PRAYAS

JEE 2025

Lecture -

Physics

[redacted] wave optics – 03

By- Saleem Ahmed Sir

Topics *to be covered*

1. - YDSE Qus practice
2. - YDSE modification
3. — Thin film interference
4.

$I \propto$ width of slit

$I \propto A^2$

$\Delta x = d \sin\theta$

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

$\Delta x = \frac{d \cdot y}{D}$

$y = \Delta x \frac{D}{d}$

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

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

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

$\text{max} \equiv y = n\lambda \frac{D}{d}$

$\text{min} \quad y = (\text{odd})\frac{\lambda}{2}\frac{D}{d} = (2n-1)\frac{\lambda}{2}\frac{D}{d}$

$I = 4I_0 \cos^2 \phi/2$

$I_1 = I_2 = I_0$

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$D = 1\,m \qquad d = .1\,mm$

Q In YDSE experiment if two light of wavelength 200nm & 500nm are used. find minimum distance of a point from central maxima where maxima of both ray coincide.

Soln

$$y = n_1\beta_1 = n_2\beta_2$$

$$n_1\lambda_1\frac{D}{d} = n_2\lambda_2\frac{D}{d}$$

$$\boxed{n_1\lambda_1 = n_2\lambda_2}$$

$$n_1 \times 200 = n_2 \times 500$$

$$\boxed{2n_1 = 5n_2}$$

$(n_1, n_2 \equiv \text{Integer})$

n_1	5	10	15
n_2	2	4	6

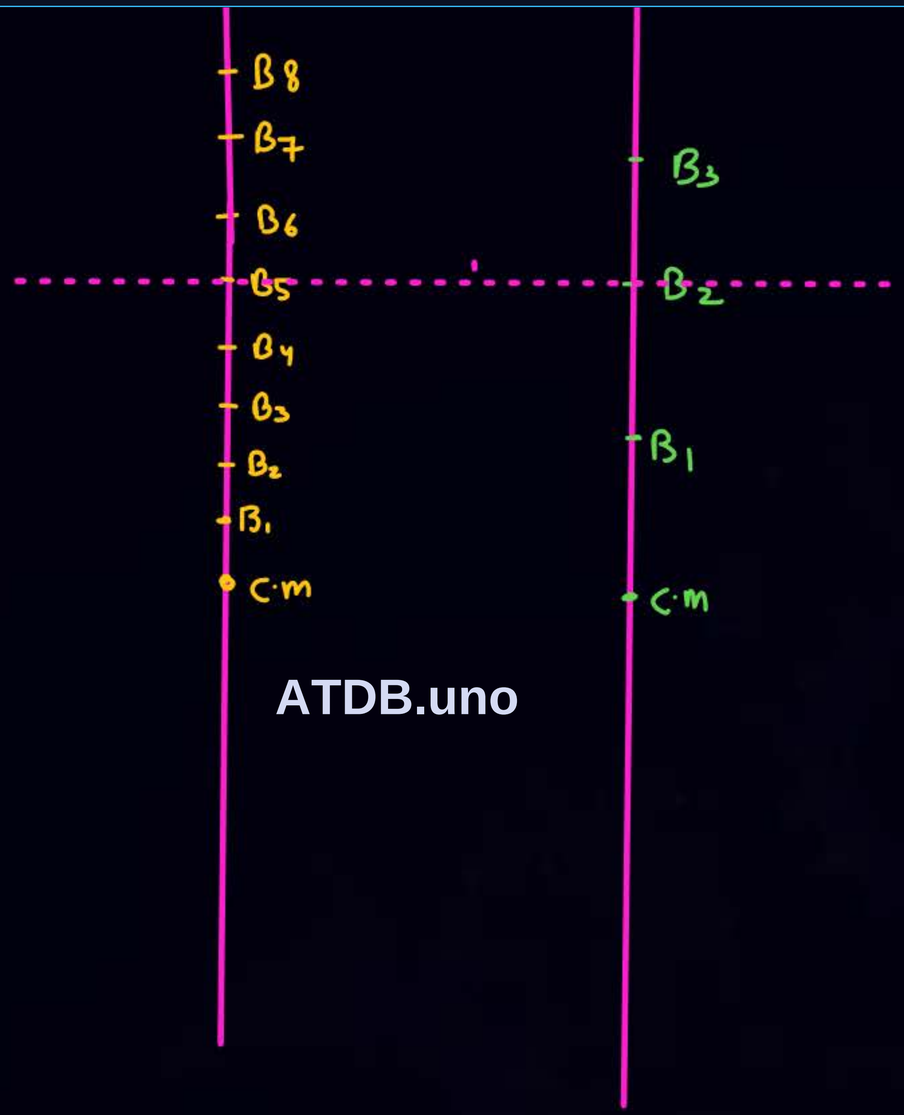
Ans $n_1 = 5 \qquad D = 1\,m$

$\lambda_1 = 200 \qquad d = .1\,mm$

$$y_{min} = n_1\beta_1 = 5 \times \frac{200 \times 10^{-9} \times 1}{1 \times 10^{-4}} = \checkmark$$

$\beta_1 = 2$ c·m let

$\beta_2 = 5$ c·m



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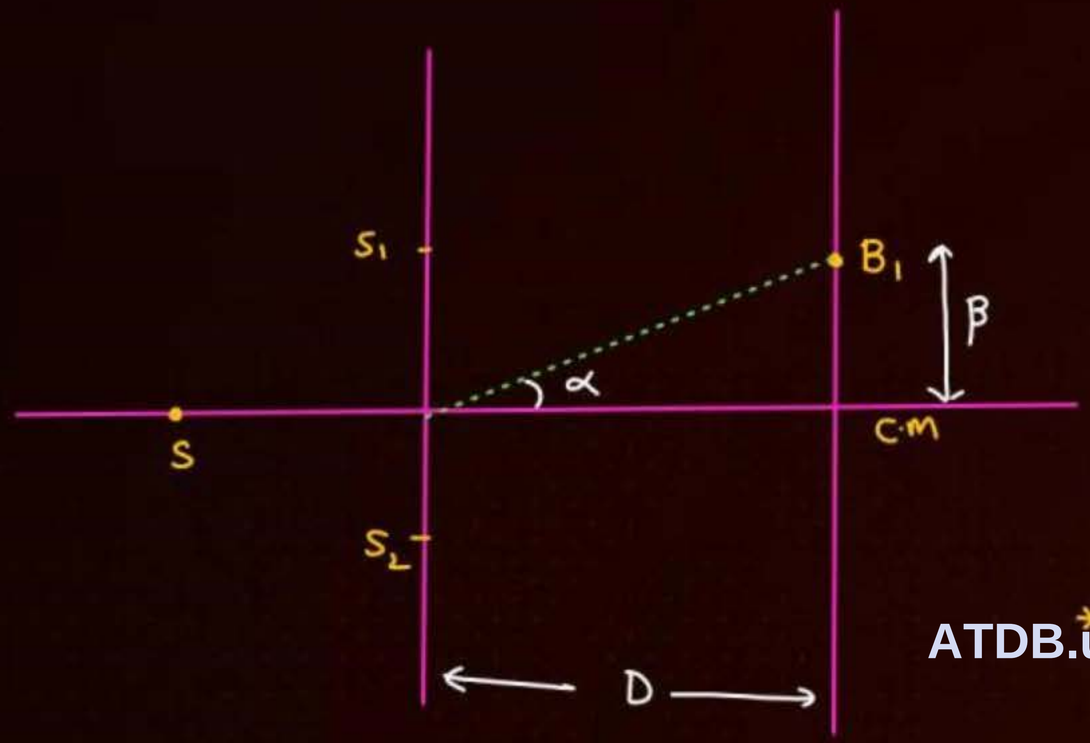


$$\tan\alpha = \frac{\beta}{D} = \frac{\lambda D/d}{D} = \frac{\lambda}{d}$$

Angular width

$$\tan\alpha = \frac{\lambda}{d}$$

Q If screen is moving away from slit

$$\beta = \frac{\lambda D}{d} \equiv (\text{increase})$$

$$\alpha = \frac{\lambda}{d} \longrightarrow \text{Same}$$

Q $\lambda = 200nm$ (Length of screen is sufficient for all max & min ∞)

$d = 700nm$

find no. of maxima on the screen.

