n-1)\lambda D}{2d}$

$\beta = \frac{\lambda D}{d}$ → $\beta_{max} \rightarrow (\lambda_{Red})_{max}$; $\beta_{min} \rightarrow (\lambda_{violet})_{min}$

→ Opp. side → add
→ Same side → Subtract
→ By default → Same Side
} Ques mein

Brighter excellent

$I_R = I_{max}\cos^2\frac{\phi}{2}$

$I_R = 4I\cos^2\phi/2$

y_{nB} → dist. from maxima or Bright

y_{nD} → dist. from minima or Dark

INTENSITY

Max. → $\Delta\phi = 2n\pi$, $\Delta x = n\lambda$

Min. → $\Delta\phi = (2n-1)\pi$, $\Delta x = (2n-1)\frac{\lambda}{2}$

No. of Max. fringes ($\lambda \approx d$) (for dono sides ($\sin\theta \neq 1$))

Bright ● ——— ● Dark

$n = \frac{2d}{\lambda} + 1$ → Integer ← $n = 2\left[\frac{d}{\lambda} + \frac{1}{2}\right]$

SLAB → PRESENT

$\Delta x = (\mu-1)t$ → Δx → extra dist. slab waali ray ko chalna hai to complete equal dist. as of Air waali

$t' = \frac{t}{v} = \frac{t\cdot\mu}{c}$ → comparison ek hi time pe krna hai

Here,
t' → time
t → thickness
μ → R.I of Slab
c → Light speed
↳ Wave speed (air)
v → velo. of wave jo slab me enter karegi

Shifting → no effect on β

$y = \frac{(\mu-1)tD}{d}$

$y_{nB} = \frac{n\lambda D}{d} + \frac{(\mu-1)tD}{d}$

$y_{nD} = \frac{(2n-1)\lambda D}{2d} + \frac{(\mu-1)tD}{d}$

$(\mu_1-1)t_1 = (\mu_2-1)t_2$ → If $\Delta x = x_2 - x_1 = 0$

No. of fringes shift $= \frac{y}{\beta} = \frac{(\mu-1)t}{\lambda}$ (OR) No. of fringes