PHYSICS

BOOKS - AAKASH SERIES

WAVE OPTICS

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) LEVEL - I (MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS

1. Waves of same amplitude and same frequency from two coherent source overlap at a point. The ratio of the resultant intensity when they arrive in phase to that when they arrive with 90° phase difference is

A. $1:1$

B. $\sqrt{2}:1$

C. $2:1$

D. $4:1$

Answer: C

Watch Video Solution

2. To demonstrate the phenomenon of interference, we require two sources which emit radiation

A. two source which emit radiation of the same frequency

B. two source which emit radiation of nearly the same frequency

C. two sources which emit radiation of the same frequency and have a definite phase relationship

D. two sources which emit radiation of different wavelength

Answer: C

Watch Video Solution

3. In Young's double-slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. What is the intensity of lgight at a point where path difference is $\frac{\lambda}{3}$.

A. $\frac{K}{4}$

B. $\frac{K}{3}$

C. $\frac{K}{2}$

D. K

Answer: A

Watch Video Solution

4. If an interference pattern produced by two identical slits, the intensity of the central maximum is I. The intensity at the same spot when either of the two slits is closed is I_0. Then

A. I/2

B. I/4

C. 2I

D. I

Answer: B

Watch Video Solution

5. Two coherent sources are placed 0.9 mm apart and the fringes are observed one metre away. The wavelength of monochromatic light used if it produces the second dark fringes at a distance of 10 mm from the central finge will be

A. $6 \times 10^{-4} cm$

B. $6 \times 10^{-6} cm$

C. $6 \times 10^{-7} cm$

D. $1.2 \times 10^{-4} cm$

Answer: A

Watch Video Solution

6. The two coherent sources of equal intensity produce maximum intensity of 100 units at a point. If the intensity of one of the sources is reduced by 50% by reducing its width then the intensity of light at the same point will be

A. 90

B. 89

C. 67

D. 72.85

Answer: D

Watch Video Solution

7. The ratio of the intensities at minima to maxima in Young's double slit experiment is $9:25$. Find the ratio of the widths of the two slits.

A. $8:1$

B. $16 : 1$

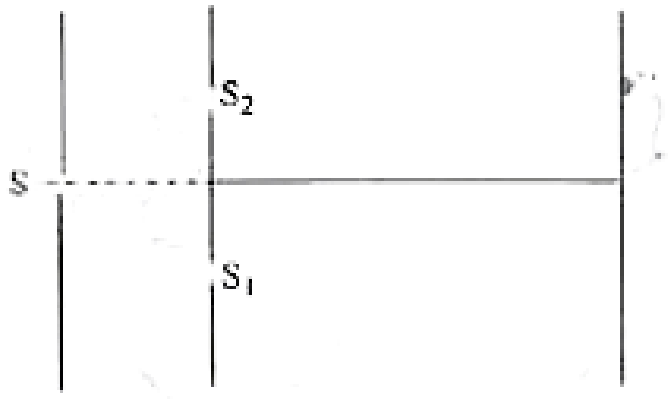
C. $4 : 1$

D. $9 : 1$

Answer: B

Watch Video Solution

8. If the width of the slit S in Young's double slit experiment is gradually increased



A. Bright fringes become brighter and dark fringes become darker

B. Bright fringes become less brighter, dark fringes become less dark

C. Bright fringes become brighter, dark fringes lighter

D. Bright fringes become less bright, dark fringes darker

Answer: B

Watch Video Solution

9. The distance between the tew slits in a Young's double slit experiment is d and the distance of the screen from the plane of the slits is b, P is a point on the screen directly infront of one of the slits. The path difference between the waves arriving at P from the two slits is

A. $\frac{d^2}{b}$

B. $\frac{d^2}{2b}$

C. $\frac{2d^2}{b}$

D. $\frac{d^2}{4b}$

Answer: B

Watch Video Solution

10. In young's double slit experiment the fringe width is 4mm. If the experiment is shifted to water of refractive index 4/3 the fringe width becomes (in mm)

A. 3

B. 4

C. 6

D. 8

Answer: A

Watch Video Solution

11. A double slit is illuminated by the light of wavelength 12000A .The slits are 0.1 cm apart and the screen is placed one metre away.calculate the angular posiyion of 10 maximum in radians ?

A. 6×10^{-3} rad

B. 6 rad

C. 0.006°

D. 6°

Answer: A

Watch Video Solution

12. In young's double slit experiment the n^{th} red bright band coincides with $(n+1)^{th}$ blue bright band. If the wavelength of red and blue lights are $7500A^{\circ}$ and $5000A^{\circ}$, the value of 'n' is

A. 1

B. 2

C. 5

D. 4

Answer: B

Watch Video Solution

13. In a Young's double slit experiment using monochromatic light, the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the slits and screen is doubled. It is found that the distance between successive maxima now is the same as observed fringe shift upon the introduced of the mica sheet . Calculate the wavelength of the monochromatic light used in the experiment .

A. $5762A^{\circ}$

B. $5825A^{\circ}$

C. $6000A^{\circ}$

D. $6500A^{\circ}$

Answer: C

Watch Video Solution

14. When a thin transparent plate of Refractive Index 1.5 is introduced in one of the interfearing becomes, 20 fringes shift. If it is replaced by another thin plate of half the thickness and of R.I 1.7 the number of fringes that undergo displacement is

A. 23

B. 14

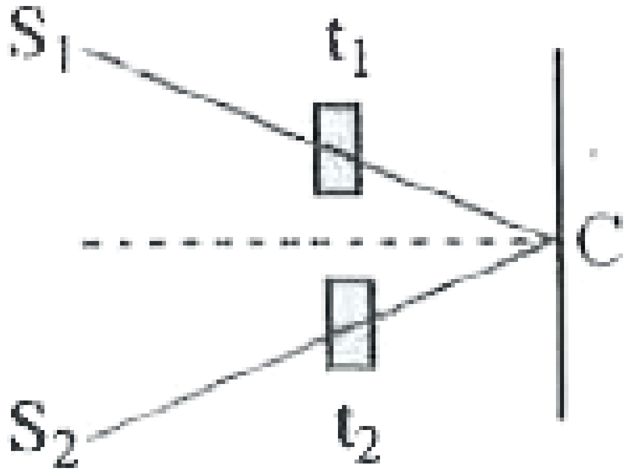
C. 28

D. 7

Answer: B

Watch Video Solution

15. In Young's double slit experiment S_1 and S_2 are two slits. Films of thickness t_1 and t_2 and refractive indices μ_1 and μ_2 are placed in front of S_1 and S_2 respectively. If $\mu_1 t_1 = \mu_2 t_2$, then the central maximum will :



A. Not shift

B. Shift towards S_2 irrespective of amounts of t_1 and t_2

C. Shift towards S_2 irrespective of amounts of t_1 and t_2

D. Shift towards S_1 if $t_2 > t_1$ and towards S_2 if $t_2 < t_1$.

Answer: D

Watch Video Solution

16. A transparent glass plate of thickness 0.5 mm and refractive index 1.5 is placed infront of one of the slits in a double slit experiment. If the wavelength of light used is $6000A^{\circ}$, the ratio of maximum to minimum intensity in the interference pattern is 25/4. Then the ratio of light intensity transmitted to incident on thin transparent glass plate is

A. $9:7$

B. $9:49$

C. $3:7$

D. $7:3$

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) Level - II (ADVANCED) (straight objective Type Questions)

1. White light is passed through a double slit and interference pattern is observed on a screen 2.5 m away. The separation between the slits is 0.5 mm. The first violet and red fringes are formed 2.0 mm and 3.5 mm away from the central white fringe. Calculate the wavelengths of the violet and the red light.

A. 400 nm, 650 nm

B. 400 nm, 700 nm

C. 350 nm, 200 nm

D. 200 nm, 350 nm

Answer: B

Watch Video Solution

2. A source emitting light of wavelengths 480 nm and 600 nm is used in a double slit interference experiment. The separation between the slits is 0.25 mm and the interference is observed on a screen placed at 150 cm from the slits. Find the linear separation between the first maximum (next to the central maximum) corresponding to the two wavelengths.

A. 0.36 mm

B. 0.18 mm

C. 0.72 mm

D. 0.98 mm

Answer: C

Watch Video Solution

3. A parallel beam of monochromatic light is used in a Young's double slit experiment. The slits are separated by a distance d and the screen is placed parallel to the plane of the slits. Show that if the incident beam makes an angle $\theta = \sin^{-1}\left(\frac{\lambda}{2d}\right)$ with the normal to the plane of the slits, there will be a dark fringe at the centre Po of the pattern.

A. 1/4the maximum intensity

B. half the maximum intensity

C. bright

D. dark

Answer: D

Watch Video Solution

4. In a YDSE, the central beight fringe can be indentified:

A. as it has greater intensity than the other bright fringes

B. as it wider than the other bright fringes

C. as it is narrower than the other bright fringes.

D. by using while light instead of single wave-length light.

Answer: D

Watch Video Solution

5. In Young's double slit experiment, the two slits acts as coherent sources of equal amplitude A and wavelength λ. In another experiment with the same set up the two slits are sources of equal amplitude A and wavelength λ but are indoherent. The ratio of the intensity of light at the mid point of the screen in the first case to that in the second case is

A. $1:1$

B. $2:1$

C. $4:1$

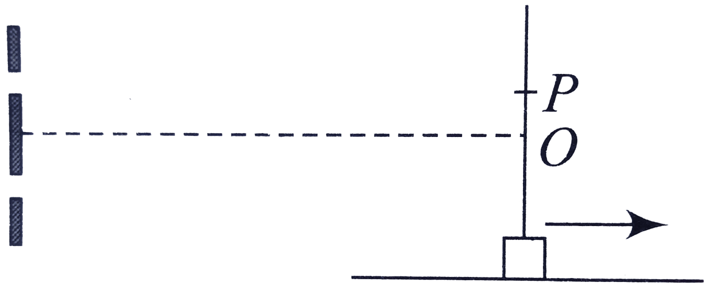
D. none of these

Answer: B

Watch Video Solution

6. In Young's double-slit experment, the frist maxima is observed at a fixed point P on the screen. Now, the screen is continously moved away from the plane of slits. The ratio of intensity at point P to the intensity at point O

(center of the screen)



A. remains constant

B. keeps on decreasing

C. first decreases and then increases

D. First decreases and then becomes constant

Answer: C

Watch Video Solution

7. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other Then in the interference pattern

A. the intensity of both the maxima and minima increase.

B. the intensity of the maxima decreases and the minima has zero intensity

C. the intensity of the maxima decreases and that of minima increases

D. the intensity of the maxima decreases and the minima has zero intensity

Answer: A

Watch Video Solution

8. In a YDSE , if the silts are of unequal widths,

A. fringes will not be formed

B. the positions of minimum intensity will not be completely dark

C. bright fringe will not be formed at the centre of the screen.

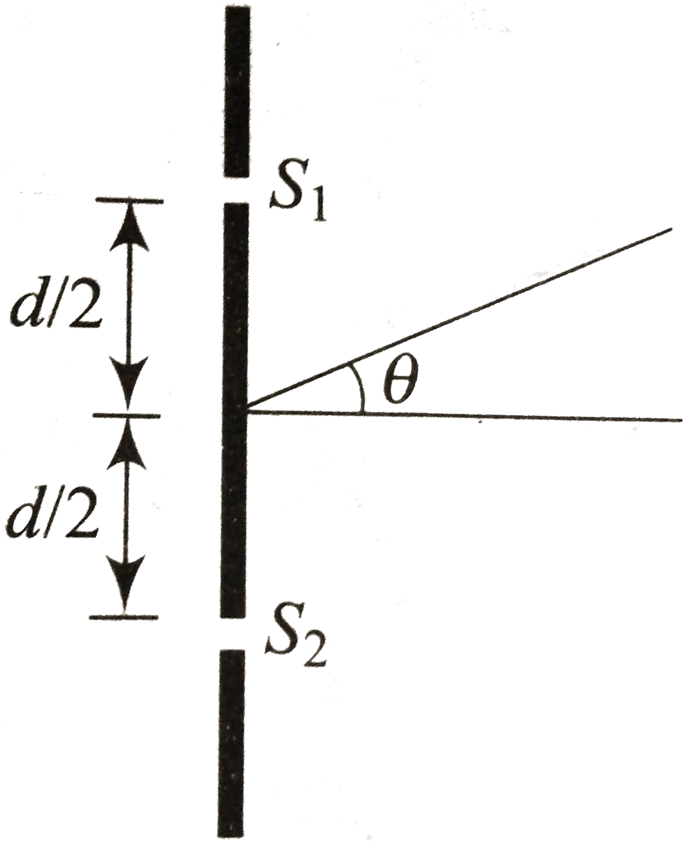
D. distance between two consecutive bright fringes will not be equal to the distance between two consecutive dark fringes.

Answer: B

Watch Video Solution

9. In an interference arrangement similar to Young's double-slit experiment, the slits S_1 and S_2 are illuminated with coherent microwave sources, each of frequency 10^6 Hz. The sources are synchronized to have zero phase difference. The slits are separated by a distance $d = 150.0m$. The intensity $I(\theta)$ is measured as a function of θ, where θ is defined asa shown in fig. If I_0 is hte maximum intensity, then $I(\theta)$ for

$0 \leq \theta \leq 90^\circ$ is given by ltbrrgt



A. $I(\theta) = I_0 / 2$ for $\theta = 30^\circ$

B. $I(\theta) = I_0 / 4$ for $\theta = 90^\circ$

C. $I(\theta) = I_0$ for $\theta = 0^\circ$

D. $I(\theta)$ is constant for all value of θ

Answer: C

Watch Video Solution

10. Let S_1 and S_2 be the two slits in Young's double-slit experiment. If central maxima is observed at P and angle $\angle S_1PS_2 = \theta$, then fringe width for the light of wavelength λ will be

A. λ / θ

B. $\lambda\theta$

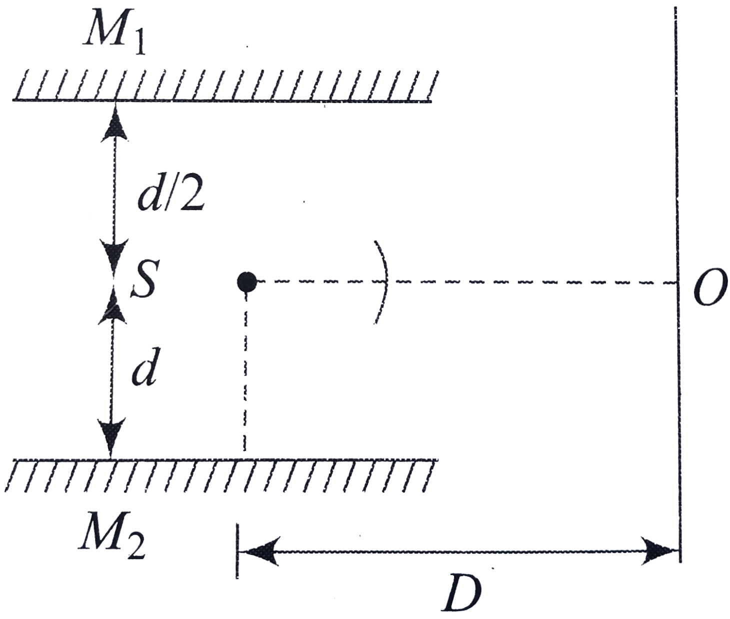
C. $2\lambda / \theta$

D. $\lambda / 2\theta$

Answer: A

Watch Video Solution

11. M_1 and M_2 are plane mirrors and kept parallel to each other. At point O, there will be a maxima for wavelength λ. Light from a monochromatic sources S of wavelength λ is not reaching directly on the screen. Then, λ is



A. $\dfrac{3d^2}{D}$

B. $\dfrac{3d^2}{2D}$

C. $\dfrac{d^2}{D}$

D. $\dfrac{2d^2}{D}$

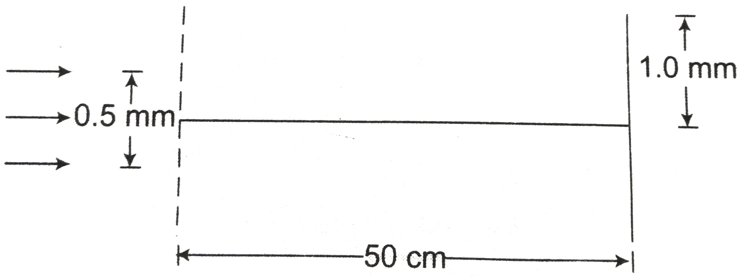
Answer: B

Watch Video Solution

12. White coherent light $(400nm - 700nm)$ is sent through the slits of a YDSE. $d = 0.5mm$, D=50 cm. There is a hole in the screen at a point $1.0mm$ away (along the width of the fringes) from the central line.