Sol

$$\Delta x = d\sin\theta = n\lambda$$

$$\sin\theta = \frac{n\lambda}{d}$$

$$-1 \leq \sin\theta \leq +1$$

$$-1 \leq \frac{n\lambda}{d} \leq +1$$

$$-\frac{d}{\lambda} \leq n \leq +\frac{d}{\lambda}$$

$$-\frac{700}{200} \leq n \leq \frac{700}{200}$$

$$\boxed{-3.5 \leq n \leq +3.5}$$

$n \equiv -3, -2, -1, 0, 1, 2, 3$

7 Values

$$-\frac{d}{2\lambda} \le n \le +\frac{d}{2\lambda}$$

$$\frac{-600}{2} \le n \le \frac{600}{2}$$

$$-300 \le n \le +300$$

Q

$d = 3\,mm$

$\lambda = 500\,nm$

$$\frac{d}{\lambda} = \frac{3\times10^{-4}}{5\times10^{-7}} = \frac{3}{5}\times10^{3} = 600$$

Find the no. of maxima formed between angular width $-30 \le \theta \le +30$

Ans = 601

Sol^n

$$\Delta x = n\lambda = d\sin\theta$$

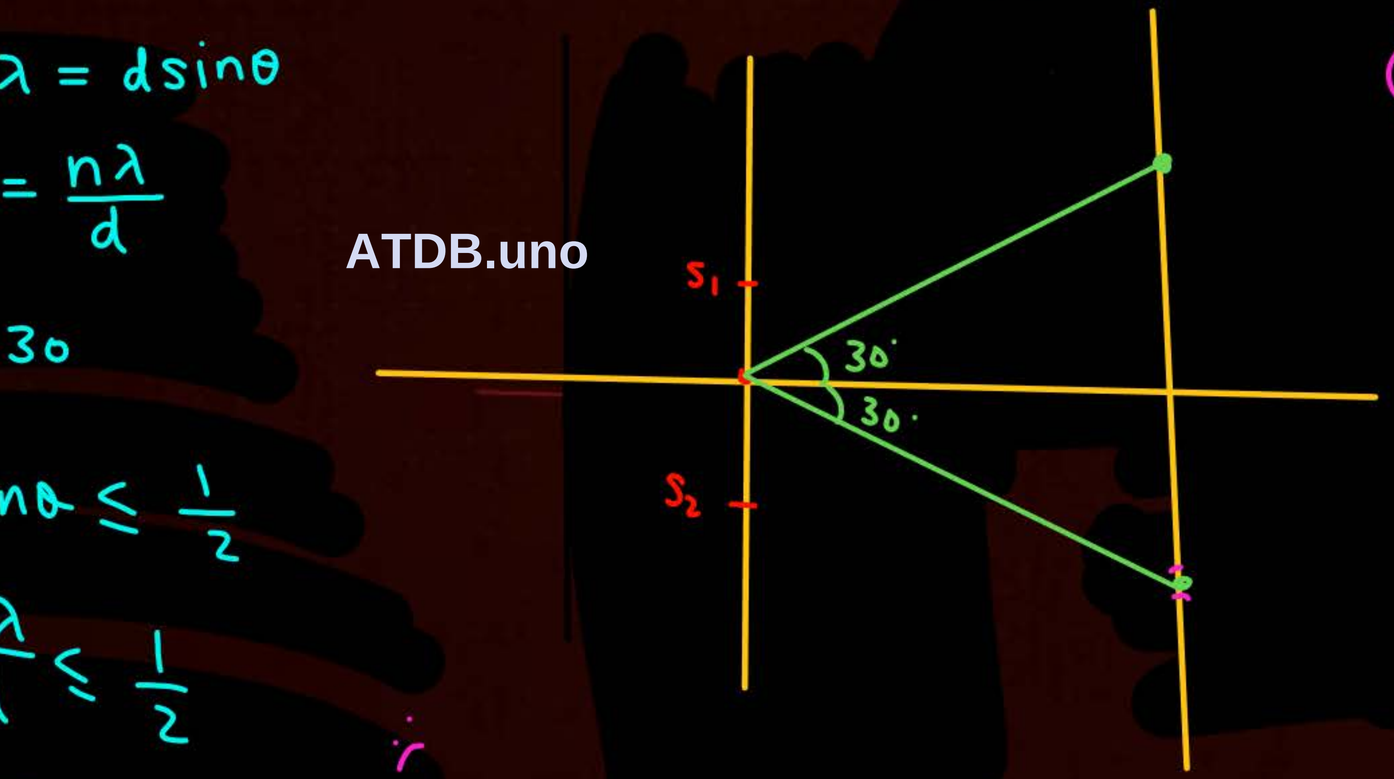
$$\sin\theta = \frac{n\lambda}{d}$$

$$-30 \le \theta \le 30$$

$$-\frac{1}{2} \le \sin\theta \le \frac{1}{2}$$

$$-\frac{1}{2} \le \frac{n\lambda}{d} \le \frac{1}{2}$$

$$-\frac{d}{2\lambda} \le n \le \frac{d}{2\lambda}$$



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$$(\Delta x)_{\text{at } P} = (SS_2 + S_2P) - (SS_1 + S_1P)$$

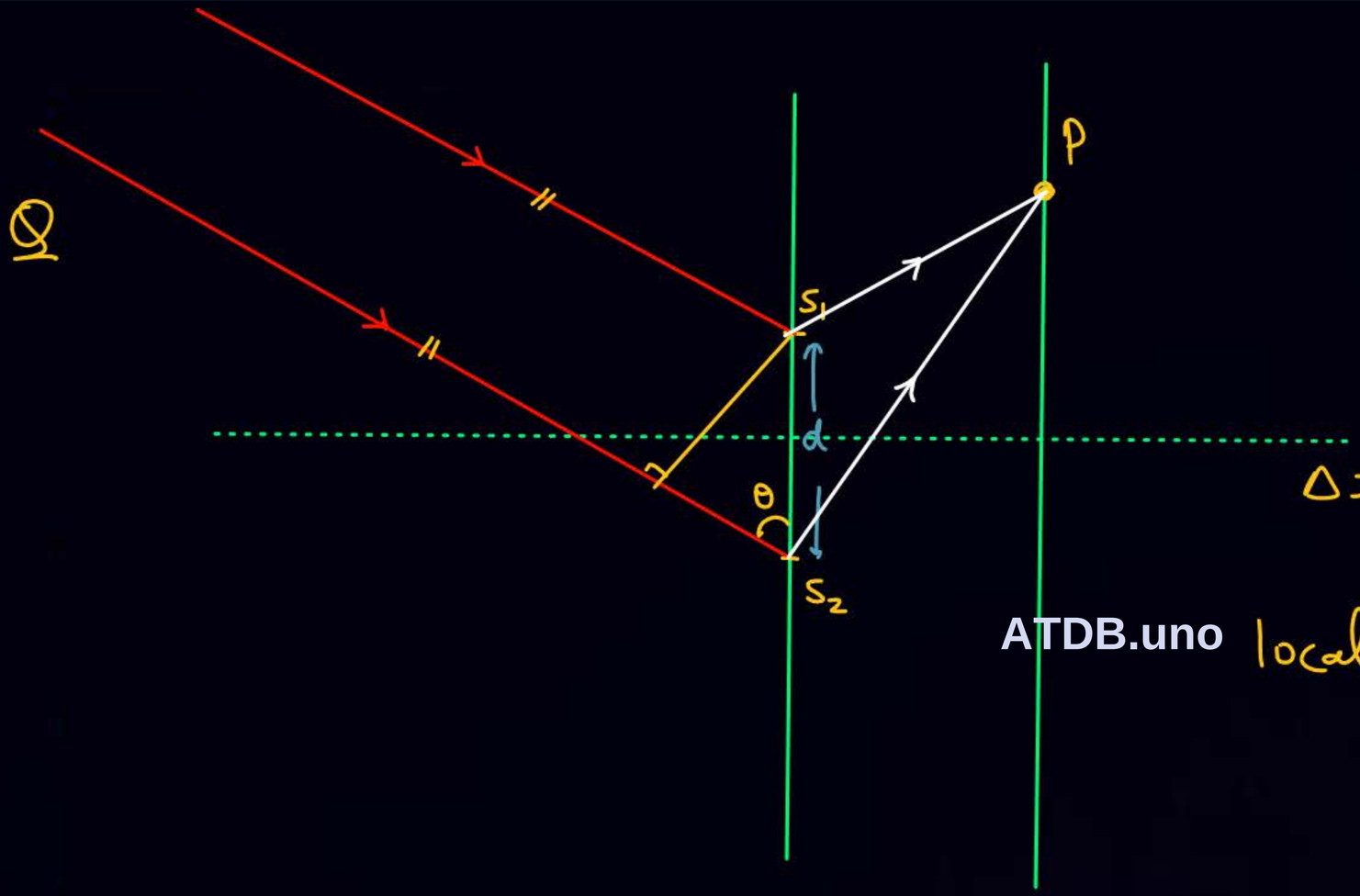
$$\Delta x = (SS_2 - SS_1) + (S_2P - S_1P)$$

$$\Delta x = -d\sin\theta + \frac{d.y}{D}$$

Central max $\Delta x = 0$

$$-d\sin\theta + \frac{dy}{D} = 0$$

$$\boxed{y = D\sin\theta} \equiv \text{C.m ऊपर}$$



$$\Delta x = (SS_2 + S_2P) - (SS_1 + S_1P)$$

$$= (SS_2 - SS_1) + (S_2P - S_1P)$$

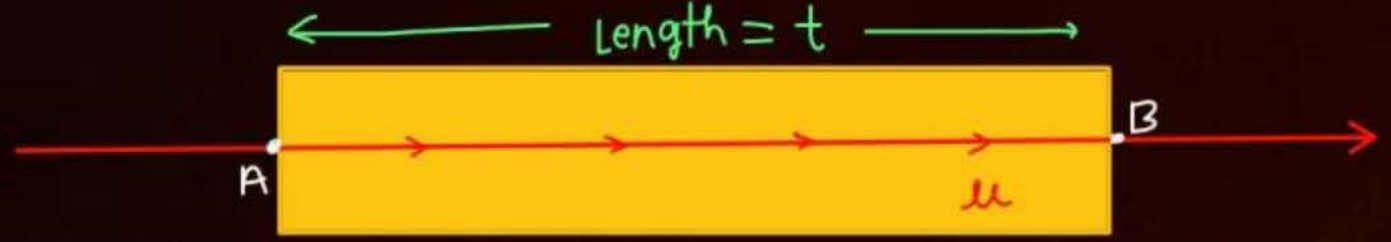
$$\Delta x = d\cos\theta + \frac{d \cdot y}{D}$$

location of c.m $\equiv (\Delta x = 0)$ put

$$\boxed{y = -D\cos\theta}$$

→ c.m नीचे

Idea of optical path

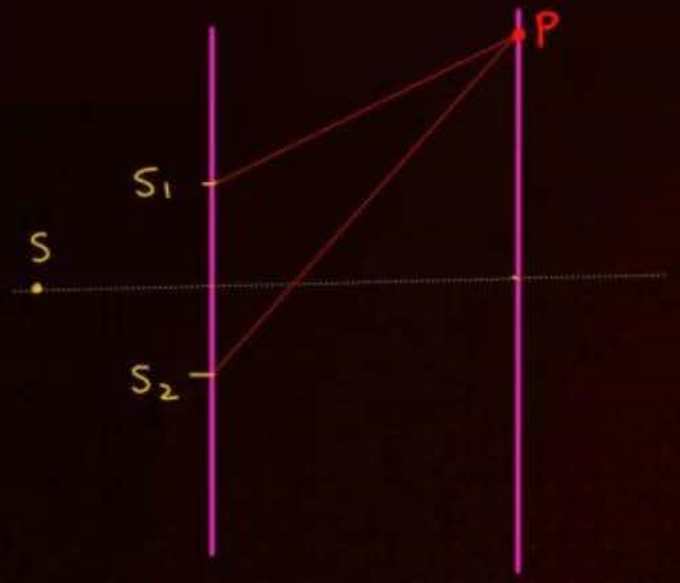


time taken by light to cross the slab (A ⟶ B) $= \frac{\text{distance}}{\text{speed}} = \frac{t}{c/\mu} = \frac{\mu t}{c}$

time taken by light to travel distance μt in Vaccume (ईथर) $= \frac{\mu t}{c}$

* If light travel a distance 't' in a medium of refractive index 'μ' suffer the same phase as when it travel distance μt in Vaccume.

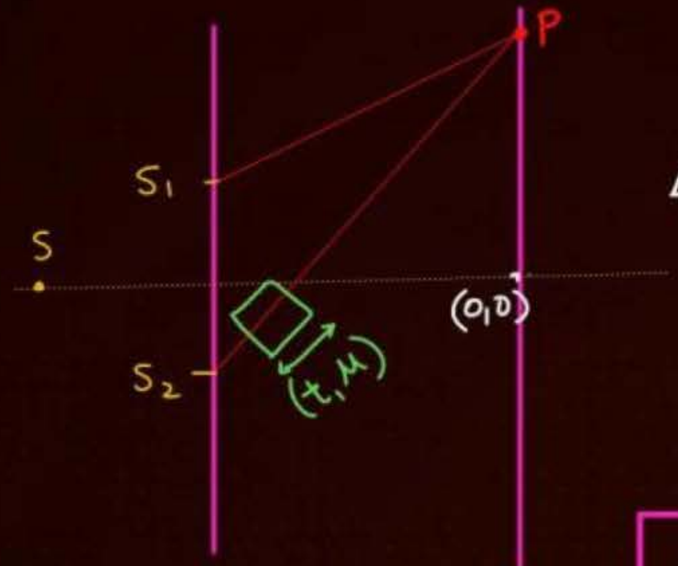
** Path length of 't' distance in medium (μ) is equivalent to 'path length' μt in Vaccume.



At P $\Rightarrow$ $\Delta x = d\sin\theta$, $\tan\theta = \frac{y}{D}$

$\Delta x = S_2P - S_1P = d\,\frac{y}{D}$

(θ very small)



① Location of cm

$\Delta x = 0$ (put)

$$y = \ominus \frac{(\mu-1)t\,D}{d}$$

↳ नीचे

At P Δx

$$\Delta x = \left[(S_2P - t)_{\text{हवा}} + t_{\text{slab}}\right] - (S_1P)_{\text{हवा}}$$

$$\Delta x = S_2P - t + \mu t - S_1P$$

$$\Delta x = (S_2P - S_1P) + (\mu t - t)$$

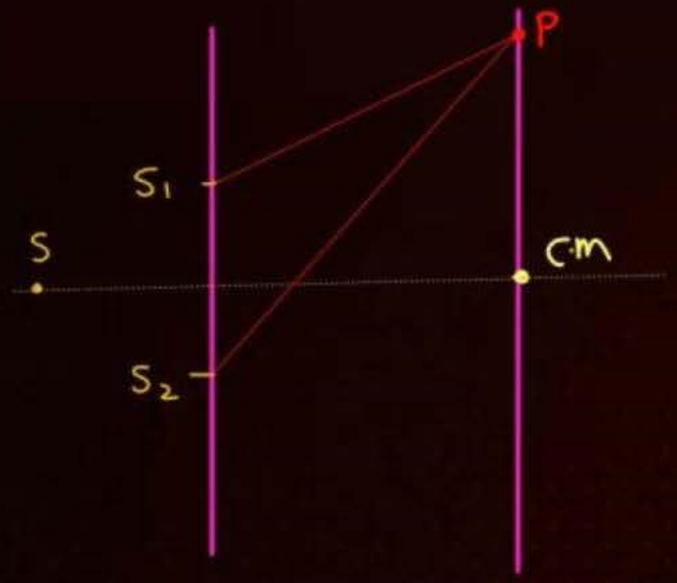
$$\boxed{\Delta x = \frac{d\cdot y}{D} + t(\mu-1)}$$

② Intensity at origin

$y = 0$, $\Delta x = (\mu-1)t$

$\Delta\phi =$ ✓

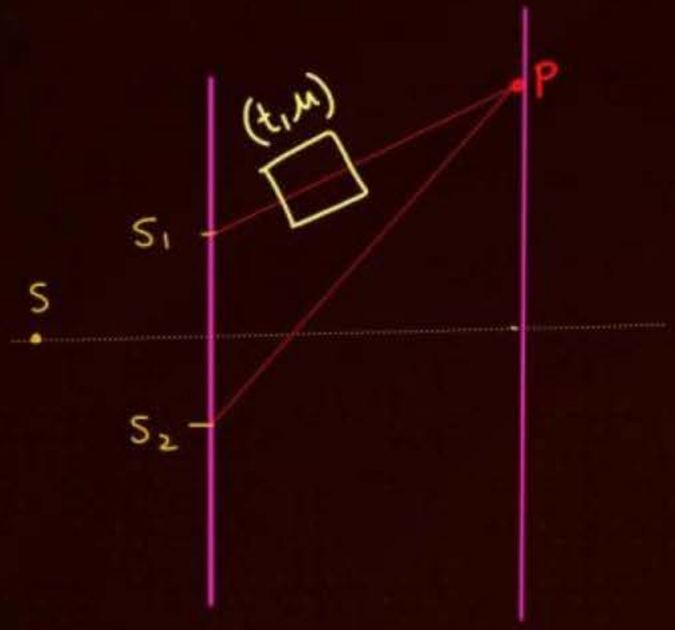
$I =$ ✓



At 'P' ⇛ $\Delta x = d\sin\theta$, $\tan\theta = \frac{y}{D}$

$\Delta x = S_2P - S_1P = d\,\frac{y}{D}$

(θ very small)



Δx at 'P'

$\Delta x = (S_2P)_{\text{हवा}} - [(S_1P - t)_{\text{हवा}} + t_{slab}]$

$\Delta x = S_2P - [S_1P - t + \mu t]$

$\Delta x = (S_2P - S_1P) + t - \mu t$

$$\boxed{\Delta x = \frac{d\cdot y}{D} - t(\mu - 1)}$$

Location of C.m

$\Delta x = 0$ (put)

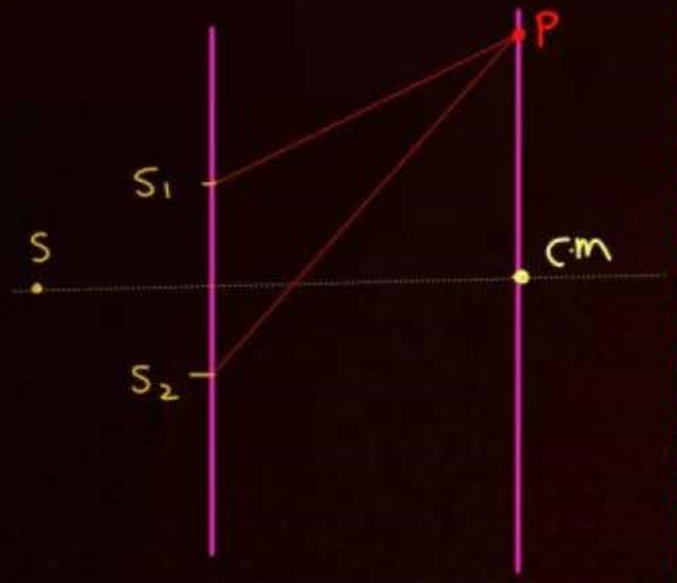
$$\boxed{y = +(\mu - 1)t\,\frac{D}{d}}$$