(a) Which wavelength will be absent in the light coming from the hole?

(b) Which wavelength(s) will have a strong intensity?



A. 400nm, 667 nm

B. 400 nm, 500 nm

C. 667 nm, 800 nm

D. 300 nm, 700 nm

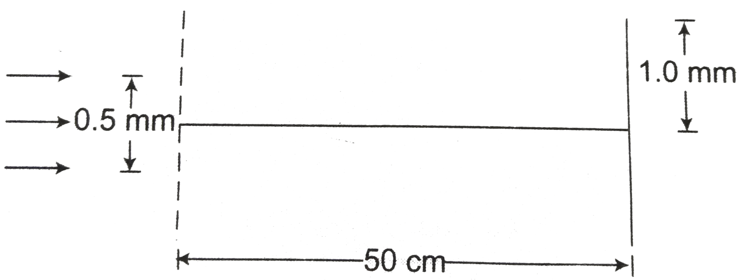
Answer: A

Watch Video Solution

13. White coherent light $(400nm - 700nm)$ is sent through the slits of a YDSE. $d = 0.5mm$, D=50 cm. There is a hole in the screen at a point $1.0mm$ away (along the width of the fringes) from the central line.

(a) Which wavelength will be absent in the light coming from the hole?

(b) Which wavelength(s) will have a strong intensity?



A. 400 nm

B. 500 nm

C. 600 nm

D. 700 nm

Answer: B

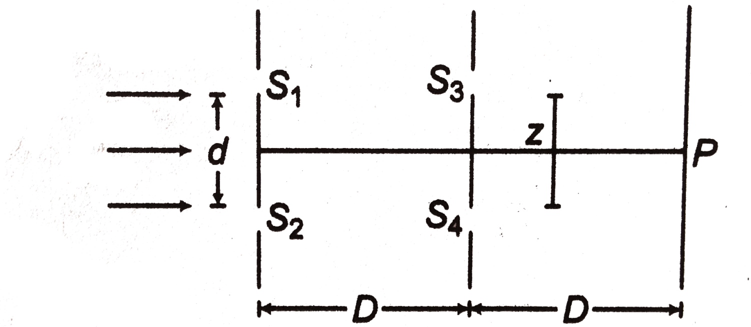
Watch Video Solution

14. Consider the arrangement shown in figure.

By some mechanism,

the separation between the slits S_3 and S_4

can be changed. The intensity is measured at the point P which is at the common perpendicular bisector of S_1S_2 and S_3S_4. When $z = \frac{D\lambda}{2d}$, the intensity measured at P is I. Find the intensity when z is equal to



$(a)\frac{D\lambda}{d}(b)\frac{3D\lambda}{2d}(c)\frac{2D\lambda}{d}$.

A. O, I, 2I

B. I, O, 2I

C. 2I, O, I

D. I, 2I, 3I

Answer: A

Watch Video Solution

15. Plane microwaves from a transmitter are directed normally towards a plane reflector. A detector moves along the normal to the reflection. Between positions of 14 successive maxima, the detector travels a distance 0.14m. If the velocity of light is $3 \times 10^8 m / s$, find the frequency of the transmitter.

A. $1.5 \times 10^{10} Hz$

B. $10^{10} Hz$

C. $3 \times 10^{10} Hz$

D. $6 \times 10^{10} Hz$

Answer: A

Watch Video Solution

16. Consider the situation shown in figure. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by a monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted by the slits falls on a screen Σ_1 placed at a distance D from the slits. The slit S_3 is at the placed central line and the slit S_4, is at a distance z from S_3. Another screenΣ_2 is placed a further distance D away from 1,1. Find the ratio of the maximum to minimum intensity observed on Σ_2 if z is equal to a. $z = \dfrac{\lambda D}{2d}$ b.

$\frac{\lambda D}{d}$ C. $\frac{\lambda D}{4d}$

A. $2, 25, \infty$

B. $1, \infty, 34$

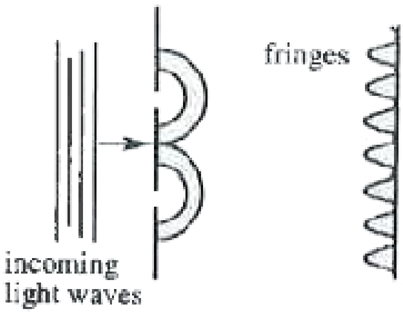
C. $1, \infty, 30$

D. $10, \infty, 20$

Answer: B

Watch Video Solution

17. 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

Answer: B

Watch Video Solution

18. A plate of thickness t made of a material of refractive index μ is placed in front of one of the slits in a double slit experiment. (a) Find the changes in he optical path due to introduction of the plate. (b) Wht should be the minimum thickness t which will make the intensity at the centre of the fringe pattern zero ? Wavelength of the light used is λ. Neglect any absorption of light in the plate.

A. $(\mu - 1)t, \dfrac{\lambda}{2(\mu - 1)}$

B. $2(\mu - 1)t, \dfrac{\lambda}{\mu - 1}$

C. $(\mu - 1)t, \dfrac{\lambda}{\mu - 1}$

D. $(\mu - 1)\dfrac{t}{2}, \dfrac{\lambda}{\mu - 1}$

Answer: A

Watch Video Solution

19. A mica strip and a polysterence strip are fitted on the two slite of a double slit apparatus. The thickness of the strips is 0.50 mm and the separation between the slits is 0.12 cm. The refractive index of mica and polysterene are 1.58 and 1.55 respectively for the light of wavelength 590 nm which is used in the experiment. The interference is observed on a screen a distance one meter away. (a) What would be the fringe- width ? (b) At what distance from the centre will the first maximum be located ?

A. $2.45 \times 10^{-4} m$

B. $4.9 \times 10^{-4} m$

C. $9.8 \times 10^{-4} m$

D. $10^{-3} m$

Answer: B

Watch Video Solution

20. A mica strip and a polysterence strip are fitted on the two slite of a double slit apparatus. The thickness of the strips is 0.50 mm and the separation between the slits is 0.12 cm. The refractive index of mica and polysterene are 1.58 and 1.55 respectively for the light of wavelength 590 nm which is used in the experiment. The interference is observed on a screen a distance one meter away. (a) What would be the fringe- width ? (b) At what distance from the centre will the first maximum be located ?

A. 0.021 cm on the one side and 0.028 cm on the other side

B. 0.042 cm on the side and 0.048 cm on the other side

C. 0.042 cm on the one side and 0.028 cm on the other side

D. 0.021 cm on one side and 0.048 cm on the other side

Answer: A

Watch Video Solution

21. YDSE is carried out in a liquid of refractive index $\mu = 1.3$ and a thin film of air is formed in front of the lower slit as shown in the figure. If a maxima of third order is formed at the origin O, find the thickness of the air film. Find the positions of the fourth maxima. The wavelength of light is air is $\lambda_0 = 0.78 \mu m$ and $D/d = 1000.$

(##DCP_V05_C32_E01_086_Q01.png"

width="80%">

A. $7.8 \mu m$

B. $3.9\mu m$

C. $15.6\mu m$

D. $0.5\mu m$

Answer: A

Watch Video Solution

22. In the above problem the displacement after 2 s is:

A. $+3.6mm, \ -2.4mm$

B. $+4.2mm, \ -0.6mm$

C. $+6mm, \ -2mm$

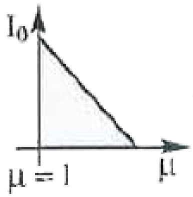
D. $+3mm, \ -6mm$

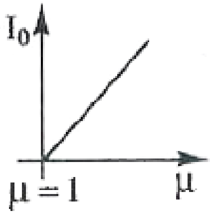
Answer: B

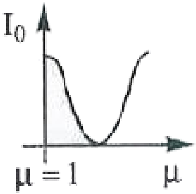
Watch Video Solution

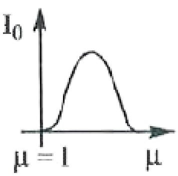
23. In a YDSE experiment if a slab whose refractive index can be varied is placed in front of one of the slits, then the variation of resultant intensity at mid-point of screen with

μ will be best represented by $(\mu \geq 1)$. [Assume slits of equal width and there is no absorption by slab]

A. 

B. 

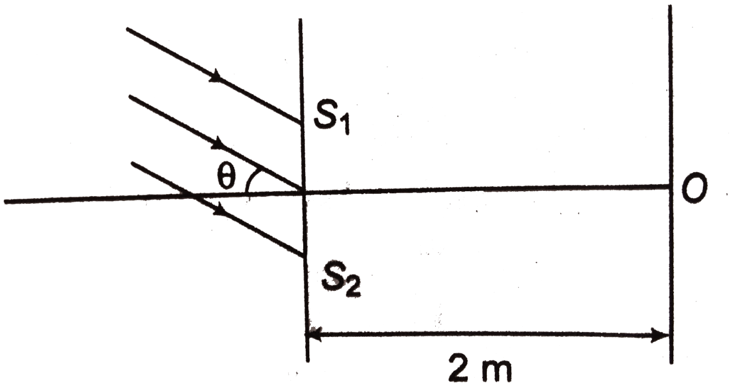
C. 

D. 

Answer: C

Watch Video Solution

24. A parallel beam of light $(\lambda = 5000\text{Å})$ is incident at an angle $\theta = 30^\circ$ with the normal to the slit plane in a Young's double slit experiment. The intensity due to each slit is I_0. Point O is equidistant from S_1 and S_2. The distance between slits is 1mm.



A. the intensity at O is 4Io

B. the intensity at O is zero.

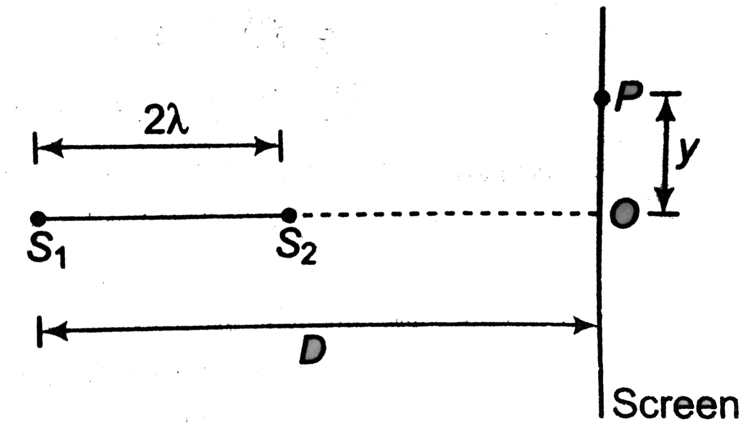
C. the intensity at a point on the screen 4mm from O is 4Io

D. the intensity at a point on the screen 4mm from O is zero.

Answer: A

Watch Video Solution

25. Two coherent narrow slits emitting sound of wavelength λ in the same phase are placed parallel to each other at a small separation of 2λ . The sound is delected by maving a delector on the screen at a distance $D(> > \lambda)$ from the slit S_1 as shows in figure. Find the distance y such that the intensity at P is equal to intensity at O .



A. $\frac{D}{\sqrt{3}}$

B. $\sqrt{3} D$

C. $\frac{\sqrt{3}}{2} D$

D. $\frac{D}{2}$

Answer: B

Watch Video Solution

26. Two coherent radio point sources that are separated by 2.0 m are radiating in phase with a wavelength of 0.25m. If a detector moves in a large circle around their mid-point. At how many points will the detector show a maximum signal?

A. 10

B. 16

C. 8

D. 32

Answer: D

Watch Video Solution

27. Four monochromatic and coherent sources of light, emitting waves in phase of wavelength λ, are placed at the points x = 0, d 2d and 3d on the x-axis. Then

A. point having $|x| > > d$ appear dark if $d = \lambda/4$

B. point having $|x| > > d$ appear dark if $d = \lambda/8$

C. point having $|x| > > d$ appear maximum bright dark if $d = \lambda/4$

D. point having $|x| > > d$ appear maximum bright dark if $d = \lambda/8$

Answer: A

Watch Video Solution

28. Four monochromatic and coherent sources of light emitting waves in phase at placed on y axis at y = 0, a, 2a and 3a. If the intensity of wave reaching at point P far away on y axis from each of the source is almost the same and equal to I_0, then the resultant intensity at P for $a = \frac{\lambda}{8}$ is nI_0. The value of $[n]$ is.

Here [] is greatest integer funciton.

A. If $d = \lambda / 4$, the intensity at P is $4I_0$

B. If $d = \lambda / 6$, the intensity at P is $3I_0$

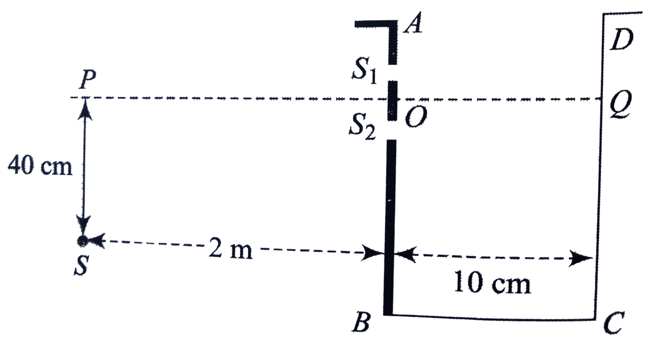
C. If $d = \lambda / 2$, the intensity at P is$3I_0$

D. none of these is true.

Answer: B

Watch Video Solution

29. A vessel ABCD of 10 cm width has two small slits S_1 and S_2 sealed with identical glass plates of equal thickness. The distance between the slits is 0.8 mm. POQ is the line peropendicular to the plane AB and passing through O, the middle point of S_1 and S_2. A monochromatic light source is kept at S, 40 cm below P and 2 m form the vessel to illuminate the slits as shown in figure .Calculate the position of the central bright fringe on the other wall CD with respect to line OQ. Now , a liquid is poured into the vessel and filled up to OQ. The central bright fringe is found to be at Q. Calculate the refractive index of the liquid to the liquid.



A. 4 cm

B. 6 cm

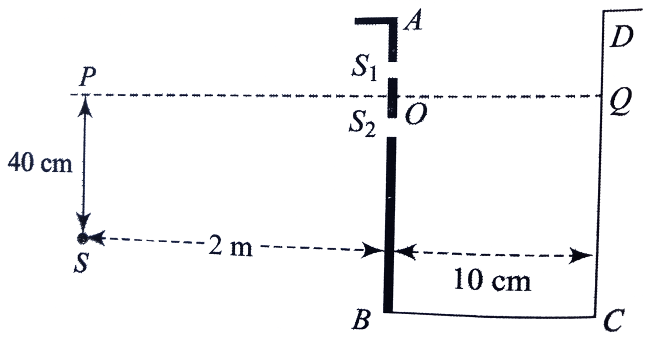
C. 5 cm

D. 2 cm

Answer: D

Watch Video Solution

30. A vessel ABCD of 10 cm width has two small slits S_1 and S_2 sealed with identical glass plates of equal thickness. The distance between the slits is 0.8 mm. POQ is the line peropendicular to the plane AB and passing through O, the middle point of S_1 and S_2. A monochromatic light source is kept at S, 40 cm below P and 2 m form the vessel to illuminate the slits as shown in figure .Calculate the position of the central bright fringe on the other wall CD with respect to line OQ. Now , a liquid is poured into the vessel and filled up to OQ. The central bright fringe is found to be at Q. Calculate the refractive index of the liquid to the liquid.