ऊपर

shift in C.m

$\beta = 4mm$

24 mm



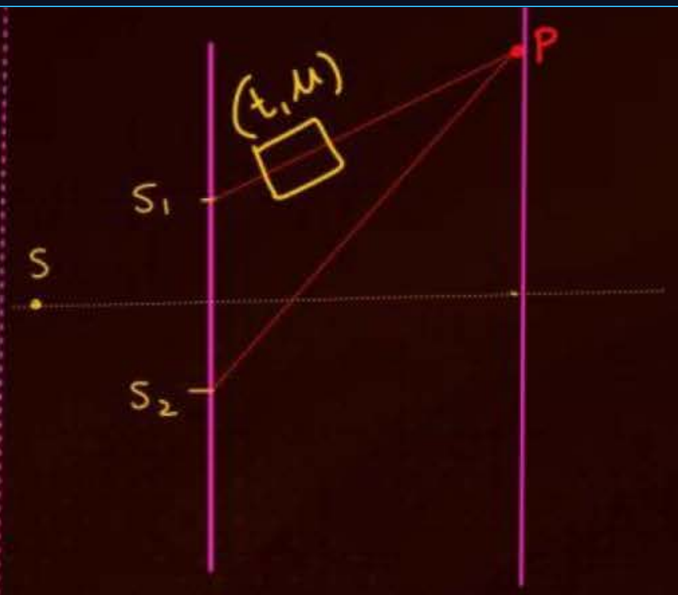
$$(\Delta x)_{\text{at } P} = y \cdot \frac{d}{D}$$

$$(\Delta x)_{\text{at } P'} = y \cdot \frac{d}{D} + (\mu - 1)t$$

Shift in cm ⇛

$$y = -(\mu - 1)t\,\frac{D}{d}$$

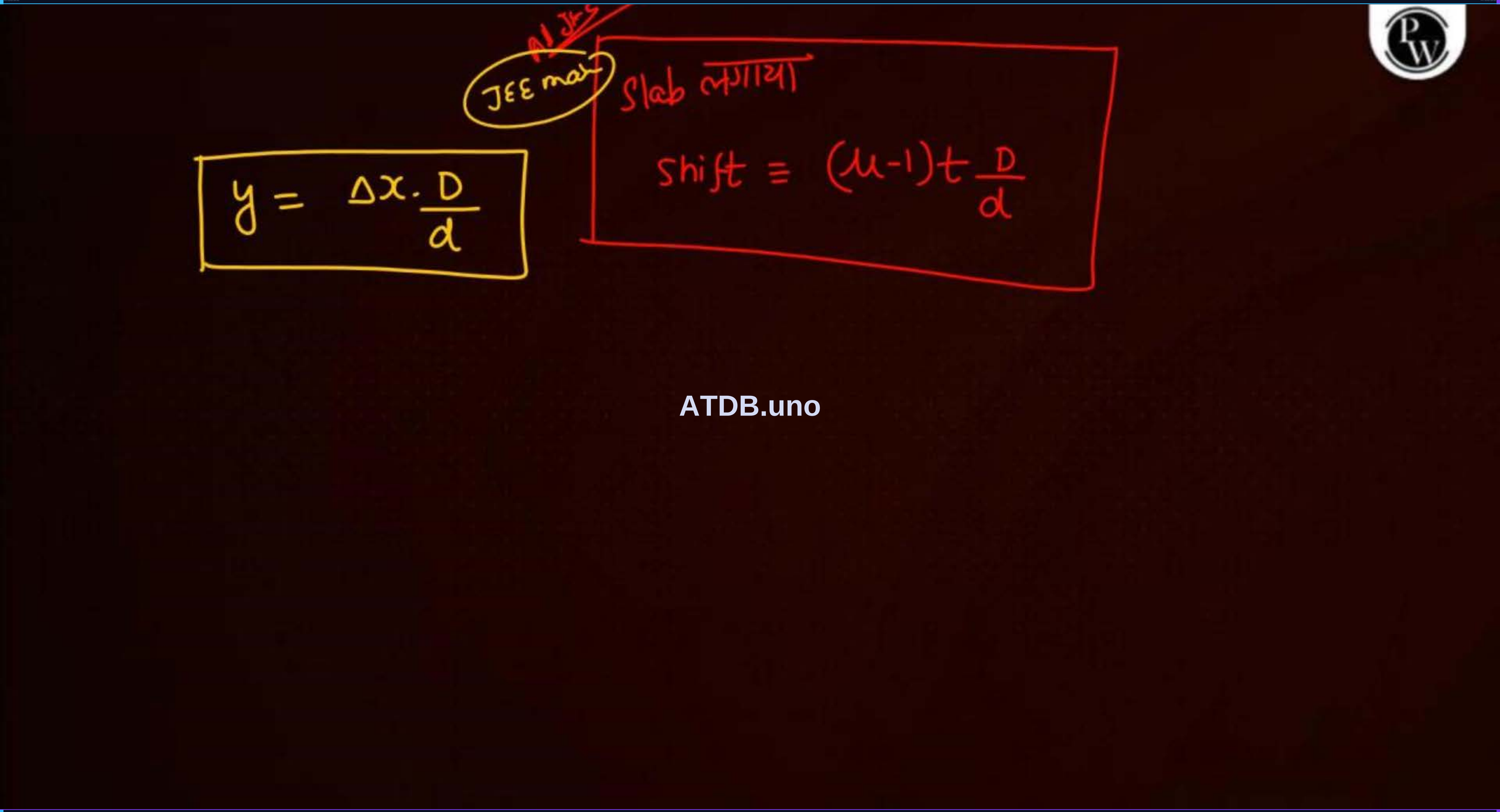
No. of fringes shifted $= \frac{y}{\beta}$



$$(\Delta x)_{\text{at } P'} = y \cdot \frac{d}{D} - (\mu - 1)t$$

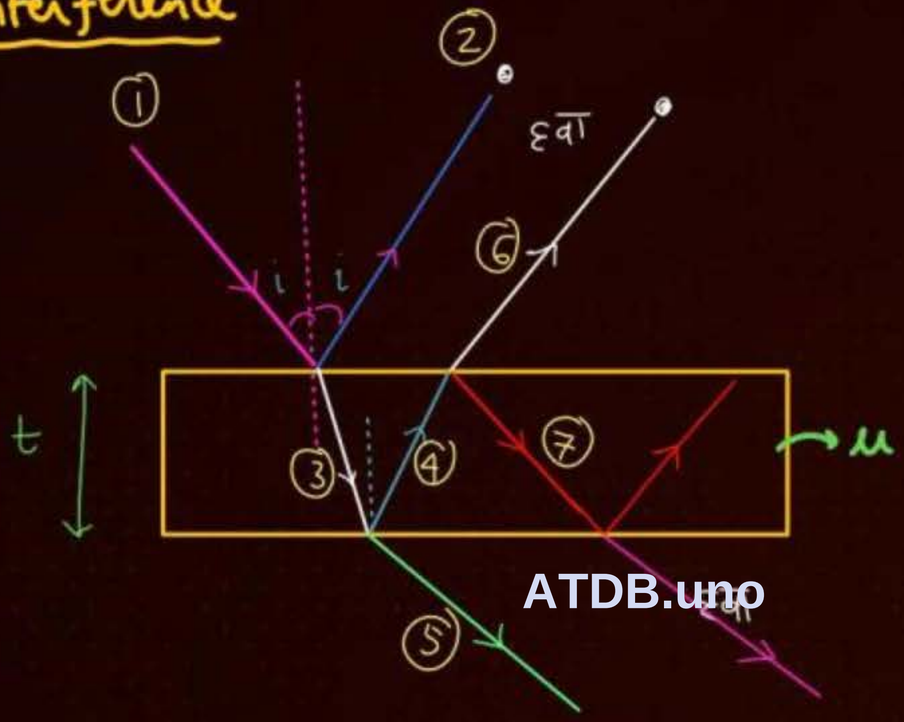
Shift in cm ⇛

$$y = +(\mu - 1)t\,\frac{D}{d}$$



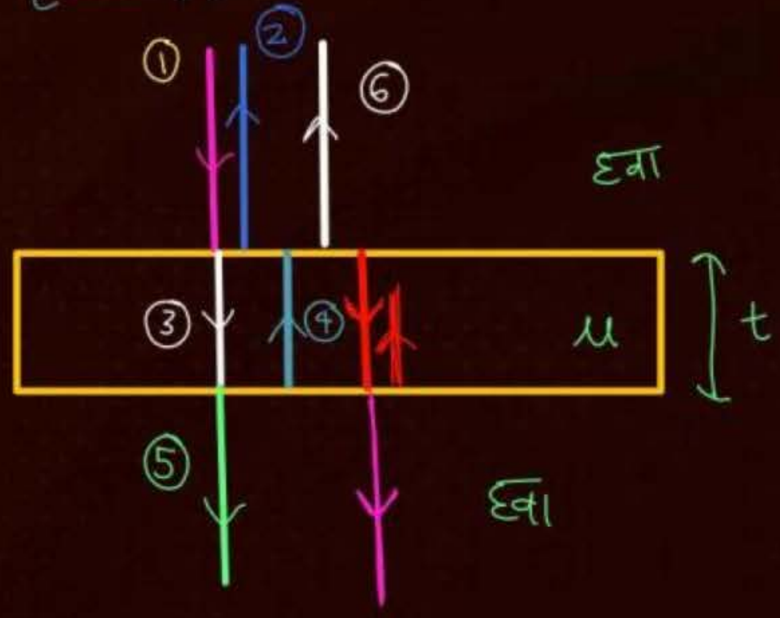
ATDB.uno

Thin film interference

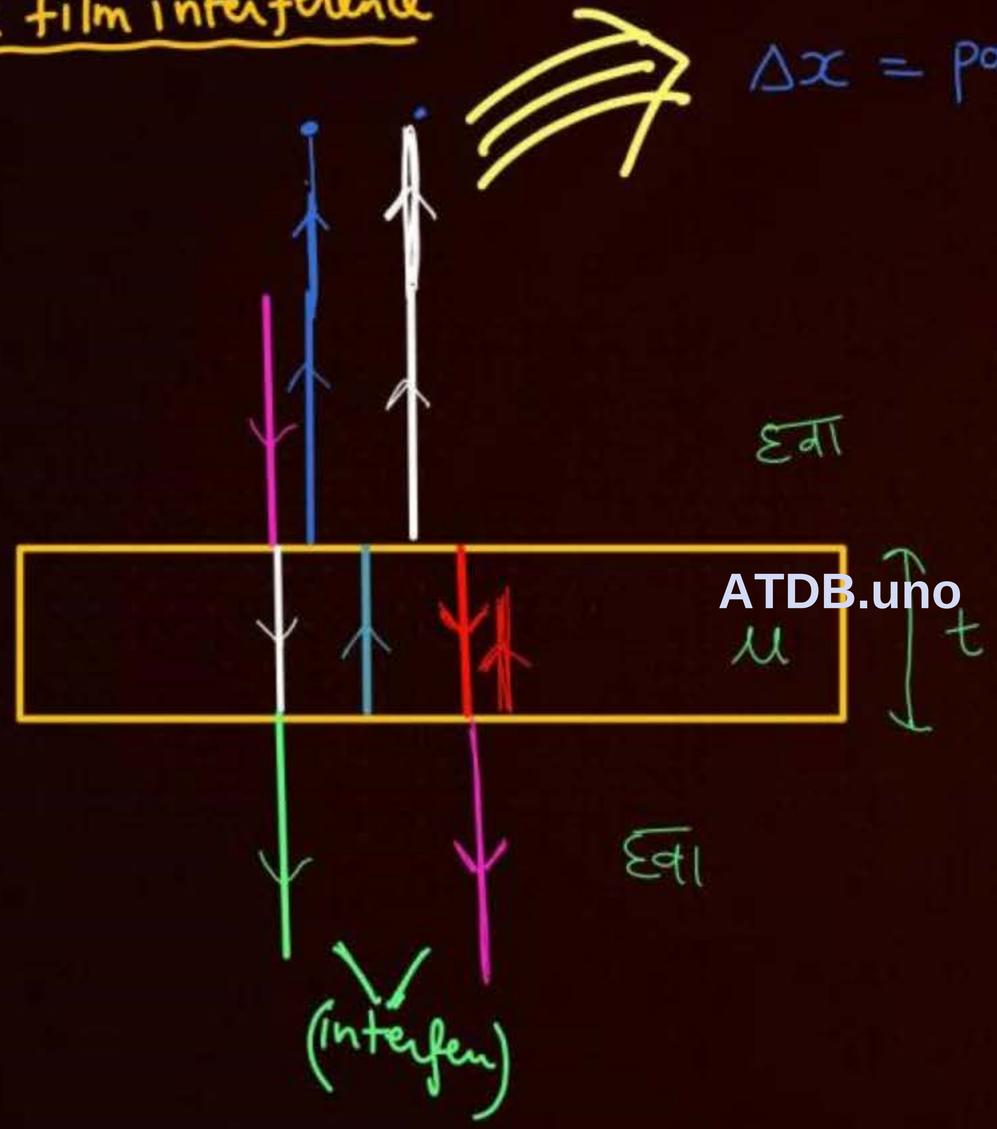


if $\angle i \longrightarrow$ very small

$i \longrightarrow 0$



Thin film interference



Δx = path difference $= 2\mu t + \frac{\lambda}{2} = n\lambda$ (maxima)

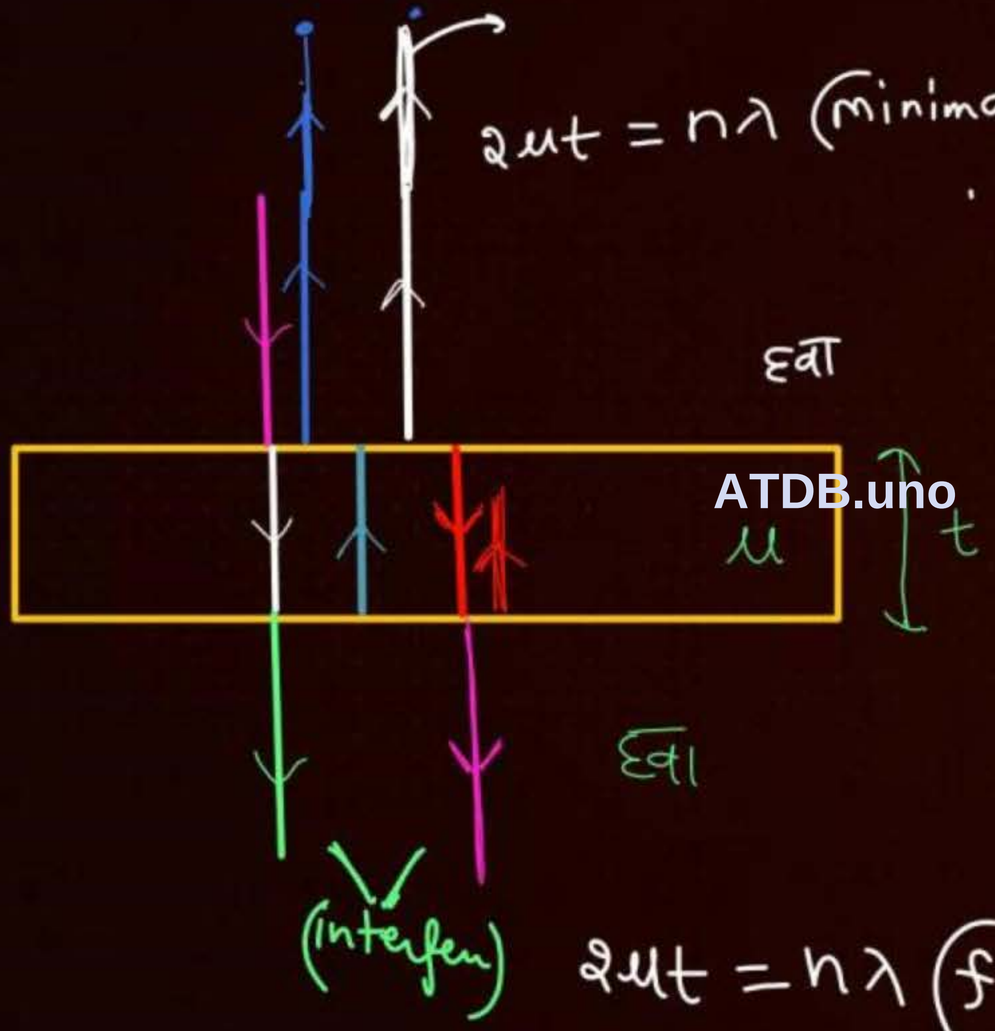
$2\mu t = n\lambda - \frac{\lambda}{2} = (2n-1)\frac{\lambda}{2}$

= odd $\lambda/2$

$2\mu t = (\text{odd})\frac{\lambda}{2}$ (maxima)

$2\mu t = n\lambda$ (minima)

Thin film interference



$2\mu t = n\lambda$ (minima)

हवा

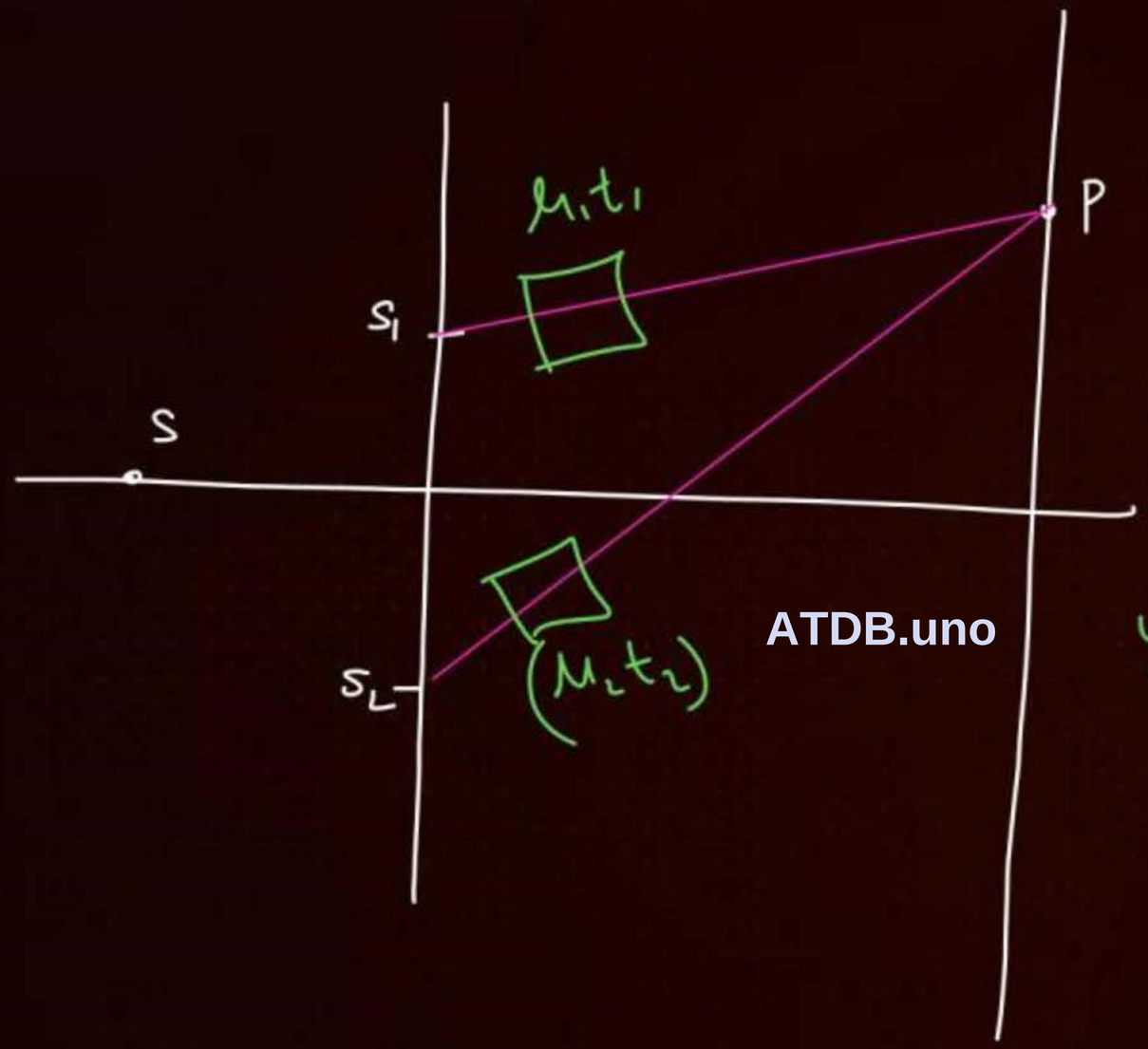
μ

t

हवा

(interfere)