A. 1.0016

B. 1.016

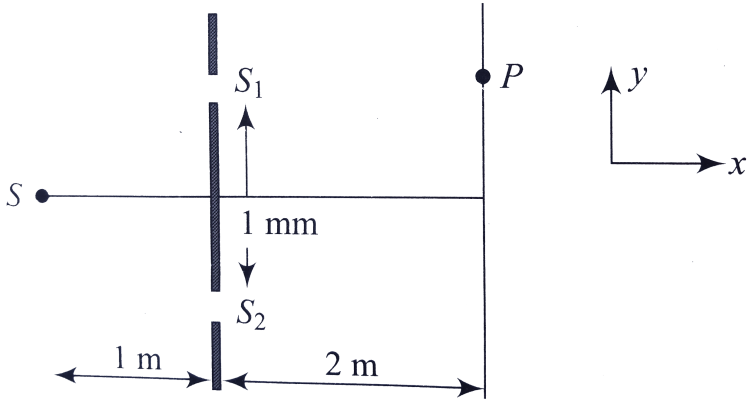
C. 1.16

D. 1.6

Answer: A

Watch Video Solution

31. In young's double-slit experiment set up, sources S of wavelength 50 nm illumiantes two slits S_1 and S_2 which act as two coherent sources. The sources S oscillates about its own position according to the equation $y = 0.5 \sin \pi t$, where y is in nm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exaclty in front of the upper slit becomes minimum is



A. 1s

B. 2s

C. 3s

D. $1.5s$

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) Level - II (ADVANCED) More than one correct answer type questions

1. If the source of light used in a Young's Double Slit experiment is changed from red to blue, then

A. the fringes will become brighter

B. consecutive fringes will come closer

C. the number of maxima formed on the screen increases

D. the central bright fringe will become a dark fringe.

Answer: B::C

Watch Video Solution

2. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance $d(> > b)$ from the slits At a point on the screen directly in front of one of the slits, certain wavelengths are missing some of these missing wavelengths are

A. $\frac{d^2}{D}$

B. $\frac{2d^2}{D}$

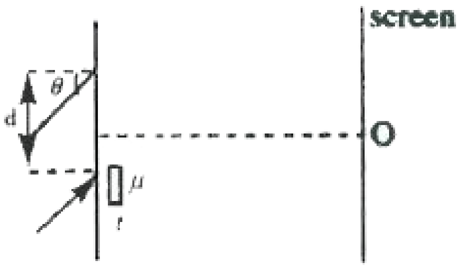
C. $\frac{d^2}{3D}$

D. $\frac{2d^2}{3D}$

Answer: A::C

Watch Video Solution

3. A monochromatic beam of light falls on YDSE apparatus at some angle (θ) as shown, a thin sheet of glas (R.I. = μ, thickness = t) is insdted in front of the lower slit S_2. Select the correct alternative.



A. Central maxima will be at O always

B. If $(\mu - 1)t = d\sin\theta$, central maxima will be at O

C. If $(\mu - 1)t > d \sin\theta$, central maxima will be below O

D. If $(\mu - 1)t = d \sin\theta + \lambda$, a maxima is formed at O

Answer: B::C::D

Watch Video Solution

4. Two monochromatic coherent point sources S_1 and S_2 are separated by a distance L. Each sources emits light of wavelength λ, where

$L > > \lambda$. The line S_1S_2 when extended meets a screen perpendicular to it at point A. Then

A. The interference fringes are circular in shape

B. Interference fringes are straight lines perpendicular to line S_2S_2A

C. On the point A intensity is maximum if $L = n\lambda$ (n is an integer)

D. Point A is always an intensity maximum for any separation L

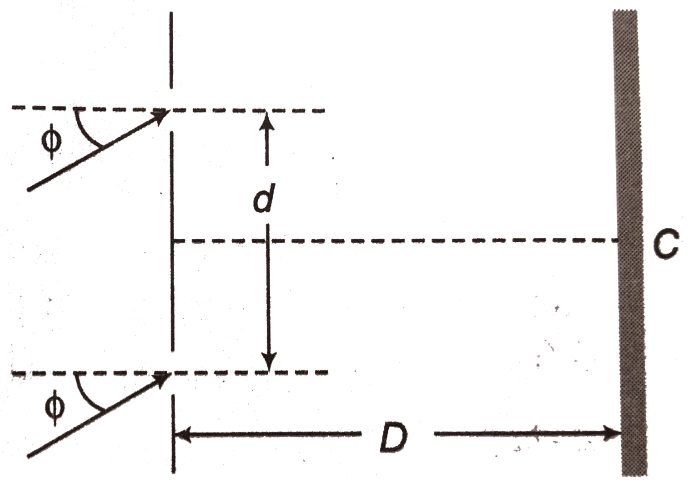
Answer: A::D

Watch Video Solution

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) Level - II (ADVANCED) Linked Comprehension type questions

1. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^{\circ}$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 30° above OB

B. 45° above OB

C. 45° above OB

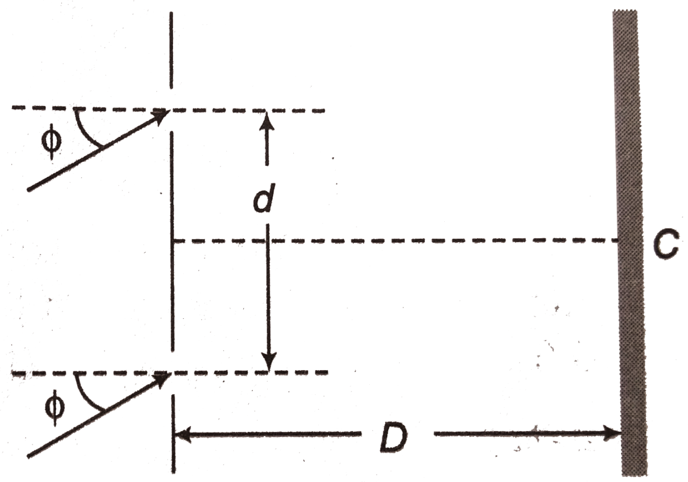
D. 30° below OB

Answer: D

Watch Video Solution

2. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^\circ$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 50th minima

B. 49th minima

C. 51st minima

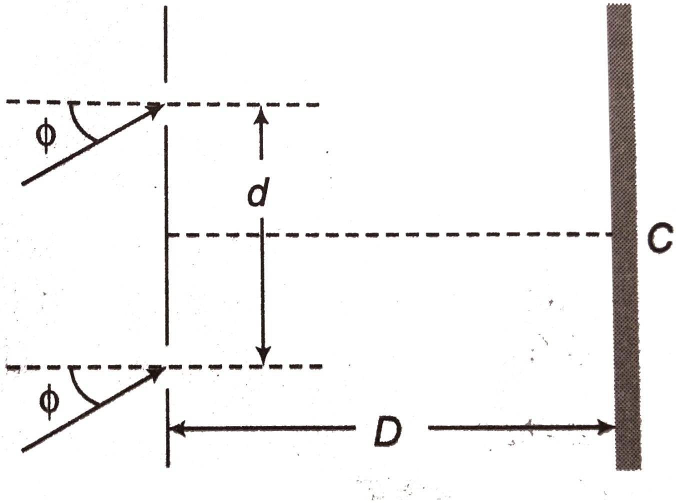
D. 1st minima

Answer: A

Watch Video Solution

3. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^\circ$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 50

B. 40

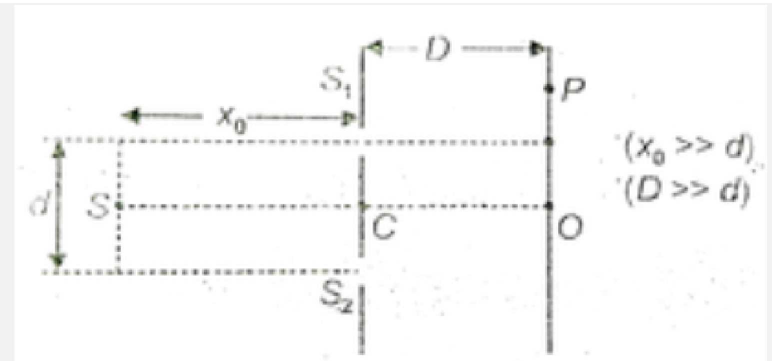
C. 100

D. 80

Answer: C

Watch Video Solution

4. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the resultant intensity at P is same as that O, then the distance OP can not be

A. $\frac{\lambda D}{d}$

B. $\frac{2\lambda D}{d}$

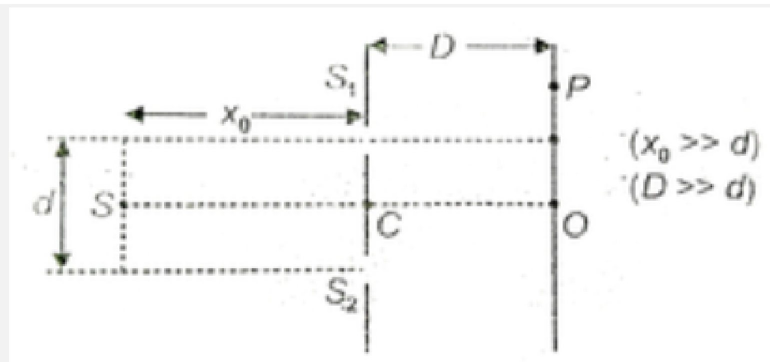
C. $\frac{3\lambda D}{d}$

D. $\frac{1.5\lambda D}{d}$

Answer: D

Watch Video Solution

5. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown.

interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the source is moved up by a very small distance y_0, the central maxima will shift

A. Up by $\frac{y_0 d}{x_0}$

B. Down by $\frac{y_0 d}{x_0}$

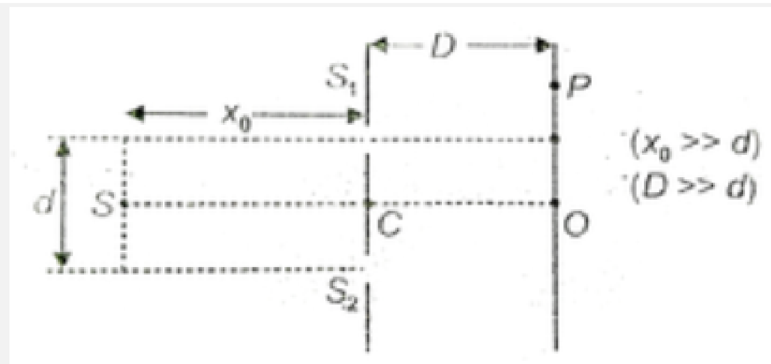
C. Up by $\frac{y_0 D}{x_0}$

D. Down by $\frac{y_0 D}{x_0}$

Answer: D

Watch Video Solution

6. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the size of slits S_1 is slightly decreased, then

A. Intensity at central maxima will remain same

B. Intensity at central maxima will increase

C. Intensity at first minima will slightly increase from zero

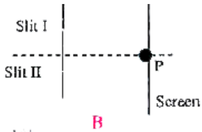
D. Intensity at first minima will remain zero

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) Level - II (ADVANCED) Matrix Match Type Questions

1. A double slit interference pattern is produced on a screen, as shown in the figure, using momochromatic light of wavelength 500 nm. Point P is the location of the central bright fringe, that is produced when light waves arrive in phase without any path difference. A choice of the three strips A, B and C of transparent materials with different thickness and refractive indices is available, as shown in the table. These are placed over one or both of the slits, singularly or in conjunction causing the interference pattern to be shifted across the screen from the original pattern. In the Column - I, how the strips have been placed, is mentioned whereas in the Column-II, order of the fringe at point P on the screen that will be produced due to the placement of the strip(s), is shown. Correctly match both the column.



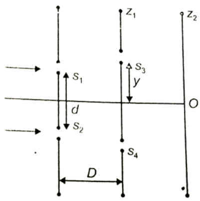
Film	A	B	C
Thickness (in μm)	5	1.5	0.25
Refractive Index	1.5	2.5	2

Column - I	Column - II
A) Only strip B is placed over slit -I	p) First Bright
B) Strip A is placed over slit-I and strip C is placed over slit-II.	q) Fourth Dark
C) Strip A is placed over the slit-I and strip B and strip C are placed over the slit-II	r) Fifth Dark
D) Strip A and strip C are placed over slit-I (in conjuction) and strip B is placed over slit-II	s) Central Bright

Watch Video Solution

2. In the arrangement shown in figure, z_1 and z_2 are two screens. Line PO is the bisector line of $s_1 s_2$ and $s_3 s_4$, s_1 is removed, resultant intensity at O due to slits s_1 and s_2 is I. now z_1

is placed. For different values of y given in column-I match the resultant intensity at O given in column -II.

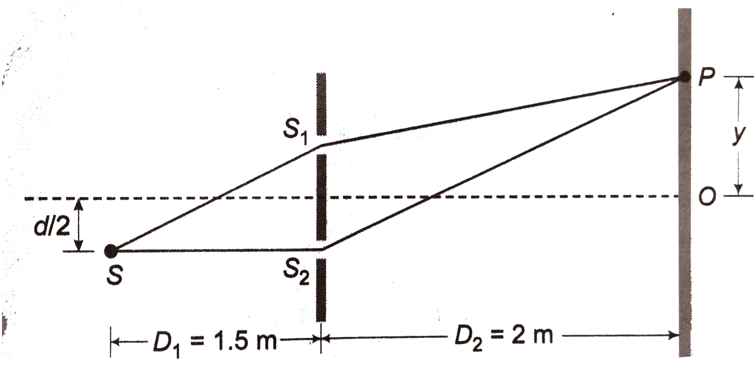


Column-I	Column-II
(A) $y = \frac{D\lambda}{2d}$	(p) $3I$
(B) $y = \frac{D\lambda}{6d}$	(q) Zero
(C) $y = \frac{D\lambda}{4d}$	(r) I
(D) $y = \frac{D\lambda}{3d}$	(s) None of these

Watch Video Solution

LECTURE SHEET (EXERCISE - I) (INTERFERENCE & YDSE) Level - II (ADVANCED) Level - II (straight objective Type Questions) Integer Type Questions

1. In the YDSE, the monochromatic source of wavelength λ is placed at a distance $\frac{d}{2}$ from the central axis (as shown in the figure), where d is the separation between the two slits S_1 and S_2 .



(a)Find the position of the central maxima.

(b) Find the order of interference formed at O.

(c)Now, S is placed on centre dotted line. Find the minimum thickness of the film of refractive indes $\mu = 1.5$ to be placed in front of S_2 so that intensity at O becomes $\frac{3}{4}$th of the maximum intensity.

(Take $\lambda = 6000 \text{Å}, d = 6mm.$)

Watch Video Solution

LECTURE SHEET Exercise - II DIFFRACTION (Level - I (Main) (Straight objective Type questions)

1. Ratio of intensities in consecutive maxima in a diffraction pattern due to a single slit is

A. $1:2:3$

B. $1:4:9$

C. $1:\frac{2}{\pi^2}:\frac{3}{\pi^2}$

D. $1:\frac{4}{9\pi^2}:\frac{4}{25\pi^2}$

Answer: D

Watch Video Solution

2. Assetion To observe diffraction of light the size of obstacle/aperture should be of the order of $10^{-7}m$

Reason $10^{-7}m$ is the order of wavelength of visible light

A. λ

B. $\lambda/2$

C. $\lambda/4$

D. 2λ

Answer: A

Watch Video Solution

3. The average path difference between two waves coming from third and fifth fresnel zones of a wave front at the centre of the screen is

A. $\frac{\lambda}{2}$

B. 2λ

C. λ

D. 4λ

Answer: C

Watch Video Solution

4. The main difference in the phenomenon of interference and diffraction is that

A. diffraction is due to interaction of light from the same wavefront whereas interference is the interaction of waves from wave isolated sources

B. diffraction is due to interaction of light from the same wavefront whereas interference is the interaction of two waves derived from the same source

C. diffraction is due to interaction of waves derived from the same source, whereas the interference is the bending of light from the same wavefront

D. diffraction is caused by reflected waves from a source whereas interference caused is due to refraction of waves from a surface

Answer: B

Watch Video Solution

5. With both light and sound show wave character, diffraction is much harder to observer in light. This is because

A. wavelength of light is smaller

B. waves of light are transverse

C. speed of light is far greater

D. light does not require any medium

Answer: A

Watch Video Solution

6. A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?

A. no change

B. diffraction bands become narrower and crowded together

C. bands become broader and father apart

D. bands disapear

Answer: B

Watch Video Solution

7. A slit 5cm wide is irradiated normally with microwaves of wavelength 1cm. Then the angular spread of the central maxima on either side of the incident light is nearly

A. $\frac{1}{5}$ radian

B. 5 radian

C. 4 radian

D. 6 radian

Answer: A

Watch Video Solution

8. A screen is at a distance of 2m from a narrow slit illuminated with light of 600nm. The first minimum lies 5mm on either side of the central maximum. The width of slit is

A. 0.024 mm

B. 0.24mm

C. 2.4 mm

D. 24mm

Answer: B

Watch Video Solution

9. The first diffraction minimum due to a single slit Fraunhoffer diffraction is at the angle of diffraction 30° for a light of wavelength $5460A^\circ$. The width of the slit is

A. $1.082 \times 10^{-4} cm$

B. $2.164 \times 10^{-4} cm$

C. $1.082 \times 10^{-3} cm$

D. $0.546 cm$

Answer: A

Watch Video Solution

10. Figure shows a wire ring of radius a that is perpendicular to the general direction of a radially sysmmetric, diverging magnetic field. The magnetic field at the ring is everywhere of the same magnitude B, and its direction at the ring everywhere makes an angle θ with a normal to the plane of the ring. thge twisted lead wires have no effect on the problem. Find the magnitude of the force the field exerts on the ring if the ring carries a current i.