$2\mu t = n\lambda$ (for maxima)



$$\Delta x = \frac{d \cdot y}{D} - (\mu_1 - 1) t_1 + (\mu_2 - 1) t_2$$

$$y = (\mu - 1) t \frac{D}{d} \text{ (mains)}$$

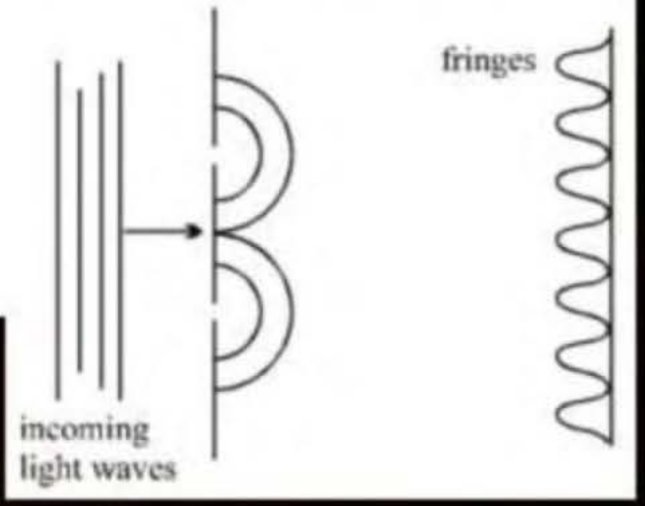
Q . **9.** In a Young's double slit experiment, green light is incident on the two slits. The interference pattern is observed on a screen. Which of the following changes would cause the observed fringes to be more closely spaced?

(A) Reducing the separation between the slits

(B*) Using blue light instead of green light

(C) Used red light instead of green light

(D) Moving the light source further away from the slits.



Ans : (B)

Q. **10.** In Young's double slit experiment, the wavelength of red light is 7800 Å and that of blue light is 5200 Å. The value of n for which n^{th} bright band due to red light coincides with $(n+1)^{th}$ bright band due to blue light, is :

(A) 1 (B*) 2 (C) 3 (D) 4

Ans : (B)

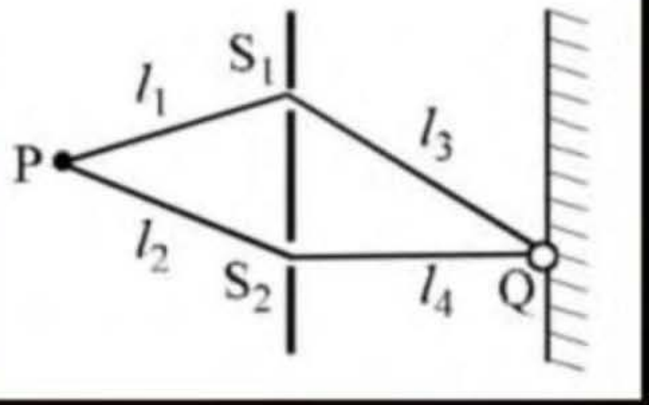
Q. 11. Two identical narrow slits S_1 and S_2 are illuminated by light of wavelength λ from a point source P. If, as shown in the diagram, the light is then allowed to fall on a screen, and if n is a positive integer, the condition for destructive interference at Q is :-

(A) $(\ell_1 - \ell_2) = (2n + 1)\lambda/2$

(B) $(\ell_3 - \ell_4) = (2n + 1)\lambda/2$

(C) $(\ell_1 + \ell_2) - (\ell_3 + \ell_4) = n\lambda$

(D*) $(\ell_1 + \ell_3) - (\ell_2 + \ell_4) = (2n + 1)\lambda/2$



Ans : (D)

Q . **13.** In a Young's double slit experiment, a small detector measures an intensity of illumination of I units at the centre of the fringe pattern. If one of the two (identical) slits is now covered, the measured intensity will be :-

(A) 2I (B) I (C*) I/4 (D) I/2

Ans : (C)

Q. 21. In the ideal double–slit experiment, when a glass–plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass–plate is :– **[IIT-JEE 2002]**

(A) 2λ (B) $\frac{2\lambda}{3}$ (C) $\frac{\lambda}{3}$ (D) λ

Ans : (A)

Q. **6.** Two point monochromatic and coherent sources of light of wavelength λ are placed on the dotted line in front of a large screen. The sources emit waves in phase with each other. The distance between S_1 and S_2 is d while their distance from the screen is much larger.

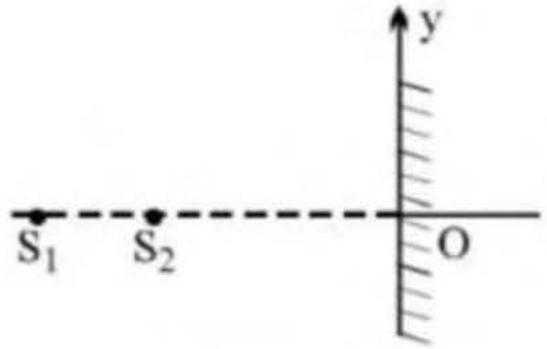
(1) If $d = 7\lambda/2$, O will be a minima

(2) If $d = 4.3\lambda$, there will be a total of 8 minima on y-axis.

(3) If $d = 7\lambda$, O will be a maxima.

(4) If $d = \lambda$, there will be only one maxima on the screen.

Which is the set of correct statement :



(A) 1, 2 & 3 (B) 2, 3 & 4 (C*) 1, 2, 3 & 4 (D) 1, 3 & 4

Ans : (C)

Q. **2.** Young's double slit experiment is carried out by using green, red and blue light, one color at a time. The fringe widths recorded are β_G, β_R and β_B, respectively. Then **[IIT-JEE-2012]**

(A) $\beta_G > \beta_B > \beta_R$ (B) $\beta_B > \beta_G > \beta_R$ (C) $\beta_R > \beta_B > \beta_G$ (D) $\beta_R > \beta_G > \beta_B$

Ans : (D)

Q. **3.** In the Young's double slit experiment using a monochromatic light of wavelength λ, the path difference (in terms of an integer n) corresponding to any point having half the peak intensity is :-

[JEE Advanced 2013]

(A) $(2n+1)\frac{\lambda}{2}$ (B) $(2n+1)\frac{\lambda}{4}$ (C) $(2n+1)\frac{\lambda}{8}$ (D) $(2n+1)\frac{\lambda}{16}$

50%.

Ans : (B)

Q. **4.** A light source, which emits two wavelengths $\lambda_1 = 400$ nm and $\lambda_2 = 600$ nm, is used in a Young's double slit experiment. If recorded fringe widths for λ_1 and λ_2 are β_1 and β_2 and the number of fringes for them within a distance y on one side of the central maximum are m_1 and m_2, respectively, then :- **[JEE Advanced 2014]**

(A) $\beta_2 > \beta_1$

(B) $m_1 > m_2$

(C) From the central maximum, 3^{rd} maximum of λ_2 overlaps with 5^{th} minimum of λ_1

(D) The angular separation of fringes of λ_1 is greater than λ_2

Ans : (A, B, C)

Q Calculate the minimum thickness of a soap film $\mu = 1.33$ that results in constructive interference in the reflected light if film is illuminated with light (normally) whose wavelength in free space is $\lambda = 600\,nm$.