A. $\dfrac{2a\sin\theta}{3}$

B. $\dfrac{3a\sin\theta}{2}$

C. $\dfrac{2a\sin\theta}{5}$

D. $\dfrac{2a\cos\theta}{3}$

Answer: C

Watch Video Solution

LECTURE SHEET Exercise - II DIFFRACTION (Level - I (Main) Level - II (Straight objective type questions)

1. In a Fraunhoffer diffraction experiment at a single slit using light of wavelength 400 nm, the first minimum is formed at an angle of 30° Then the direction θ of the first secondary maximum is

A. $\tan^{-1}\left(\frac{4}{3}\right)$

B. 60°

C. $\sin^{-1}\left(\frac{3}{4}\right)$

D. $\tan^{-1}\left(\frac{3}{4}\right)$

Answer: C

Watch Video Solution

2. Light of wavelength $5900 \times 10^{-10} m$ falls normally on a slit of width $11.8 \times 10^{-7} m$. The resulting diffraction pattern is received on a screen. The angular position of the first minimum is.

A. 30°

B. 60°

C. 45°

D. 90°

Answer: A

Watch Video Solution

3. Angular width of central maximum in the Fraunhofer diffraction pattern of a slit is measured. The slit is illuminated by light of wavelength 6000Å. When the slit is illuminated by light of another wavelength, the angular width decreases by $30\,\%$. Calculate the wavelength of this light. The same decrease in the angular width of central maximum is obtained when the original apparatus is immersed in a liquid. Find the refractive index of the liquid.

A. 30°

B. 60°

C. 45°

D. 90°

Answer: B

Watch Video Solution

4. A slit 5cm wide is irradiated normally with microwaves of wavelength 1cm. Then the angular spread of the central maxima on either side of the incident light is nearly

A. $2\sin^{-1}(2/5)$

B. $\sin^{-1}(2/5)$

C. $\cos^{-1}(4/5)$

D. $\cos^{-1}(2/5)$

Answer: A

Watch Video Solution

5. Light of wavelength $5000A^{\circ}$ is diffracted by a slit. In diffraction pattern fifth minimum is at a distance of 5 mm from central maximum. If the distance between the screen and the slit is 1m. The slit width is

A. 0.5 mm

B. 0.55mm

C. 0.25mm

D. 0.6 mm

Answer: A

Watch Video Solution

6. In a Fraunhoffer diffraction experiment at a single slit using light of wavelength 400 nm, the first minimum is formed at an angle of 30° Then the direction θ of the first secondary maximum is

A. $\sin^{-1}(3/2)$

B. $\sin^{-1}(3/4)$

C. $\cos^{-1}(3/4)$

D. $\cos^{-1}(3/2)$

Answer: B

Watch Video Solution

7. In a single slit diffraction experiment first minima for $\lambda_1 = 660 nm$ coincides with first maxima for wavelength λ_2. Calculate the value of λ_2.

A. 990 nm

B. 440 nm

C. 330 nm

D. 550 nm

Answer: B

Watch Video Solution

8. Plane microwaves are incident on a long slit having a width of 5.0 cm. Calculate the wavelength of the microwaves if the first diffraction minimum is formed at $\theta = 30^\circ$.

A. 2.5 cm

B. 5 cm

C. 1.25 cm

D. 7.5 cm

Answer: A

Watch Video Solution

LECTURE SHEET Exercise - III POLARLISATION(Level - I (Main) (Straight objective Type questions))

1. From brewster's law for polarisation, it follows that the angle polarisation depends upon

A. the wavelength of light

B. plane of polarisation's orientation

C. plane of vibrations orientations

D. None of above

Answer: A

Watch Video Solution

2. The refractive index of glass is 3/2. What is the polarising angle for glass

A. $56^{\circ} 18$

B. 60°

C. 30°

D. None

Answer: A

Watch Video Solution

3. The angle between polariser and analyser is 30°. The ratio of intensity of incident light and transmitted by the analyser is

A. $3:4$

B. $4:3$

C. $\sqrt{3}:2$

D. $2:\sqrt{3}$

Answer: B

Watch Video Solution

4. Two polarising plates have polarising directions parallel score to trasmit maxmum intensity of light through what angle most either plate be turned in the intensites of the transmitted beam is to drop by half?

A. 30°

B. 45°

C. 135°

D. Both (2) and (3) are correct

Answer: D

Watch Video Solution

5. (a) Show using a proper diagram how unpolarised light can be linearly polarised by reflection from a transparent glass surface.

(b) The figure shows a ray of light falling normally on. the face AB of an equilateral glass prism having refractive index 3/2, placed A in water of refractive index 4/3. Will this ray suffer total internal reflection on striking the face AC? Justify your answer.

A. reflected and refracted rays are mutually perpendicular

B. Both reflected and refracted rays are plane polarised

C. refracted ray is partially polarised

D. The R.I. of transparent surfaces is equal to tangent of Brewster's angle

Answer: B

Watch Video Solution

6. A ray of light passes from glass, having a refractive index of 1.6, to air. The angle of incidence for which the angle of refraction is twice the angle of incidence is

A. A and B are true

B. A and C are true

C. B and C are true

D. A, B and C are true

Answer: D

Watch Video Solution

7. The angle between polariser and analyser is 30°. The ratio of intensity of incident light and transmitted by the analyser is

A. C,D,A,B

B. C,A,D,B

C. B,C,A,D

D. C,A,B,D

Answer: D

Watch Video Solution

LECTURE SHEET Exercise - III POLARLISATION (Level-II (Straight objective Type questions))

1. Unpolarised light of intensity $32Wm^{-2}$ passes through three polarisers such that the transmission axis of the last polariser is crossed with first. If the intensity of the emerging light is $3Wm^{-2}$, the angle between the axes of the first two polarisers is

A. 45°

B. 60°

C. 30°

D. Zero

Answer: C

Watch Video Solution

2. The axes of the polariser and analyser are inclined to each other at 60°. If the amplitude of the polarised light emergent through analyser is A. The amplitude of unpolarised light incident on polariser is

A. $\frac{A}{2}$

B. A

C. 2A

D. $2\sqrt{2}A$

Answer: D

Watch Video Solution

3. An analyser is inclined to a polariser at an angle of 30°. The intensity of light emerging from the analyser is 1/nth of that is incident on the polariser. Then n is equal to

A. 4

B. $4/3$

C. $8/3$

D. $1/4$

Answer: C

Watch Video Solution

4. A beam of unpolarised light is incident on a tourmaline crystal C_1. The intensity of the emergent light is I_0 and it is incident on another tourmaline crystal C_2. It is found that no light emerges from C_2. If now C_1 is rotated through 45° towards C_2, the intensity of the light emerging from C_2 is

A. Zero

B. $\frac{I_0}{4}$

C. $\frac{I_0}{2}$

D. $\frac{3I_0}{4}$

Answer: C

Watch Video Solution

5. Two plane mirrors are inclined to each other at an angle 60° if a ray of light incident on first mirror parallel to the second mirror, it is reflected from the second mirror

A. $\frac{3I}{4}$

B. $\frac{I}{2}$

C. $\frac{I}{4}$

D. $\frac{3I}{8}$

Answer: D

Watch Video Solution

6. The polariser and analyser are inclined to each other at 60°. If I/2 is the intensity of the polarised light emergent from analyser. Then the intensity of the unpolarised light incident on the polariser is

A. 8I

B. 4I

C. 2I

D. I

Answer: B

Watch Video Solution

7. Estimate the distance for which ray optics is good approximation for an aperture of 4 mm and wavelength 400 nm ?

A. 0.01 m

B. 1600 m

C. 40 m

D. 100 m

Answer: C

Watch Video Solution

8. An astronomial telescope has a large aperture to

A. 6.71×10^{-7} radian

B. 3.35×10^{-7} radians

C. 6.71×10^{-5} radian

D. 3.35×10^{-5} radian

Answer: A

Watch Video Solution

Practice Sheet (Exercise - I) (INTERFERENCE & YDSE) (Level - 1 (Main) Straight Objective Type questions

1. The coordinates of a particle moving in a plane are given by x (t) = a cos (pt) and y (t) = b sin (pt), where a, b ($<$ a), and p are positive constants of appropriate dimensions. Then:

A. 5 cm

B. 7 cm

C. 1 cm

D. zero

Answer: A

Watch Video Solution

2. In the case of interference, the maximum and minimum intensities are in the ratio 16 : 9. Then

A. The maximum and minimum amplitudes will be in the ratio 9 : 5

B. The intensities of the individual waves will be in the ratio 4 : 3

C. The amplitudes of the individual waves will be in the ratio 7 : 1

D. none of the above is true

Answer: C

Watch Video Solution

3. Four light sources produce the following four waves :

i. $y_1 = a' \sin(\omega t + \phi_1)$

ii. $y_2 = a' \sin(2\omega t)$

iii. $y^3 = a' \sin(\omega t + \phi_2)$

iv $y_4 = a' \sin(3\omega + \phi)$

Superposition of which two waves give rise to interfernce ?

A. (i) and (ii)

B. (ii) and (iii)

C. (i) and (iii)

D. (iii) and (iv)

Answer: C

Watch Video Solution

4. A screen is at a distance of 2m that are narrow slit illuminated with light of $6000A^{\circ}$. The first maximum lies at 0.005mm on either side of the central maximum, then the distance between the slits will be

A. 0.024 mm

B. 0.24 mm

C. 2.4 mm

D. 24 mm

Answer: B

Watch Video Solution

5. In Young's double slit experiment with a mono - chromatic light of wavelength $4000 A^{\circ}$, the fringe width is found to be 0.4 mm. When the slits are now illuminated with a light of wavelength $5000 A^{\circ}$ the fringe width will the

A. 0.32 mm

B. 0.5 mm

C. 0.6 mm

D. 0.8 mm

Answer: B

Watch Video Solution

6. The intensity of central fringe in the interference pattern produced by two indetical slits is I. When one of the slits is closed then the intensity at the same points is I_0. The relation between I and I_0 is

A. $I = 4I_0$

B. $I = 2I_0$

C. $I = I_0$

D. $I = \frac{I_0}{2}$

Answer: A

Watch Video Solution

7. In Young's double slit experiment, the 10^{th} maximum of wavelength λ_1 is at a distance y_1 from its central maximum and the 5^{th} maximum of wavelength λ_2 is at a distance y_2 from its central maximum. The ratio y_1 / y_2 will be

A. $\frac{2\lambda_1}{\lambda_2}$

B. $\frac{2\lambda_2}{\lambda_1}$

C. $\frac{\lambda_1}{2\lambda_2}$

D. $\frac{\lambda_2}{2\lambda_1}$

Answer: A

Watch Video Solution

8. In Young's double - slit experiment, the intensities at two points P_1 and P_2 on the screen are I_1 and I_2 respectively. If P_1 is located at the central bright fringe and P_2 is located at a distance equal to quarter of fringe width from P_1, then $\frac{I_1}{I_2}$ is

A. 2

B. $1/2$

C. 4

D. 16

Answer: A

Watch Video Solution

9. A mixture of light, consisting of wavelength 590 nm and an unknown wavelength, illuminates Young's double slit and gives rise to two overlapping interference patterns on the screen. The central maximum of both lights coincide. Further, it is observed that the third bright fringe of known light coincides with the 4^{th} bright fringe of the unknown light. From this data, the wavelength of the unknown light is

A. 885.0 nm

B. 442.5 nm

C. 776.8 nm

D. 393.4 nm

Answer: B

Watch Video Solution

10. The maximum numbers of possible interference maxima for slit separation equal to twice the wavelength in Young's double slit experiment is

A. infinite

B. five

C. three

D. zero

Answer: C

Watch Video Solution

11. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 mm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will:

A. remain unshifted

B. shift downward by nearly two fringes

C. shift upward by nearly two fringes

D. shift downward by 10 fringes

Answer: C

Watch Video Solution

Practice Sheet (Exercise - I) (INTERFERENCE & YDSE) (Level - II (Advanced) Straight Objective Type questions

1. A beam of light consisting of two wavelength, $6500 A^{\circ}$ and $5200 A^{\circ}$ is used to obtain interference fringes in a Young's double slit experiment $(1\text{Å} = 10^{-10} m)$. The distance between the slits 2.0 mm and the distance between the plane of the slits and the screen is 120 cm. Find the distance of the third bright fringe on the screen from the central maximum for the wavelength 6500Å.

A. 0.117 cm

B. 0.28 cm

C. 0.05 cm

D. 0.3 cm

Answer: A

Watch Video Solution

2. A beam of light consisting of two wavelengths, 650 nm and 520 nm is used to obtain interference fringes in a Young's double-slit experiment. What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide?

A. 0.32 cm

B. 0.48 cm

C. 0.16 cm

D. 0.08 cm

Answer: C

Watch Video Solution

3. Find the angular separation between the consecutive bright fringes in a Young's double slit experiment with blue-green light of wavelength 500 nm. The separation between the slits is 2.0×10^{-3} m.

A. 0.14°

B. 0.014°

C. 0.28°

D. 0.028°

Answer: B

Watch Video Solution

Watch Video Solution

4. Find the thickness of a plate which will produce a change in optical path equal to half the wavelength λ of the light passing through it normally. The refractive index of the plate is μ

.

A. $\frac{\lambda}{4(\mu - 1)}$

B. $\frac{2\lambda}{\mu - 1}$

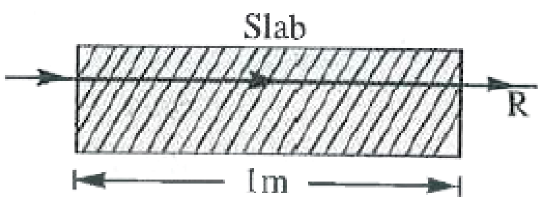
C. $\frac{\lambda}{\mu - 1}$

D. $\frac{\lambda}{2(\mu - 1)}$

Answer: D

Watch Video Solution

5. The figure shows a transparent slab of length m placed in air whose refractive index in x direction varies as $\mu = 1 + x^2 (0 < x < 1)$. The optical path length of ray R will be



A. 1m

B. $\frac{2}{3}m$

C. $\frac{4}{3}m$

D. $\sqrt{2}m$

Answer: C

Watch Video Solution

6. Two light waves having the same wavelengths λ in vacuum are in phase initially . Then the first wave travels a path L_1 through a medium of refractive index n_1 while the second wave travels a path of length L_2 through a medium of refractive index n_2 . After this the phase difference between the two waves is :

A. $\frac{2\pi}{\lambda}(L_1 - L_2)$

B. $\frac{2\pi}{\lambda}(\mu_1 L_1 - \mu_2 L_2)$

C. $\frac{2\pi}{\lambda}(\mu_2 L_1 - \mu_1 L_2)$

D. $\frac{2\pi}{\lambda}\left[\frac{Li}{\mu_1} - \frac{L_2}{\mu_2}\right]$

Answer: C

Watch Video Solution

7. Two transparent slabs having equal thickness but different refractive indices μ_1 and μ_2, are pasted side by side to form a composite slab. This slab is placed just after the double slit in a Young's experiment so that the light from one slit goes through one material and the light from the other slit goes through the other material. What should be the minimum thickness of the slab so that there is a minimum at the point P_0 which is equidistant from the slits ?

A. $\dfrac{2\lambda}{\mu_1 - \mu_2}$

B. $\frac{\lambda}{4(\mu_1 \sim \mu_2)}$

C. $\frac{\lambda}{\mu_1 \sim \mu_2}$

D. $\frac{\lambda}{2(\mu_1 \sim \mu_2)}$

Answer: D

Watch Video Solution

8. Young's double slit experiment is carried out using microwaves of wavelength $\lambda = 3cm$. Distance between the slits is $d = 5cm$ and the distance between the plane of slits and the screen is $D = 100 cm$.

(a) Find total number of maxima and

(b) their positions on the screen.

A. 0 , +25 cm, -25 cm

B. 0 , 25 cm, 75 cm

C. 0 , +75 cm, -75 cm

D. 0, 25 cm, 50 cm

Answer: C

Watch Video Solution

9. Light of wavelength λ_0 in air enters a medium of refractive index n. If two points A and B in this medium lie along the path of this light at a distance x, then phase difference ϕ_0 between these two points is:

A. $\phi_0 = \frac{1}{n}\left(\frac{2\pi}{\lambda_0}\right)x$

B. $\phi_0 = n\left(\frac{2\pi}{\lambda_0}\right)x$

C. $\phi_0 = (n-1)\left(\frac{2\pi}{\lambda_0}\right)x$

D. $\phi_0 = \frac{1}{(n-1)}\left(\frac{2\pi}{\lambda_0}\right)x$

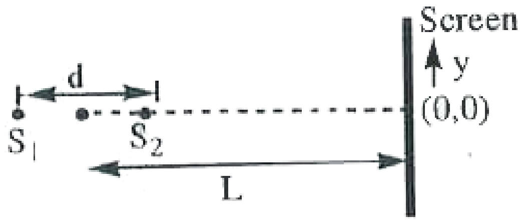
Answer: B

Watch Video Solution

Practice Sheet (Exercise - I) (INTERFERENCE & YDSE) (Level - II (Advanced) More than one correct answer type questions

1. The figure shows two points source which emit light of wavelength λ in phase with each other and are at a distance $d = 5.5\lambda$ apart along a line which is perpendicular to a large screen at a distance L from the centre of the source. Assume that d is much less than L.

Which of the following statement is (are) correct ?



A. only five bright fringes appear on the screen

B. only ten bright fringes appear on the screen

C. Point y = 0 corresponds to bright fringe

D. Point y = 0 corresponds to dark fringe.

Answer: B::D

Watch Video Solution

2. In Young's double-slit experiment, let A and B be the two slit. A thin film of thickness t and refractive index μ is placed in front of A. Let $\beta =$ fringe width. Then the central maxima will shift

A. towards A

B. towards B

C. by $t(\mu - 1)\frac{\beta}{\lambda}$

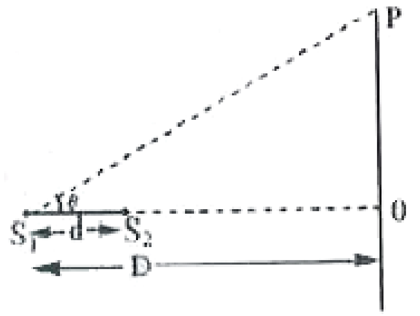
D. by $\mu t\frac{\beta}{\lambda}$

Answer: A::C

Watch Video Solution

Practice Sheet (Exercise - I) (INTERFERENCE & YDSE) (Level - II (Advanced) Linked Comprehension Type Questions

1. In the arrangement shown, a screen is placed normal to the line joining the two point coherent sources S_1 and S_2. The interference pattern consist of concentric circles. λ is the wavelength of light $(D > \ > d)$.



The phase difference of the interfering light at point P is

A. $\frac{2\pi}{\lambda} d \cos \theta$

B. $\frac{2\pi}{\lambda} d. \cos^3 \theta$

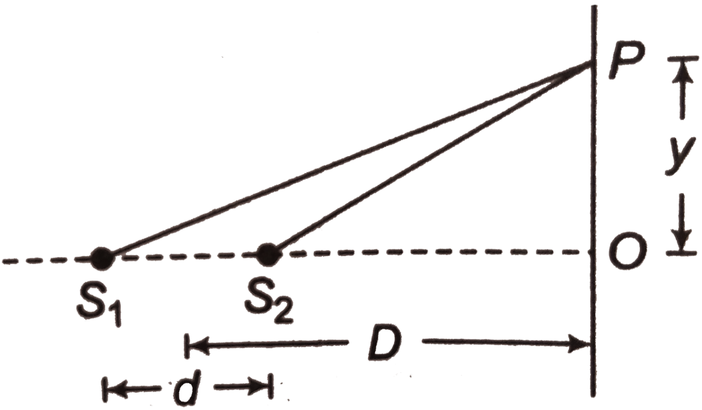
C. $\frac{2\pi}{\lambda} d \cos^2 \theta$

D. $\frac{2\pi}{\lambda}(d)$

Answer: A

Watch Video Solution

2. In the figure shown, a screen is placed normal to the line joining the two point coherent sources S_1 and S_2. The interference pattern consists of concentric circles.



(a)Find the radius of the nth bright ring.

(b) If d=0.5 mm, $\lambda = 5000 \text{Å}$ and D=100 cm, find the radius of the closest second bright ring.

(c) Also, find the value of n for this ring.

A. $\dfrac{n\lambda D}{d}$

B. $\left(1 - \dfrac{n\lambda D}{d}\right)$

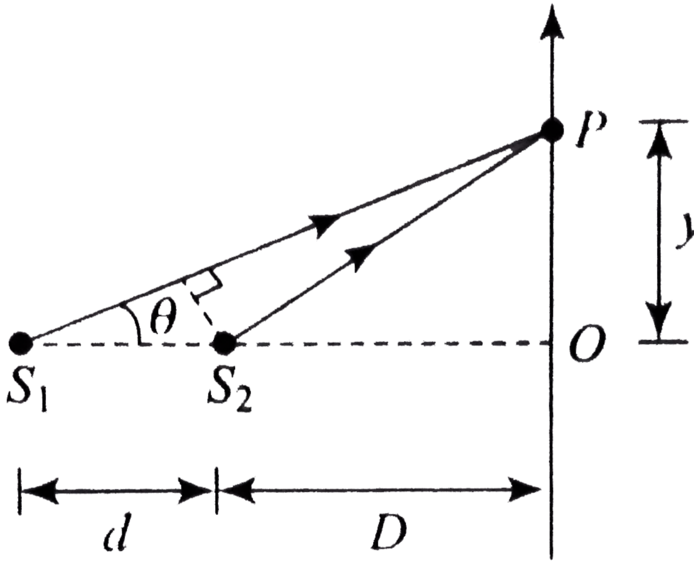
C. $D\sqrt{1 - \dfrac{n\lambda}{d}}$

D. $D\sqrt{2\left(1-\frac{n\lambda}{d}\right)}$

Answer: D

Watch Video Solution

3. In figure, a screen is placed normaol to the line joining the two point coherent sources S_1 and S_2. The interference pattern consists of concentric circles.



If $d = 0.5mm$, $\lambda = 5000\text{Å}$ and $D = 10cm$, find the value of n for the closest second bright ring.

A. 1000 th dark fringe

B. 1000th bright fringe

C. 998th dark fringe

D. 998th bright fringe

Answer: B

Watch Video Solution

Practice Sheet (Exercise - I) (INTERFERENCE & YDSE) (Level - II (Advanced) Matrix Matching Type Questions

1. Match the following

Column - I	Column - II
A) Spherical wave front	p) location of new wave front
B) plane wave front	q) line source
C) cylindrical wave front	r) point source at finite
D) Huygen's principle	s) point source at infinite distance

Watch Video Solution

2. In a double-slit experiment, fringes are produced using light of wavelength $4800A^{\circ}$. One slit is covered by a thin plate of glass of refractive index 1.4 and the other slit by another plate of glass of double thickness and of refractive index 1.7. On doing so, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the center. find the thickness of the glass plates.

Watch Video Solution

3. Two coherent monochromatic light sources are located at two vertices of an equilateral triangle if the intensity due to each of the sources independently is $1W/m^2$ at the third vertex, the resultant intensity due to both the sources at that point (i.e at the third vertex) is

Watch Video Solution

4. In a modified YDSE, monochromatic uniform and parallel beam of light of wavelength

$6000 A^{\circ}$ and intensity $\left(\frac{10}{\pi}\right) W / m^2$ is incident normally on two circular apertures A and B of radii 1 mm and 2 mm respectively. Find the ratio of the intensity of the sources $\left[\frac{I_B}{I_A}\right]$?

Watch Video Solution

Practice Sheet Exercise - II (DIFFRACTION) (Level - I (Main) (Straight objective Type questions)

1. Light of wavelength λ_0 in air enters a medium of refractive index n. If two points A and B in this medium lie along the path of this light at a distance x, then phase difference ϕ_0 between these two points is:

A. $\pi / 2$

B. $\pi / 8$

C. $\pi / 4$

D. Zero

Answer: A

Watch Video Solution

2. Both light and sound waves suffer diffraction. Why it is more difficult to observe diffraction with light waves?

A. Light wave do not require medium

B. Wavelength of light waves is far smaller

C. Light waves are transverse

D. Speed of light is far greater

Answer: B

Watch Video Solution

3. The crystal structure can be studied by using

A. diffraction of visible light

B. diffraction of x-rays

C. interference of sound waves

D. refraction of radio waves

Answer: B

Watch Video Solution

Practice Sheet Exercise - II (DIFFRACTION)(Level - II) (Straight objective Type questions)

1. In a single slit diffraction pattem

A. 0.2 mm

B. 0.4 mm

C. 0.1 mm

D. 0.02 mm

Answer: A

Watch Video Solution

Practice Sheet Exercise - III (POLARISATION) (Level - I (Main) (Straight objective Type questions)

1. The critical angle of a transparent crystal is 45°. Then its polarizing angle is

A. $\theta = \tan^{-1}(\sqrt{2})$

B. $\theta = \sin^{-1}(\sqrt{2})$

C. $\theta = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

D. $\theta = \cot^{-1}(\sqrt{2})$

Answer: A

Watch Video Solution

2. The phenomenon of polarisation of electromagnetic wave proves that the electromagnetic waves are

A. longitudinal

B. transverse

C. neither longitudinal nor transverse

D. both longitudinal and transverse

Answer: B

Watch Video Solution

3. Does the polarizing angle e, for a transparent medium depend upon the wavelength of light?

A. $\theta = \cot^{-1}(v/c)$

B. $\theta = \cos^{-1}(v/c)$

C. $\theta = \sin^{-1}(v/c)$

D. $\theta = \cos ec^{-1}(v/c)$

Answer: A

Watch Video Solution

4. The axes of the polariser and analyser are inclined to each other at 60°. If the amplitude of the polarised light emergent through analyser is A. The amplitude of unpolarised light incident on polariser is

A. $\frac{A}{2}$

B. $\frac{A}{\sqrt{2}}$

C. 2A

D. $\sqrt{2}A$

Answer: D

Watch Video Solution

5. The maximum intensities produced by two coherent waves of intensity I_1 and I_2 will be:

A. $1:3$

B. $3:1$

C. $\sqrt{3}:1$

D. $1:\sqrt{3}$

Answer: A

Watch Video Solution

Practice Sheet Exercise - III (POLARISATION) (Level - II) (Straight objective Type questions)

1. A ray of light in air is incident on a glass plate at polarising angle of incidence. It suffers a deviations of 22° on entering glass. The angle of polarisation is

A. 90°

B. 56°

C. 68°

D. zero

Answer: B

Watch Video Solution

2. The rays from the sun are considered to be

A. $16^{\circ}56'$

B. $26^{\circ}56'$

C. $36^{\circ}56'$

D. $46^{\circ}56'$

Answer: C

Watch Video Solution

3. An analyser is inclined to a polariser at an angle of 30°. The intensity of light emerging from the analyser is 1/nth of that is incident on the polariser. Then n is equal to

A. 4

B. $4/3$

C. $3/4$

D. $1/4$

Answer: B

Watch Video Solution

4. A beam of plane polarized light having flux 10^{-3} Watt falls normally on polarizer of cross sectional area $3 \times 10^{-4} m^2$. Polarizer rotates with angular frequency of 31.4 rad/s. Energy of light passes through the polarizer per revolution will be

A. 10^{-4} joule

B. 10^{-3} joule

C. 10^{-2} joule

D. 10^{-1} joule

Answer: A

Watch Video Solution

5. Two polaroids are kept crossed to each other . If one of them is rotated an angle 60° , the percentage of incident light now transmitted through the system is

A. $37.5\,\%$

B. $40\,\%$

C. $20\,\%$

D. $50\,\%$

Answer: A

Watch Video Solution

Additional Practice Exercise (Level - I) (Main)

Straight objective type questions

1. The phase difference between two waves reaching a point is $\frac{\pi}{2}$. What is the resultant amplitude. If the individual amplitude are 3 mm and 4mm ?

A. 1mm

B. 2mm

C. 3mm

D. 5mm

Answer: D

Watch Video Solution

2. Three coherent waves having amplitudes 12mm, 6mm and 4mm arrive at a given point with successive phase difference of $\frac{\pi}{2}$. Then, the amplitude of the resultant wave is

A. 7mm

B. 10 mm

C. 5 mm

D. 4.8 mm

Answer: B

Watch Video Solution

3. For constructive interference to take place between two monochromatic light waves of wavelength A, the path difference should be:

A. $\frac{(2n-1)\lambda}{4}$

B. $2n\lambda$

C. $\dfrac{(2n+1)\lambda}{4}$

D. $n\lambda$

Answer: C

Watch Video Solution

4. If the amplitude ratio of two sources producing interference is $3:5$ then the ratio of intensities at maxima and minima is

A. $25:16$

B. $5:3$

C. $16:1$

D. $25:9$

Answer: C

Watch Video Solution

5. Young's double slit experiment is made in a liquid. The tenth bright fringe in liquid lies in screen where 6th dark fringe lies in vacuum.

The refractive index of the liquid is approximately

A. 1.8

B. 1.54

C. 1.67

D. 1.2

Answer: A

Watch Video Solution

6. In Young's double slit experiment, the intensity of light at a point on the screen where path difference is λ is I. If intensity at another point is I/4, then possible path differences at this point are

A. $\frac{\lambda}{2}, \frac{\lambda}{3}$

B. $\frac{\lambda}{3}, \frac{\lambda}{3}$

C. $\frac{\lambda}{3}, \frac{\lambda}{4}$

D. $\frac{2\lambda}{3}, \frac{\lambda}{4}$

Answer: B

Watch Video Solution

7. In Young's double slit experiment the distance between slits is $2 \times 10^{-3} m$, the distance between screen and slits is 200 cm. When the light of wave length $5000 A^{\circ}$ is used, the central maximum is at x=0 . the third maximum will be at x equal to

A. 2cm

B. 0.05cm

C. 15cm

D. 0.5cm

Answer: D

Watch Video Solution

8. In Young's double slit experiment, when light of wavelength $4000A^{\circ}$ is used 90 fringes are seen on the screen. When light of 3000 A is used, the number of fringes seen is

A. 70

B. 120

C. 140

D. 68

Answer: B

Watch Video Solution

9. In Young`s double slit experiment, the phase different between two coherent sources of equal intensity is $\pi/3$.The intensity at a point which is at equal distance from the two slits is (I0 is maximum intensity)

A. $\frac{\sqrt{3}}{2}I_0$

B. $\frac{I_0}{\sqrt{2}}$

C. $\frac{1}{2}I_0$

D. $\frac{3}{4}I_0$

Answer: D

Watch Video Solution

10. 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

A. 2λ

B. λ

C. $\frac{2}{3}\lambda$

D. $\frac{\lambda}{3}$

Answer: A

Watch Video Solution

11. In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

A. 18

B. 12

C. 24

D. 30

Answer: A

Watch Video Solution

12. Young's double-slit experiment is carried ot by using green, redj and blue light, one color at a time. The fringe widths recorded are β_G, β_R and β_B, respectively. Then,

A. $\beta_G > \beta_B > \beta_R$

B. $\beta_B > \beta_G > \beta_R$

C. $\beta_R > \beta_B > \beta_G$

D. $\beta_R > \beta_G > \beta_B$

Answer: D

Watch Video Solution

13. It is belived that the Universe is expanding and hence the distant stars receding from us. Light form such a star will show

A. shift in frequency towards longer wavelength

B. shift in frequency towards shorter wavelength

C. No shift in frequency but a decrease in intensity

D. A shift in frequency sometimes towards longer and sometimes towards shorter wavelength

Answer: A

Watch Video Solution

14. The 6563 $\overset{o}{A}$ line emitted by hydrogen atom in a star is found to be red shifted by 5 $\overset{o}{A}$. The speed with which the star is receding from the earth is:

A. $17.3 \times 10^3 m/s$

B. $4.29 \times 10^7 m/s$

C. $3.39 \times 10^5 m/s$

D. $2.29 \times 10^5 m/s$

Answer: D

Watch Video Solution

15. In context of Doppler's effect in light, the term 'red shift' sighifies

A. Decreases in frequency

B. Increases in frequency

C. Decreasesin intensity

D. Increase in intensity

Answer: A

Watch Video Solution

16. Light enters in a glass slab of refractive index 3/2 and covers a distance 20 cm. The optical path of it is

A. 40 cm

B. 30 cm

C. 40/3 cm

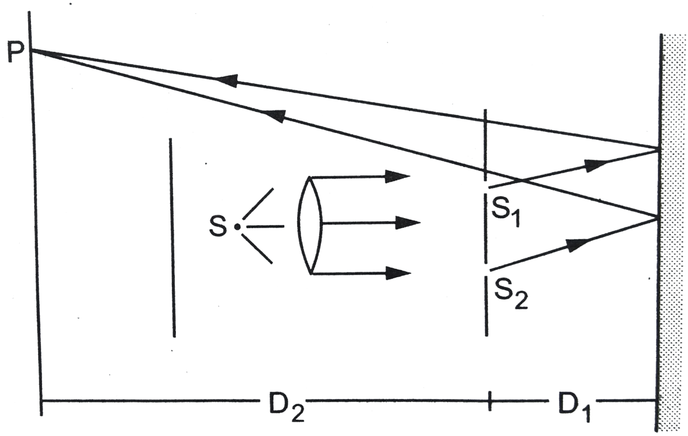
D. 60 cm

Answer: B

Watch Video Solution

Additional Practice Exercise Level - II (Lecture Sheet (Advanced) Straight objective Type Questions

1. A double slit $S_1 - S_2$ is illuminated by a coherent light of wavelength λ. The slits are separated by a distance d. A plane mirror is placed in front of the double slit at a distance D_1, from it and a screen $\sum$ is placed behind the double slit at a distance D_2, from it . The screen $\sum$ receives only the light reflected by the mirror. Find the fringe-width of the interference pattern on the screen.