Soln

$$2\mu t = (odd)\frac{\lambda}{2}$$

$$t = \frac{(odd)\lambda}{4\mu} = \frac{1 \times 600 \times 10^{-9}}{4 \times \frac{4}{3}}$$

min

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Abhi Humne Prism Nahi padha hai

QUESTION

In a Young's double slit experiment, 16 fringes are observed in a certain segment of the screen when light of wavelength 700 nm is used. If the wavelength of light is changed to 400 nm, the number of fringes observed in the same segment of the screen would be:

[JEE Mains 2020]

$$16\beta = \ell = n\beta'$$

$$16 \times 700 \times \frac{D}{d} = n \times 400 \times \frac{D}{d}$$

1. 28
2. 24
3. 18
4. 30

Ans. (1)

QUESTION

A Young's double-slit experiment is performed using monochromatic light of wavelength λ. The intensity of light at a point on the screen, where the path difference is λ, is K units. The intensity of light at a point where the path difference is $\lambda/6$ given by $\frac{nK}{12}$, where n is an integer. The value of n is _____ . **[JEE Mains 2020]**

Ans. 9

QUESTION

In a double slit experiment, at a certain point on the screen the path difference between the two interfering waves is $\frac{1}{8}$ th of a wavelength. The ratio of the intensity of light at that point to that at the centre of a bright fringe is: **[JEE Mains 2020]**

$\rightarrow 4I_0$

$\Delta x = \frac{\lambda}{8}$

$I = 4I_0 \cos^2(\phi/2)$

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

$\Delta\phi = 2\pi \frac{1}{8} = \frac{\pi}{4}$

1. 0.568
2. 0.672
3. 0.760
4. 0.853

Ans. (4)

QUESTION

In a Young's double slit experiment, the separation between the slits is 0.15 mm. In the experiment, a source of light of wavelength 589 nm is used and the interference pattern is observed on a screen kept 1.5 m away. The separation between the successive bright fringes on the screen is: **[JEE Mains 2020]**

1. 6.9 mm
2. 5.9 mm
3. 4.9 mm
4. 3.9 mm

Ans. (2)

QUESTION

In a Young's double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit-width. Find the ratio of the maximum to the minimum intensity in the interference pattern.

[JEE Mains 2021]

1. 1 : 4
2. 3 : 1
3. 4 : 1
4. 2 : 1

Ans. (3)

QUESTION

If the source of light used in a Young's double slit experiment is changed from red to violet:

[JEE Mains 2021]

1. consecutive fringe lines will come closer.
2. the central bright fringe will become a dark fringe.
3. the fringes will become brighter.
4. the intensity of minima will increase.

Ans. (1)

QUESTION

In a Young's double slit experiment two slits are separated by 2 mm and the screen is placed one meter away. When a light of wavelength 500 nm is used, the fringe separation will be:

[JEE Mains 2021]

1. 0.25 mm
2. 0.50 mm
3. 0.75 mm
4. 1 mm

Ans. (1)

QUESTION

In Young's double slit experiment, if the source of light changes from orange to blue then:

[JEE Mains 2021]

1. the central bright fringe will become a dark fringe.
2. the distance between consecutive fringes will decrease.
3. the distance between consecutive fringes will increase.
4. the intensity of the minima will increase.

Ans. (2)

QUESTION

Two coherent light sources having intensity in the ratio 2x produce an interference pattern. The ratio $\frac{I_{max}-I_{min}}{I_{max}+I_{min}}$ will be:

[JEE Mains 2021]

1. $\frac{2\sqrt{2}}{x+1}$
2. $\frac{\sqrt{2x}}{2x+1}$
3. $\frac{\sqrt{2x}}{x+1}$
4. $\frac{2\sqrt{2x}}{2x+1}$

Ans. (4)

QUESTION

d

In Young's double slit arrangement, slits are separated by a gap of 0.5 mm, and the screen is placed at a distance of 0.5 m from them. The distance between the first and the third bright fringe formed when the slits are illuminated by a monochromatic light of 5890 Å is:

D

[JEE Mains 2021]

1. 1178×10^{-9} m
2. 1178×10^{-6} m
3. 1178×10^{-12} m
4. 5890×10^{-7} m

Ans. (2)

QUESTION

In the Young's double slit experiment, the distance between the slits varies in time as $d(t) = d_0 + a_0 \sin\omega t$; where d_0, ω and a_0 are constants. The difference between the largest fringe width and the smallest fringe width obtained over time is given as:

[JEE Mains 2021]

1. $\dfrac{2\lambda D(d_0)}{(d_0^2 - a_0^2)}$
2. $\dfrac{2\lambda D a_0}{(d_0^2 - a_0^2)}$
3. $\dfrac{\lambda D}{d_0^2} a_0$
4. $\dfrac{\lambda D}{d_0 + a_0}$

Ans. (2)

QUESTION

White light is passed through a double slit and interference is observed on a screen 1.5 m away. The separation between the slits is 0.3 mm. The first violet and red fringes are formed 2.0 mm and 3.5 mm away from the central white fringes. The difference in wavelengths of red and violet light is ___300___ nm. **[JEE Mains 2021]**

$$\beta_{red} - \beta_v = (3.5 - 2) \times 10^{-3}$$

$$\lambda_R \cdot \frac{D}{d} - \lambda_v \frac{D}{d} = 1.5 \times 10^{-3}$$

$$(\lambda_R - \lambda_v) \cdot \frac{1.5}{3 \times 10^{-4}} = 1.5 \times 10^{-3} \equiv$$

3×10^{-7}

300×10^{-9}

Ans. 300

QUESTION

The light waves from two coherent sources have same intensity $I_1 = I_2 = I_0$. In interference pattern the intensity of light at minima is zero. What will be the intensity of light at maxima?

[JEE Mains 2021]

1. I_0
2. $2\,I_0$
3. $5\,I_0$
4. $4\,I_0$

Ans. (4)

QUESTION

A fringe width of 6 mm was produced for two slits separated by 1 mm apart. The screen is placed 10 m away. The wavelength of light used is 'x' nm. The value of 'x' to the nearest integer is _____.

[JEE Mains 2021]

Ans. 600

QUESTION

In a Young's double slit experiment, the slits are separated by 0.3 mm and the screen is 1.5 m away from the plane of slits. Distance between fourth bright fringes on both sides of central bright is 2.4 cm. The frequency of light used is _____ $\times 10^{14}$ Hz.

[JEE Mains 2021]

Ans. 5

QUESTION

The width of one of the two slits in a Young's double slit experiment is three times the other slit. If the amplitude of the light coming from a slit is proportional to the slit-width, the ratio of minimum to maximum intensity in the interference pattern is x : 4 where x is _____.

[JEE Mains 2021]

Ans. 1

QUESTION

In young's double slit experiment, the fringe width is 12 mm. If the entire arrangement is placed in water of refractive index $\frac{4}{3}$, then the fringe width becomes (in mm).

[JEE Mains 2022]

1. 16
2. 9
3. 48
4. 12

Ans. (2)

QUESTION

Two coherent sources of light interfere. The intensity ratio of two sources is 1 : 4.

For this interference pattern if the value of $\frac{I_{max}+I_{min}}{I_{max}-I_{min}}$ is equal to $\frac{2\alpha+1}{\beta+3}$, then $\frac{\alpha}{\beta}$ will be:

[JEE Mains 2022]

1. 1.5
2. 2
3. 0.5
4. 1

Ans. (2)

QUESTION

In a Young's double slit experiment, a laser light of 560 nm produces an interference pattern with consecutive bright fringes' separation of 7.22 mm. Now another light is used to produce an interference pattern with consecutive bright fringes' separation of 8.1 mm. The wavelength of second light is _____ nm.

[JEE Mains 2022]

Ans. 630

QUESTION

The two light beams having intensities I and 9I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point P and π at point Q. Then the difference between the resultant intensities at P and Q will be:

[JEE Mains 2022]

1. 2 I
2. 6 I
3. 5 I
4. 7 I

Ans. (2)

QUESTION

The interference pattern is obtained with two coherent light sources of intensity ratio 4 : 1. And the ratio $\frac{I_{max}+I_{min}}{I_{max}-I_{min}}$ is $\frac{5}{x}$. Then, the value of x will be equal to:

[JEE Mains 2022]

Ans. 4

QUESTION

Using Young's double slit experiment, a monochromatic light of wavelength 5000 Å produces fringes of fringe width 0.5 mm. If another monochromatic light of wavelength 6000Å is used and the separation between the slits is doubled, then the new fringe width will be:

[JEE Mains 2022]

1. 0.5 mm
2. 1.0 mm
3. 0.6 mm
4. 0.3 mm

Ans. (4)

QUESTION

In a double slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the plane of slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-3} cm. If the distance between the slits is 1 mm, then the wavelength of the light will be _____ nm.

[JEE Mains 2022]

Ans. 600

QUESTION

In Young's double slits experiment, the position of 5^{th} bright fringe from the central maximum is 5 cm. The distance between slits and screen is 1 m and wavelength of used monochromatic light is 600 nm. The separation between the slits is:

[25 January 2023 - Shift 1]

1. 60 μm
2. 48 μm
3. 12 μm
4. 36 μm

Ans : (1)

QUESTION

In a Young's double slit experiment, the intensities at two points, for the path difference $\frac{\lambda}{4}$ and $\frac{\lambda}{3}$ (λ being the wavelength of light used) are I_1 and I_2 respectively. If I_0 denotes the intensity produced by each one of the individual slits, then $\frac{I_1+I_2}{I_0}$ = _____.

[30 January 2023 - Shift 2]

Ans : (3)

QUESTION

Two light waves of wavelengths 800 and 600 nm are used in Young's double slit experiment to obtain interference fringes on a screen placed 7 m away from plane of slits. If the two slits are separated by 0.35 mm, then shortest distance from the central bright maximum to the point where the bright fringes of the two wavelength coincide will be _____mm.

[31 January 2023 - Shift 2]

Ans : (48)

QUESTION

A beam of light consisting of two wavelengths 7000Å and 5500Å is used to obtain interference pattern in Young's double slit experiment. The distance between the slits is 2.5 mm and the distance between the plane of slits and the screen is 150 cm. The least distance from the central fringe, where the bright fringes due to both the wavelengths coincide, is $n \times 10^{-5}$ m. The value of n is _____.