A. $\dfrac{\lambda}{d}(D_1 + D_2)$

B. $\dfrac{2\lambda}{d}(D_1 + 2D_2)$

C. $\dfrac{\lambda}{d}(2D_1 + D_2)$

D. $\dfrac{\lambda}{2d}(D_1 + D_2)$

Answer: C

Watch Video Solution

2. Two coherent point sources S_1 and S_2, vibrating in phase emit light of wavelength X. The separation between the sources is 2λ. Consider a line passing through S_2 and perpendicular to the line S, What is the smallest distance from S_2 where a minimum of intensity occurs ?

A. $\frac{5\lambda}{2}$

B. $\frac{3\lambda}{2}$

C. $\frac{7\lambda}{12}$

D. $\frac{3\lambda}{4}$

Answer: C

Watch Video Solution

3. In a Young's double slit interference experiment the fringe pattern is observed on a screen placed at a distance D from the slits. The slits are separated by a distance d and are illuminated by monochromatic light of wavelength λ. Find the distance from the central point where the intensity falls to (a) half the maximum, (b) one fourth of the maximum.

A. $\frac{D\lambda}{4d}, \frac{D\lambda}{3d}$

B. $\frac{D\lambda}{d}, \frac{D\lambda}{2d}$

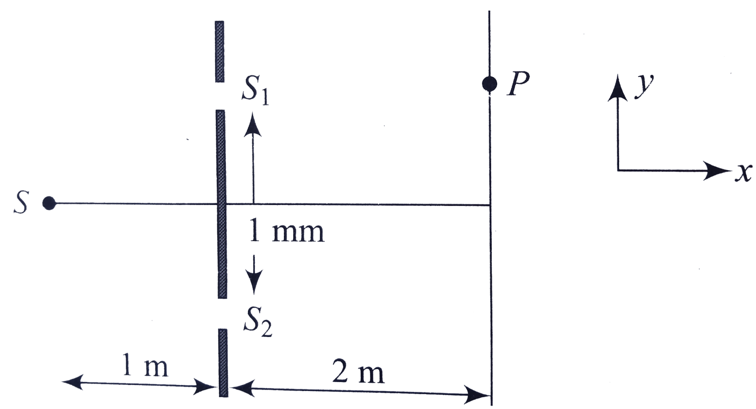
C. $\frac{D\lambda}{2d}, \frac{D\lambda}{3d}$

D. $\frac{D\lambda}{4d}, \frac{D\lambda}{d}$

Answer: A

Watch Video Solution

4. In young's double-slit experiment set up, sources S of wavelength 50 nm illumiantes two slits S_1 and S_2 which act as two coherent sources. The sources S oscillates about its own position according to the equation $y = 0.5 \sin \pi t$, where y is in nm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exaclty in front of the upper slit becomes minimum is



A. $y = (\cos 2\pi t)mm$

B. $y = -(\sin 2\pi t)mm$

C. $y = -(\cos 2\pi t)mm$

D. $y = (\sin 2\pi t)mm$

Answer: B

Watch Video Solution

5. In the above problem, minimum value of t for which the intensity at point P on the screen exactly in front of the upper slit becomes maximum.

A. 0.167s

B. 0.5 s

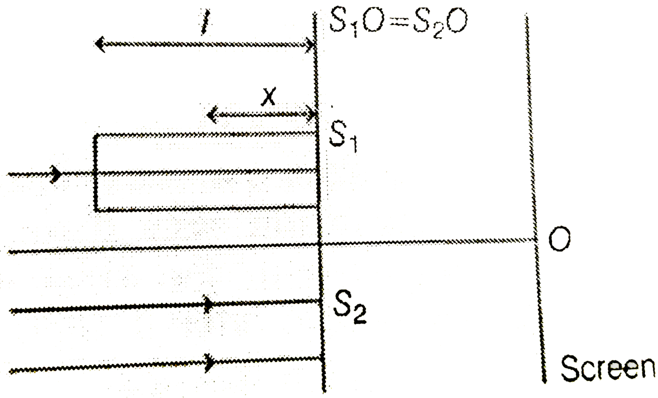
C. 0.012 s

D. 0.3 s

Answer: A

Watch Video Solution

6. In the figure shown, a parallel beam of light is incident on the plane of the slits of a Young's double slit experiment. Light incident on the slit S_1 passes through a medium of variable refractive index $\mu = 1 + ax$(where'x' is the distance from the the plane of slits as shown), upto a distance 'l' before falling on S_1. Rest of the speace is filled with air. If at O a minima is formed, then the minimum value of the positive constant a (in term of l and wavelength $'\lambda'$ in air) is:



A. $\frac{\lambda}{l}$

B. $\frac{\lambda}{l^2}$

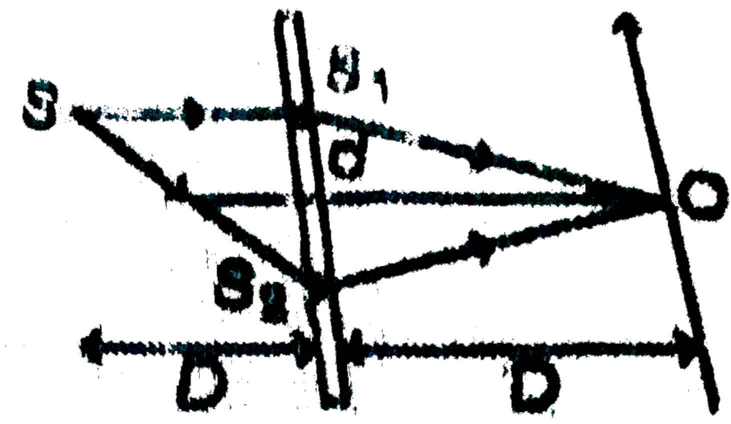
C. $\frac{l^2}{\lambda}$

D. None of these

Answer: B

Watch Video Solution

7. To make the central fringe at the centre O, a mica sheet of refractive index 1.5 is introduced . Choose the correct statement(s). $(D > > d > > \lambda)$



A. The thickness of sheet is $2\left(\sqrt{2}-1\right)d$ infront of S_1

B. The thickness of sheet is $\left(\sqrt{2}-1\right)d$ infront of S_2

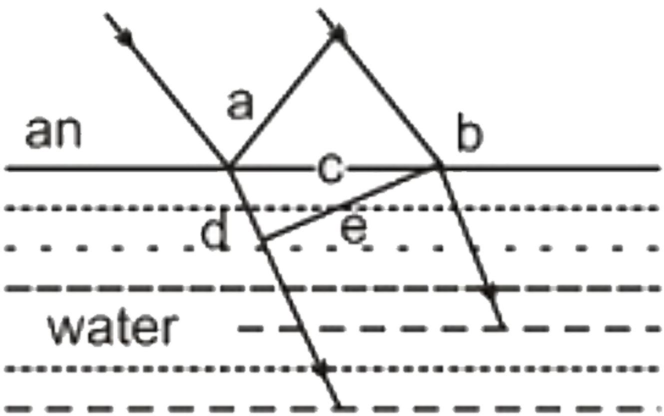
C. The thickness of sheet is $2\sqrt{2}-1\Big)d$ infront of S_1

D. The thickness of sheet is $\left(2\sqrt{2}-1\right)d$ infront of S_1

Answer: A

Watch Video Solution

8. In the figure shown plane waves are refracted from air to water using Huygen's principle a, b, c, d, e are lengths on the diagram. The refractive index of air with respect to water is in the ratio.



A. a/e

B. b/e

C. b/d

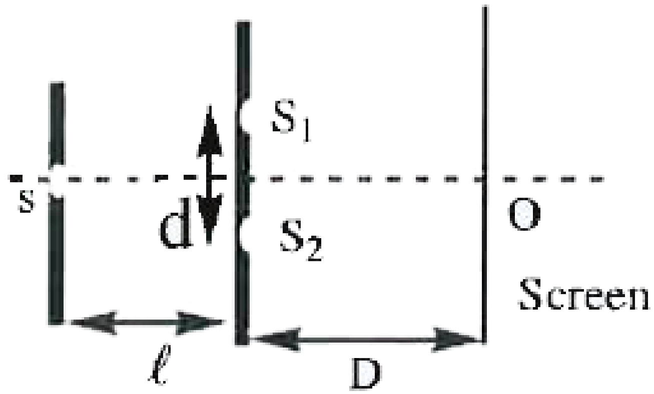
D. d/b

Answer: C

Watch Video Solution

Additional Practice Exercise Level - II (Lecture Sheet (Advanced) More Than One Correct Answer Type Questions

1. The figure shows a schematic diagram showing the arrangement of Youngs's Double Slit Experiment



Choose the correct statement (s) related to the wavelength of light used

A. Larger the wavelength of light larger the fringe width

B. The position of central maxima depends on the wavelength of light used

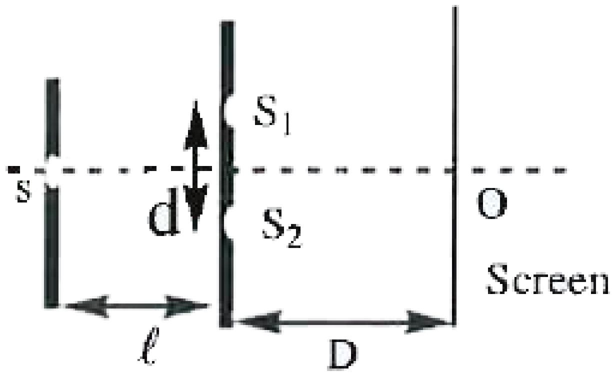
C. If white light is used in YDSE, then the violet colour forms its first maxima closest to the central maxima

D. The central maxima of all the wavelengths coincide

Answer: A::C::D

Watch Video Solution

2. The figure shows a schematic diagram showing the arrangement of Youngs's Double Slit Experiment



If the distance d is varried, then identify the correct statement

A. The angular width does not change

B. The fringe width changes in inverse proportion

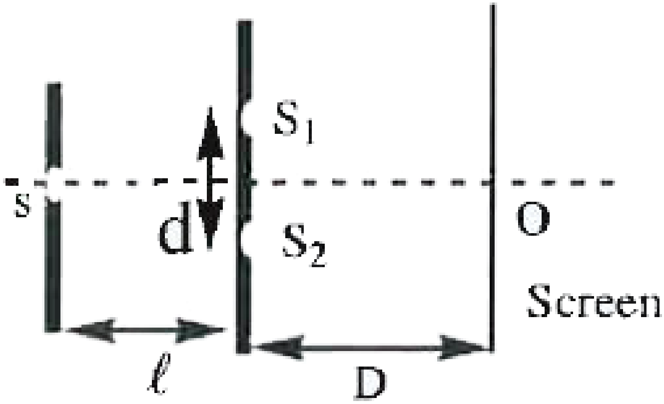
C. The positions of all maxima change

D. The positions of all minina change

Answer: B::D

Watch Video Solution

3. The figure shows a schematic diagram showing the arrangement of Youngs's Double Slit Experiment



If the distance D is varied, then choose the correct statement (s)

A. The angular fringe width does not change

B. The fringe width changes in direct proportion

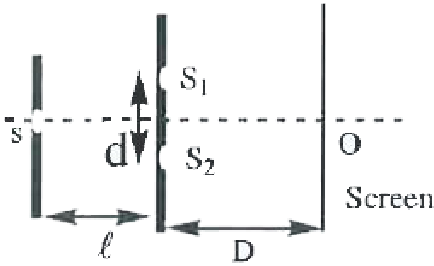
C. The change in fringe width is same for all wavelengths

D. The position of central maxima remains unchanged

Answer: A::B::D

Watch Video Solution

4. The figure shows a schematic diagram showing the arrangement of Youngs's Double Slit Experiment



Identify the correct statement(s) if the source slit S moved closer to S_1S_2, i.e., the distance l decreases

A. nothing happens to fringe pattern

B. fringe pattern may gets less sharp

C. fringe width remains unchanged

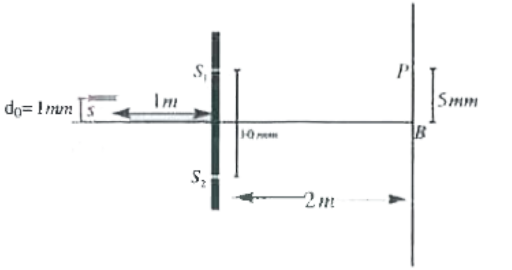
D. fringe pattern may dissapear

Answer: B::C::D

Watch Video Solution

Additional Practice Exercise Level - II (Lecture Sheet (Advanced) Linked Comprehension Type Questions)

1. In Young's double slit experiment the point source is placed slightly off the central axis as shown in figure. The plane of slits (S_1, S_2) and screen are separated by a distance of 2m. The separation between the slits is 10 mm. The position of the slit above the axis is 1mm. if the wavelength $\lambda = 4000 \mathring{A}$ in the above arrangement



The thickness of the film in the above case is

A. S_1 to P such that $[SS_1 + S_1P + (\mu - 1)t]$~$[SS_2 + S_2P] = 0$

B. S_2 to P such that $[SS_2 + S_2P + (\mu - 1)t]$~$[SS_1 + S_1P] = 0$

C. S_1 to P such that

$$[SS_2 + SS_1] \sim [S_1P + (\mu - 1)t + S_2P] = 0$$

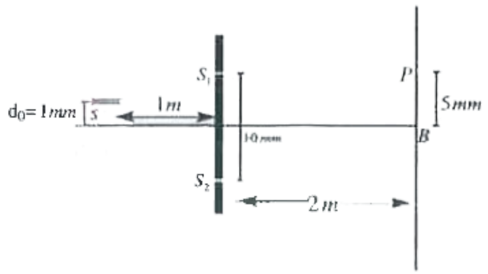
D. S_1 to P such that

$$[SS_1 + SS_2] \sim [S_1P + (\mu - 1)t + S_1P] = 0$$

Answer: A

Watch Video Solution

2. In Young's double slit experiment the point source is placed slightly off the central axis as shown in figure. The plane of slits (S_1, S_2) and screen are separated by a distance of 2m. The separation between the slits is 10 mm. The position of the slit above the axis is 1mm. if the wavelength $\lambda = 4000\text{Å}$ in the above arrangement



The thickness of the film in the above case is

A. 0.035 mm

B. 0.45mm

C. 0.060 mm

D. 0.070 mm

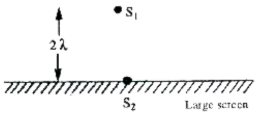
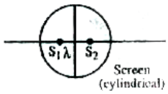
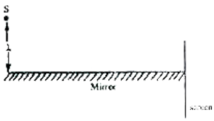
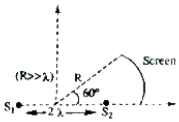
Answer: D

Watch Video Solution

Additional Practice Exercise Level - II (Lecture Sheet (Advanced) Matrix Matching Type Questions

1. S_1 and S_2 in List I represent coherent point sources, S represents a point source λ = wavelength of light emitted by the sources. Fringe pattern is observed on the screen.

Exclude the position of source while detecting the fringe pattern.

Column - I	Column - II
A) 	p) Number of maxima = 2 and number of minima = 1
B) 	q) Number of maxima = 2 and number of minima = 4
C) 	r) Number of maxima = 4 and number of minima = 4
D) 	s) Number of maxima = 2 and number of minima = 2

Watch Video Solution

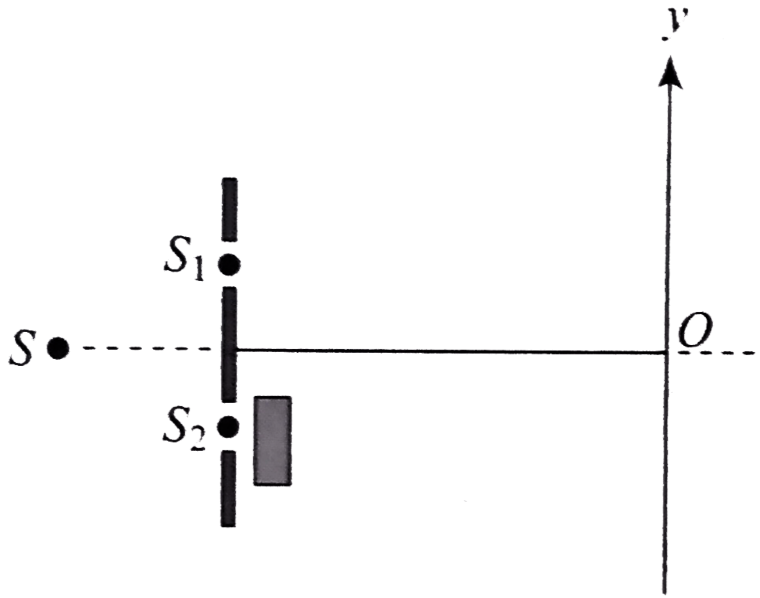
Additional Practice Exercise Level - II (Lecture Sheet (Advanced) Integer Type Questions

1. Two coherent sources are placed 0.9 mm apart and the fringes are observed one metre away. If it produces the second dark fringe at a distance of 10 mm from the central fringe. The wavelength of monochromatic light is $x \times 10^{-4} cm$, What is the value of x ?

Watch Video Solution

2. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45

nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



Find the light intensity at point O relative t

maximum fringe intensity.

Watch Video Solution

3. Two transparent slabs having equal thickness 0.45 mm and refractive indices 1.40 and 1.42 are pasted on the two slits of a double slit apparatus. The separation of slits equals 1mm. Wavelength of light used equals 600 nm. The screen is placed at a distance 1m from the plane of the slits. The central maxima from the centre of the screen is [in mm]

Watch Video Solution

Additional Practice Exercise (Practice Sheet (Advanced))

1. A slit 5cm wide is irradiated normally with microwaves of wavelength 1cm. Then the angular spread of the central maxima on either side of the incident light is nearly

A. 1/5 radian

B. 4 radian

C. 5 radian

D. 6 radian

Answer: A

Watch Video Solution

2. A narrow slit of width 1 mm is illuminated by monochromatic light of wavelength 600 nm. The distance between the first minima on either side of a screen at a distance of 2 m is

A. 1.2cm

B. 1.2mm

C. 2.4 cm

D. 2.4 mm

Answer: D

Watch Video Solution

3. A beam of unpolarised light passes through a tourmaline crystal A and then it passes through a second tourmaline crystal B oriented so that its principal plane is parallel to that of A. The intensity of emergent light is I_0. Now B is rotated by 45° about the ray. The emergent light will have intensity

A. $\frac{I_0}{2}$

B. $\frac{I_0}{\sqrt{2}}$

C. $I_0\sqrt{2}$

D. $2I_0$

Answer: A

Watch Video Solution

4. Find the equation of a line which passes through (5, 4) and makes an angle of 60° with the positive direction of the x-axis.

A. 1

B. $1/2$

C. $1/4$

D. $1/16$

Answer: C

Watch Video Solution

5. The true statements regarding refractive index of a material are

(A) it depends on the nature of the material (B) it increases with temperature

(C) it decreases with increases in wavelength

(D) it is inversely proportional to velocity of light in the medium

A. A,C,D

B. B,C,D

C. A,B,D

D. A,B,C

Answer: A

Watch Video Solution

6. If 'b' represents the size of object interacting with light L represents the distance between object and screen X is the wavelength of light then, match the following lists.

Column - I	Column - II
a) Fraunhoffer diffraction	d) $\frac{b^2}{L\lambda} \approx 1$
b) Fresnel diffraction	e) $\frac{b^2}{L\lambda} << 1$
c) Geometrical optics	f) $\frac{b^2}{L\lambda} >> 1$

1) $a \to d, b \to e, c \to f$
2) $a \to e, b \to f, c \to d$
3) $a \to e, b \to d, c \to f$
4) $a \to f, b \to e, c \to d$

Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -I) (MAIN) straight objective Type Questions

1. Waves of same amplitude and same frequency from two coherent source overlap at a point. The ratio of the resultant intensity when they arrive in phase to that when they arrive with 90° phase difference is

A. $1:1$

B. $\sqrt{2}:1$

C. $2:1$

D. $4:1$

Answer: C

Watch Video Solution

2. To demonstrate the phenomenon of interference, we require two sources which emit radiation

A. two source which emit radiation of the same frequency

B. two source which emit radiation of nearly the same frequency

C. two sources which emit radiation of nearly the same frequency

D. two source which emit radiation of the same frequency and have a definite phase relationship

Answer: C

Watch Video Solution

3. In Young's double-slit experimetn, the intensity of light at a point on the screen, where the path difference is λ,is I . The intensity of light at a point where the path difference becomes $\lambda/3$ is

A. $\frac{K}{4}$

B. $\frac{K}{3}$

C. $\frac{K}{2}$

D. K

Answer: A

Watch Video Solution

4. If an interference pattern produced by two identical slits, the intensity of the central maximum is I. The intensity at the same spot when either of the two slits is closed is I_0. Then

A. I/2

B. I/4

C. 2I

D. I

Answer: B

Watch Video Solution

5. Two coherent sources are placed 0.9 mm apart and the fringes are observed one metre away. The wavelength of monochromatic light used if it produces the second dark fringes at a distance of 10 mm from the central finge will be

A. 6×10^{4}

B. 6×10^{-6}cm

C. 6×10^{-7}cm

D. $1.2 \times 10^{4} cm$

Answer: A

Watch Video Solution

6. The two coherent sources of equal intensity produce maximum intensity of 100 units at a point. If the intensity of one of the sources is reduced by 50% by reducing its width then the intensity of light at the same point will be

A. 90

B. 89

C. 67

D. 72.85

Answer: D

Watch Video Solution

7. The ratio of the intensities at minima to maxima in Young's double slit experiment is $9:25$. Find the ratio of the widths of the two slits.

A. $8:1$

B. $16:1$

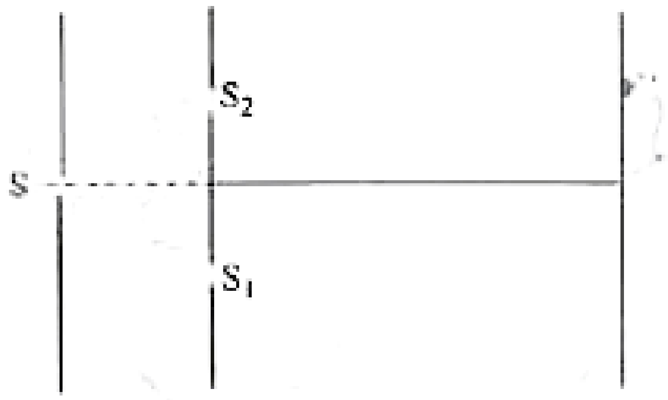
C. $4:1$

D. $9:1$

Answer: B

Watch Video Solution

8. If the width of the slit S in Young's double slit experiment is gradually increased



A. Bright fringes become brighter and dark fringes become darker

B. Bright fringes become less brighter , dark fringes become less dark

C. Bright fringes become brighter ,dark fringes lighter

D. Bright fringes become less bright , dark fringes darker .

Answer: B

Watch Video Solution

9. The distance between the tew slits in a Young's double slit experiment is d and the distance of the screen from the plane of the slits is b, P is a point on the screen directly infront of one of the slits. The path difference between the waves arriving at P from the two slits is

A. $\frac{d^2}{b}$

B. $\frac{d^2}{2b}$

C. $\frac{2d^2}{b}$

D. $\frac{d^2}{4b}$

Answer: B

Watch Video Solution

10. A single slit is illuminated by light of wavelength 6000 Ã.... The slit width is 0.1 cm and the screen is placed 1 m away. The angular position of 10^{th} minimum in radian is

A. 3

B. 4

C. 6

D. 8

Answer: A

Watch Video Solution

11. A double slit is illuminated by light of wave length 6000 Å. The slit are 0.1 cm apart and the screen is placed one metre away. Calculate.

(i). The angular position of the 10^{th} maximum in radian and

(ii). Separation of the two adjacent minimal.

A. 6×10^3 rad

B. 7 rad

C. 0.006^0

D. 6^0

Answer: A

Watch Video Solution

12. In young's double slit experiment the n^{th} red bright band coincides with $(n+1)^{th}$ blue bright band. If the wavelength of red and blue lights are $7500A^{\circ}$ and $5000A^{\circ}$, the value of 'n' is

A. $5762A^{\circ}$

B. $5825A^{\circ}$

C. $6000A^{\circ}$

D. $6500A^{\circ}$

Answer: B

Watch Video Solution

13. In a Young's double slit experiment using monochromatic light, the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the slits and screen is doubled. It is found that the distance between successive maxima now is the same as observed fringe shift upon the introduced of the mica sheet . Calculate the wavelength of the monochromatic light used in the experiment .

A. $5762A^0$

B. $5825A^0$

C. $6000A^0$

D. $6500A^0$

Answer: C

Watch Video Solution

14. When a thin transparent plate of Refractive Index 1.5 is introduced in one of the interfearing becomes, 20 fringes shift. If it is replaced by another thin plate of half the thickness and of R.I 1.7 the number of fringes that undergo displacement is

A. 23

B. 14

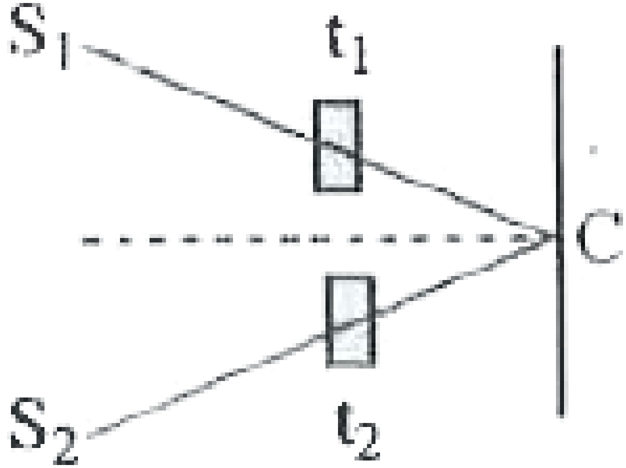
C. 28

D. 7

Answer: B

Watch Video Solution

15. In Young's double slit experiment S_1 and S_2 are two slits. Films of thickness t_1 and t_2 and refractive indices μ_1 and μ_2 are placed in front of S_1 and S_2 respectively. If $\mu_1 t_1 = \mu_2 t_2$, then the central maximum will :



A. Not shift

B. Shift towards S_1 irrespective of amount of t_1 and t_2

C. Shift towards S_2 irrespective of amounts of t_1 and t_2

D. Shift towards S_1 if $t_2 > t_1$ and towards S_2 if $t_2 < t_1$

Answer: D

Watch Video Solution

16. A transparent glass plate of thickness 0.5 mm and refractive index 1.5 is placed infront of one of the slits in a double slit experiment. If the wavelength of light used is $6000A^\circ$, the ratio of maximum to minimum intensity in the interference pattern is 25/4. Then the ratio of light intensity transmitted to incident on thin transparent glass plate is

A. $9:7$

B. $9:49$

C. $3:7$

D. $7:3$

Answer: B

Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -II) (ADVANCED)staright Objective Type Questions

1. White light is passed through a double slit and interference pattern is observed on a screen 2.5 m away. The separation between the slits is 0.5 mm. The first violet and red fringes are formed 2.0 mm and 3.5 mm away from the central white fringe. Calculate the wavelengths of the violet and the red light.

A. 400 nm , 650 nm

B. 400 nm , 700 nm

C. 350 nm , 200 nm

D. 200 nm , 350 nm

Answer: B

Watch Video Solution

2. A source emitting light of wavelengths 480 nm and 600 nm is used in a double slit interference experiment. The separation between the slits is 0.25 mm and the interference is observed on a screen placed at

150 cm from the slits. Find the linear separation between the first maximum (next to the central maximum) corresponding to the two wavelengths.

A. 0.36 mm

B. 0.18 mm

C. 0.72 mm

D. 0.98 mm

Answer: C

Watch Video Solution

3. A parallel beam of monochromatic light is used in a Young's double slit experiment. The slits are separated by a distance d and the screen is placed parallel to the plane of the slits. Show that if the incident beam makes an angle $\theta = \sin^{-1}\left(\frac{\lambda}{2d}\right)$ with the normal to the plane of the slits, there will be a dark fringe at the centre Po of the pattern.

A. 1/4 the maximum intensity

B. half the maximum intensity

C. bright

D. dark

Answer: D

Watch Video Solution

4. In a YDSE, the central beight fringe can be indentified:

A. as it has greater intensity than the other bright fringes

B. as it is wider than the other bright fringes

C. as it is narrower than the other bright fringes

D. by using white light instead of single wave- length light .

Answer: D

Watch Video Solution

5. In Young's double slit experiment, the two slits acts as coherent sources of equal amplitude A and wavelength λ. In another experiment with the same set up the two slits are sources of equal amplitude A and wavelength λ but are indoherent. The ratio of the intensity of light at the mid point of the screen in the first case to that in the second case is

A. $1:1$

B. $2:1$

C. $4:1$

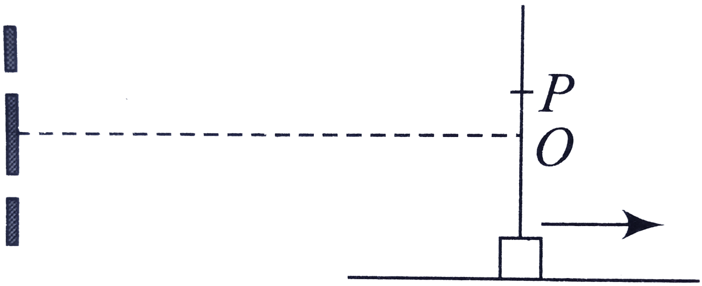
D. none of these

Answer: B

Watch Video Solution

6. In Young's double-slit experment, the frist maxima is observed at a fixed point P on the screen. Now, the screen is continously moved away from the plane of slits. The ratio of intensity at point P to the intensity at point O

(center of the screen)



A. remains constant

B. keeps on decreasing

C. first decreases and then increases

D. First decreases and then becomes constant

Answer: C

Watch Video Solution

7. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other Then in the interference pattern

A. the intensities of both the maxima and minima increase

B. the intensity of the maxima increases and the minima has zero intensity

C. the intensity of the maxima decreases , and that of minima increases ,

D. the intensity of the maxima decreases and the minima has zero intensity .

Answer: A

Watch Video Solution

8. In a YDSE , if the silts are of unequal widths,

A. fringes will not be formed

B. the positions of minimum intensity will not be completely dark .

C. bright fringe will not be formed at the centre of the screen .

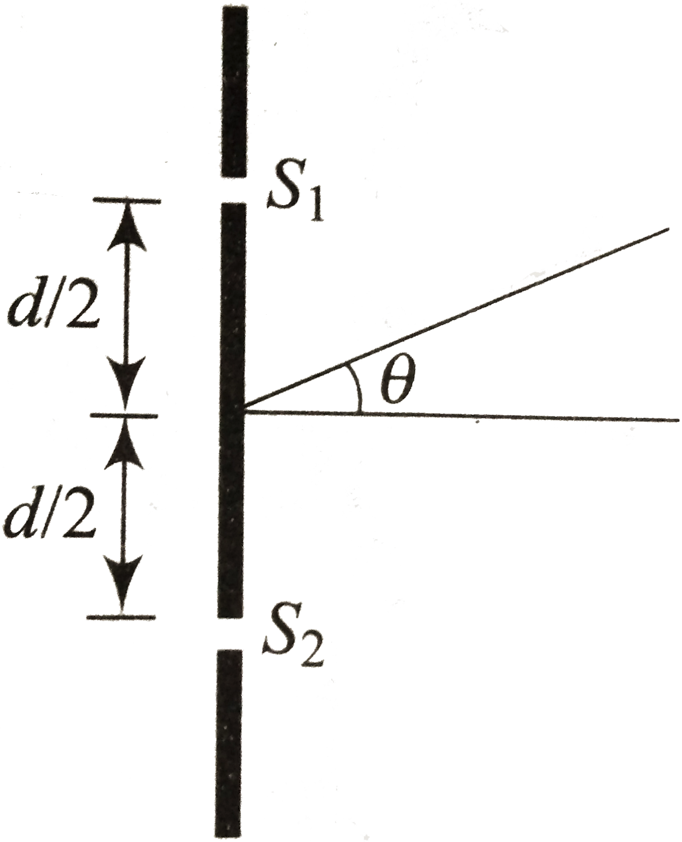
D. distance between two consecutive bright fringes will not be equal to the distance between two consecutive dark fringes .