[06 April 2023 - Shift 2]

Ans : (462)

QUESTION

The width of fringe is 2 mm on the screen in a double slit experiment for the light of wavelength of 400 nm. The width of the fringe for the light of wavelength 600 nm will be:

[08 April 2023 - Shift 2]

1. 4 mm
2. 2 mm
3. 1.33 mm
4. 3 mm

Ans : (4)

QUESTION

The ratio of intensities at two points P and Q on the screen in a Young's double slit experiment where phase difference between two waves of same amplitude are $\frac{\pi}{3}$ and $\frac{\pi}{2}$, respectively are:

[10 April 2023 - Shift 2]

1. 2 : 3
2. 1 : 3
3. 3 : 1
4. 3 : 2

Ans : (4)

QUESTION

In a Young's double slit experiment, the ratio of amplitude of light coming from slits is 2 : 1. The ratio of the maximum to minimum intensity in the interference pattern is:

[13 April 2023 - Shift 2]

1. 9 : 4
2. 25 : 9
3. 2 : 1
4. 9 : 1

Ans : (4)

QUESTION

In Young's double slit experiment, monochromatic light of wavelength 5000 Å is used. The slits are 1.0 mm apart and screen is placed at 1.0 m away from slits. The distance from the centre of the screen where intensity becomes half of the maximum intensity for the first time is _____ $\times 10^{-6}$ m. **[01 Feb. 2024 - Shift 2]**

Ans. (125)

QUESTION

In Young's double slit experiment, light from two identical sources are superimposing on a screen. The path difference between the two lights reaching at a point on the screen is $\frac{7\lambda}{4}$. The ratio of intensity of fringe at this point with respect to the maximum intensity of the fringe is:

[29 Jan. 2024 - Shift 2]

1. 1/2
2. 3/4
3. 1/3
4. 1/4

Ans. (1)

QUESTION

Two waves of intensity ratio 1:9 cross each other at a point. The resultant intensities at the point, when (a) Waves are incoherent is I_1 (b) Waves are coherent is I_2 and differ in phase by 60°. If $\frac{l_1}{l_2} = \frac{10}{x}$ then x =

[31 Jan. 2024 - Shift 1]

Ans. (13)

QUESTION

Two wavelengths λ_1 and λ_2 are used in Young's double slit experiment. $\lambda_1 = 450$ nm and $\lambda_2 = 650$ nm. The minimum order of fringe produced by λ_2 which overlaps with the fringe produced by λ_1 is n. The value of n is:

[04 Apr. 2024 - Shift 1]

Ans. (9)

QUESTION

The width of one of the two slits in a Young's double slit experiment is 4 times that of the other slit. The ratio of the maximum of the minimum intensity in the interference pattern is:

[04 Apr. 2024 - Shift 2]

1. 1 : 1
2. 4 : 1
3. 9 : 1
4. 16 : 1

Ans. (3)

QUESTION

Light emerges out of a convex lens when a source of light kept at its focus. The shape of wavefront of the light is:

[05 Apr. 2024 - Shift 1]

1. both spherical and cylindrical
2. plane
3. spherical
4. cylindrical

Ans. (2)

QUESTION

In Young's double slit experiment, carried out with light of wavelength 5000A, the distance between the slits is 0.3 mm and the screen is at 200 cm from the slits. The central maximum is at x = 0 cm. The value of x for third maxima is _____ mm.

[05 Apr. 2024 - Shift 1]

Ans. (10)

QUESTION

Two coherent monochromatic light beams of intensities I and 4I are superimposed. The difference between maximum and minimum possible intensities in the resulting beam is xI. The value of x is _____.

[06 Apr. 2024 - Shift 2]

Ans. (8)

QUESTION

In a Young's double slit experiment, the intensity at a point is $\left(\frac{1}{4}\right)^{th}$ of the maximum intensity, the minimum distance of the point from the central maximum is _____ μm. (Given : $\lambda = 600$ nm, d = 1.0 mm, D = 1.0 m) **[09 Apr. 2024 - Shift 1]**

Ans. (200)

QUESTION

In young' s double slit experiment performed using a monochromatic light of wavelength λ, when a glass plate ($\mu = 1.5$) of thickness $x\lambda$ is introduced in the path of the one of the interfering beams, the intensity at the position where the central maximum occurred previously remains unchanged. The value of x will be:

[JEE Mains 2022]

$$\text{shift} = (\mu-1)t\frac{D}{d} = n\beta = n\lambda\frac{D}{d}$$

$$t = \frac{n\lambda}{(\mu-1)} = x\lambda$$

$$x = \frac{n}{\mu-1} = \frac{n}{1.5-1} = 2n$$

2, 4, 6, 8

1. 3
2. 2
3. 1.5
4. 0.5

Ans. (2)

QUESTION

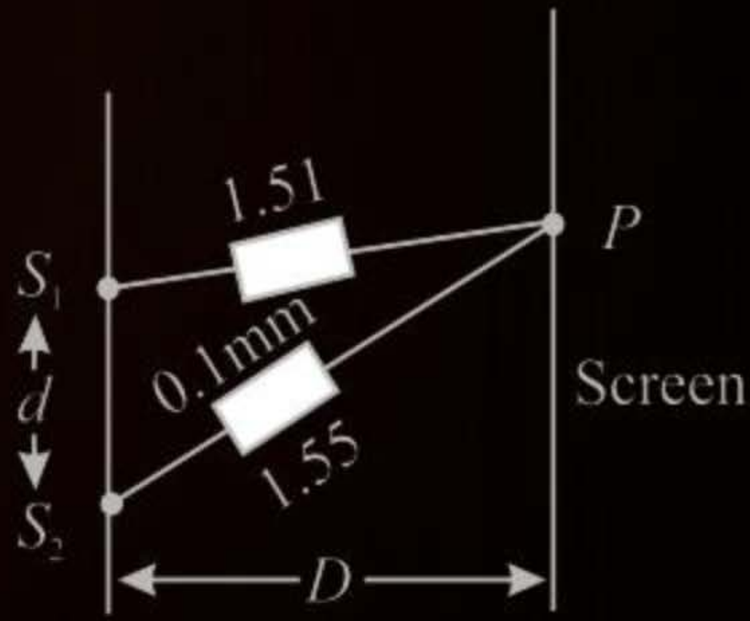
In Young's double slit experiment, two slits S_1 and S_2 are 'd' distance apart and the separation from slits to screen is D (as shown in figure). Now if two transparent slabs of equal thickness 0.1 mm but refractive index 1.51 and 1.55 are introduced in the path of beam ($\lambda = 4000\text{Å}$) from S_1 and S_2 respectively. The central bright fringe spot will shift by number of fringes.

[30 January 2023 - Shift 1]

$$\text{Ans} = \frac{\text{Shift}}{\beta} = \frac{\left((\mu_1 - 1)t_1 - (\mu_2 - 1)t_2\right)\frac{D}{d}}{\beta\lambda\frac{D}{d}}$$

$$= \frac{(\mu_1 - \mu_2)t}{\lambda} = \frac{.04 \times 1 \times 10^{-4}}{4000 \times 10^{-10}}$$

$$= 10$$



Ans : (10)

QUESTION

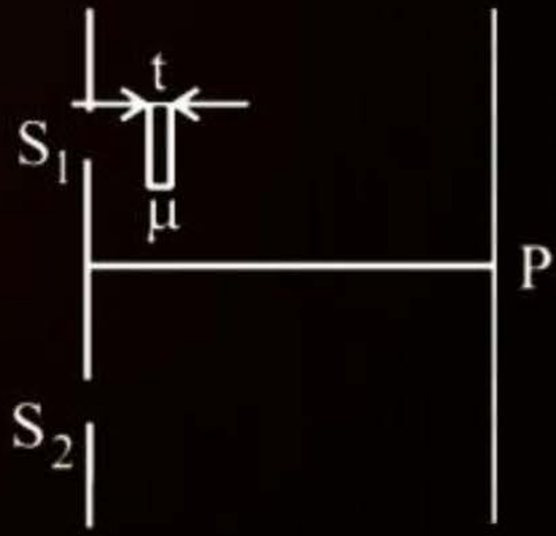
As shown in the figure, in Young's double slit experiment, a thin plate of thickness $t = 10\mu m$ and refractive index $\mu = 1.2$ is inserted infront of slit S_1. The experiment is conducted in air ($\mu = 1$) and uses a monochromatic light of wavelength $\lambda = 500$ nm. Due to the insertion of the plate, central maxima is shifted by a distance of $x\beta_0$. β_0 is the fringe-width before the insertion of the plate. The value of the x is _____.

[01 February 2023 - Shift 2]

$$(\mu-1)t\frac{D}{d} = x\beta$$

$$x\,\frac{\lambda D}{d} = \frac{2}{10}\times\frac{10\times10^{-6}}{500\times10^{-9}}\times\frac{\lambda D}{d}$$

$$= 4$$



Ans : (4)

QUESTION

Monochromatic light of wavelength 500 nm is used in Young's double slit experiment. An interference pattern is obtained on a screen. When one of the slits is covered with a very thin glass plate (refractive index $= 1.5$), the central maximum is shifted to a position previously occupied by the 4^{th} bright fringe. The thickness of the glass-plate is _____ μm.

[09 Apr. 2024 - Shift 2]

$$\text{shift} = 4\beta = 4\frac{\lambda D}{d} = (\mu-1)t\frac{D}{d}$$

$$t = \frac{4\lambda}{\mu-1} = \frac{4\times500\times10^{-9}}{0.5} = 4000\times10^{-9}$$

$$= 4\times10^{-6}$$

Ans. (4)