Answer: B

Watch Video Solution

9. In an interference arrangement similar to Young's double-slit experiment, the slits S_1 and S_2 are illuminated with coherent microwave sources, each of frequency 10^6 Hz. The sources are synchronized to have zero phase difference. The slits are separated by a distance $d = 150.0m$. The intensity $I(\theta)$ is measured as a function of θ, where θ is defined asa shown in fig. If I_0 is hte maximum intensity, then $I(\theta)$ for

$0 \leq \theta \leq 90^\circ$ is given by ltbrrgt



A. $I(\theta) = I_0 / 2$ for $\theta = 30^\circ$

B. $I(\theta) = I_0 / 4$ for $\theta = 90^\circ$

C. $I(\theta) = I_0$ for $\theta = 0^\circ$

D. $I(\theta)$ is constant for all value of θ

Answer: C

Watch Video Solution

10. Let S_1 and S_2 be the two slits in Young's double-slit experiment. If central maxima is observed at P and angle $\angle S_1PS_2 = \theta$, then fringe width for the light of wavelength λ will be

A. λ / θ

B. $\lambda\theta$

C. $2\lambda/\theta$

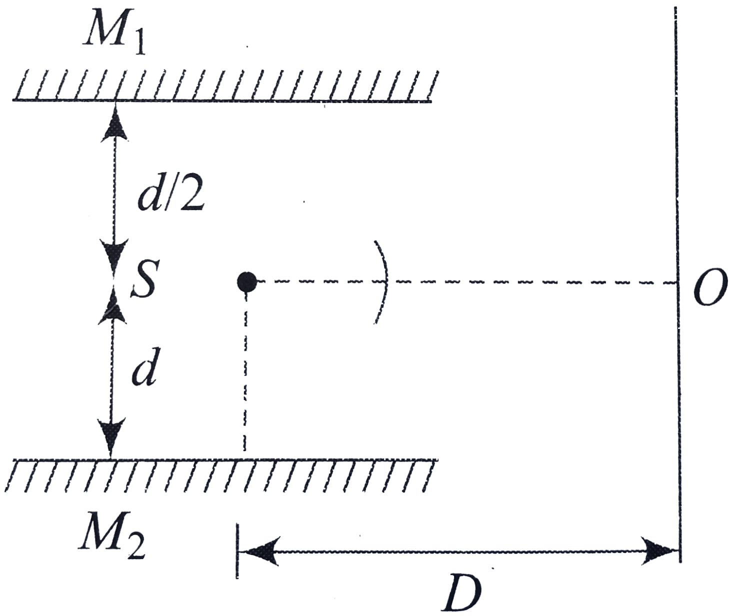
D. $\lambda/2\theta$

Answer: A

Watch Video Solution

11. M_1 and M_2 are plane mirrors and kept parallel to each other. At point O, there will be a maxima for wavelength λ. Light from a monochromatic sources S of wavelength λ is

not reaching directly on the screen. Then, λ is



A. $\frac{3d^2}{D}$

B. $\frac{3d^2}{2D}$

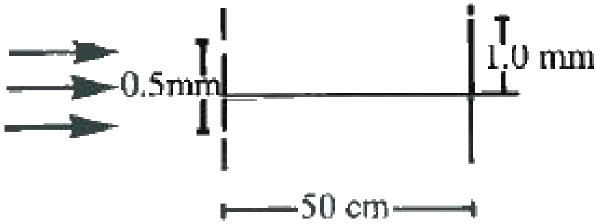
C. $\frac{d^2}{D}$

D. $\frac{2d^2}{D}$

Answer: B

Watch Video Solution

12. White coheral light (400 nm 700 nm) is sent through the slit of a Young.s double slit experiment. The separation between the slits is 0.5 mm and the screen is 50 away from the slits . There is a hole in the screen at a point 1.0 mm away (along the width of the fringes) from the central line. Which wavelengths (s) will be absent in the light coming from the hole ?



A. 400 nm ,667 nm

B. 400 nm , 500 nm

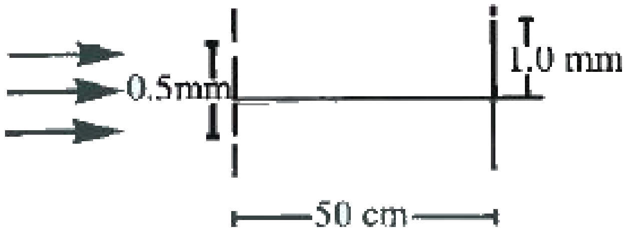
C. 667 nm , 800 nm

D. 300 nm , 700 nm

Answer: A

Watch Video Solution

13. In this problem , which wavelength (s) will have a strong intensity if light have wavelength 400 nm-700 nm?



A. 400 nm

B. 500 nm

C. 600 nm

D. 700 nm

Answer: B

Watch Video Solution

14. Consider the arrangement shown in figure.

By some mechanism,

the separation between the slits S_3 and S_4

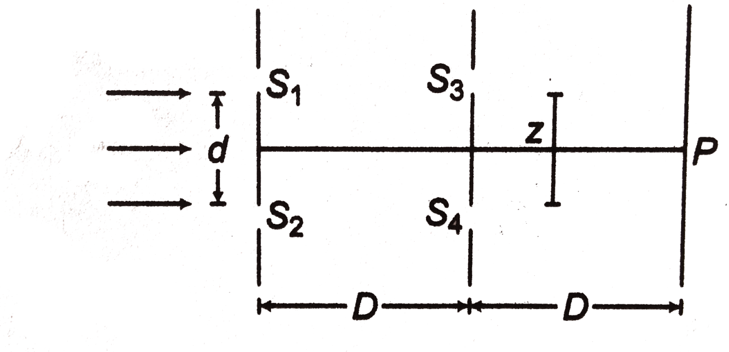
can be changed. The intensity is

measured at the point P which is at the

common perpendicular bisector of S_1S_2

and S_3S_4. When $z = \frac{D\lambda}{2d}$, the intensity

measured at P is I. Find the intensity when z is equal to



$(a)\dfrac{D\lambda}{d}(b)\dfrac{3D\lambda}{2d}(c)\dfrac{2D\lambda}{d}$.

A. O,I,2I

B. I,O,2I

C. 2I,O,I

D. I,2I,3I

Answer: A

Watch Video Solution

15. Plane microwaves from a transmitter are directed normally towards a plane reflector. A detector moves along the normal to the reflection. Between positions of 14 successive maxima, the detector travels a distance 0.14m. If the velocity of light is $3 \times 10^{8} m/s$, find the frequency of the transmitter.

A. 1.5×10^{10} Hz

B. 10^{10} Hz

C. 3×10^{10} Hz

D. 6×10^{10}Hz

Answer: A

Watch Video Solution

16. Consider the situation shown in figure. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by a monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted by the slits falls on a screen Σ_1 placed at a distance D from the slits. The slit S_3 is at the placed central line and the slit S_4, is at a distance z from S_3. Another screenΣ_2 is placed a further distance D away from 1,1. Find the ratio of the maximum to minimum intensity observed on Σ_2 if z is equal to a. $z = \dfrac{\lambda D}{2d}$ b. $\dfrac{\lambda D}{d}$ c. $\dfrac{\lambda D}{4d}$

A. $2, 25, \infty$

B. $1, \infty 34$

C. $1, \infty 30$

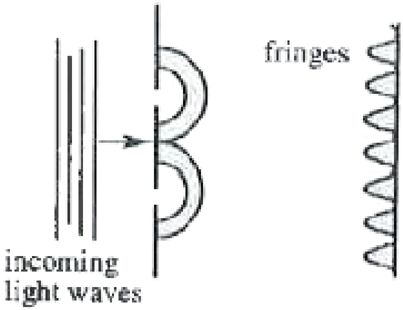
D. $10, 0, 20$

Answer: B

Watch Video Solution

17. 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 lights instead of green light

D. Moving the light source further away from the slits /

Answer: B

Watch Video Solution

18. A plate of thickness t made of a material of refractive index μ is placed in front of one of the slits in a double slit experiment. (a) Find the changes in the optical path due to introduction of the plate. (b) What should be the minimum thickness t which will make the intensity at the center of the fringe pattern zero ? Wavelength of the light used is λ. Neglect any absorption of light in the plate.

A. $(\mu-1)t, \dfrac{\lambda}{2(\mu-1)}$

B. $2(\mu-1)t, \dfrac{\lambda}{\mu-1}$

C. $(\mu-1)t, \dfrac{\lambda}{\mu-1}$

D. $(\mu-1)\dfrac{t}{2}, \dfrac{\lambda}{\mu-1}$

Answer: A

Watch Video Solution

19. A mica strip and a polysterence strip are fitted on the two slite of a double slit apparatus. The thickness of the strips is 0.50 mm and the separation between the slits is 0.12 cm. The refractive index of mica and polysterene are 1.58 and 1.55 respectively for the light of wavelength 590 nm which is used in the experiment. The interference is observed on a screen a distance one meter away. (a) What would be the fringe- width ? (b) At what distance from the centre will the first maximum be located ?

A. 2.45×10^{-4}m

B. 4.9×10^{-4}m

C. 9.8×10^{-4}m

D. 10^{-3}m

Answer: B

Watch Video Solution

20. A mica strip and a polysterence strip are fitted on the two slite of a double slit apparatus. The thickness of the strips is 0.50

mm and the separation between the slits is 0.12 cm. The refractive index of mica and polysterene are 1.58 and 1.55 respectively for the light of wavelength 590 nm which is used in the experiment. The interference is observed on a screen a distance one meter away. (a) What would be the fringe- width ? (b) At what distance from the centre will the first maximum be located ?

A. 0.021 cm on one side and 0.028 cm on the other side

B. 0.042 cm on one side and 0.048 cm on the other side

C. 0.042 cm on one side and 0.028 cm on the other side

D. 0.021 cm on one side and 0.048 cm on the other side

Answer: A

Watch Video Solution

21. YDSE is carried out in a liquid of refractive index $\mu = 1.3$ and a thin film of air is formed in front of the lower slit as shown in the figure. If a maxima of third order is formed at the origin O, find the thickness of the air film. Find the positions of the fourth maxima. The wavelength of light is air is $\lambda_0 = 0.78 \mu m$ and $D/d = 1000$.

(##DCP_V05_C32_E01_086_Q01.png"

width="80%">

A. $7.8 \mu m$

B. $3.9\mu m$

C. $15.6\mu m$

D. $0.5\mu m$

Answer: A

Watch Video Solution

22. In the above problem, find the distances of fourth maxima from 'O'.

A. $+3.6$mm, -2.4 mm

B. $+4.2$mm , -0.6 mm

C. $+6$mm, -2 mm

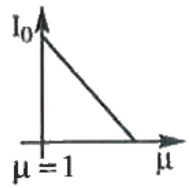
D. $+3$ mm, -6 mm

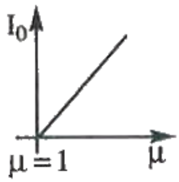
Answer: B

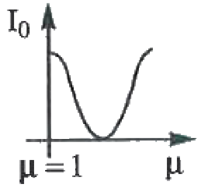
Watch Video Solution

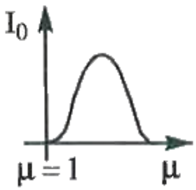
23. In a YDSE experiment if a slab whose refractive index can be varied is placed in front of one of the slits, then the variation of resultant intensity at mid-point of screen with

μ will be best represented by $(\mu \geq 1)$. [Assume slits of equal width and there is no absorption by slab]

A. 

B. 

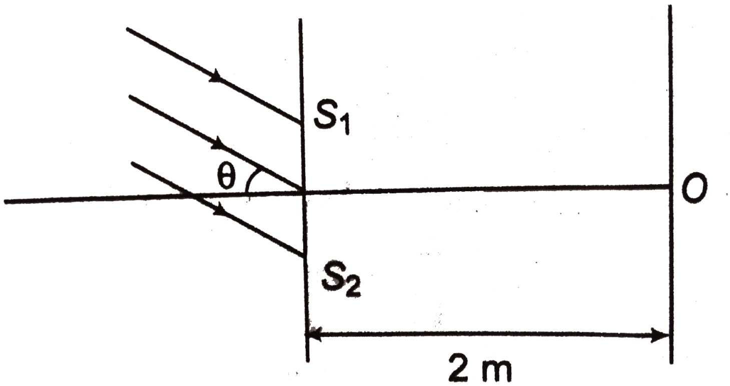
C. 

D. 

Answer: C

Watch Video Solution

24. A parallel beam of light $(\lambda = 5000\text{Å})$ is incident at an angle $\theta = 30^\circ$ with the normal to the slit plane in a Young's double slit experiment. The intensity due to each slit is I_0. Point O is equidistant from S_1 and S_2. The distance between slits is 1mm.



A. the intensity at O is 4Io

B. the intensity at O is zero

C. the intensity at a point on the screen 4mm from O is 4Io

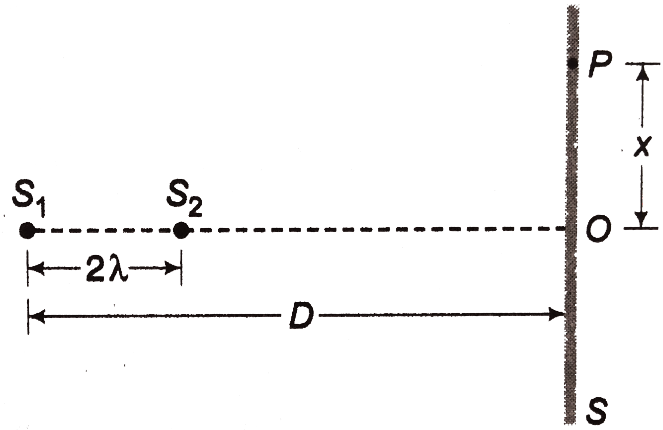
D. the intensity at a point on the screen 4mm from O is zero .

Answer: A

Watch Video Solution

25. Two coherent narrow slits emitting light of wavelength λ in the same phase are placed parallel to each other at a small separation of 2λ. The light is collected on a screen S which is placed at a distance D($> \; > \lambda$) from the slit S_1 as shown in figure. Find the finite distance x such that the intensity at P is equal to intensity

O.



A. $\dfrac{D}{\sqrt{3}}$

B. $\sqrt{3}D$

C. $\dfrac{\sqrt{3}}{2}$ D

D. $\dfrac{D}{2}$

Answer: B

Watch Video Solution

26. Two coherent radio point sources that are separated by 2.0 m are radiating in phase with a wavelength of 0.25m. If a detector moves in a large circle around their mid-point. At how many points will the detector show a maximum signal?

A. 10

B. 16

C. 8

D. 32

Answer: D

Watch Video Solution

27. Four monochromatic and coherent sources of light, emitting waves in phase of wavelength λ, are placed at the points x = 0, d 2d and 3d on the x-axis. Then

A. points having $|x| > > d$ appear dark if d $= \lambda / 4$

B. points having $|x| > > d$ appear dark if d = $\lambda/8$

C. points having $|x| > > d$ appear maximum beight if $d = \lambda/4$

D. points having $|x| > > d$ appear maximum bright if $d = \lambda/8$

Answer: A

Watch Video Solution

28. In the above questions, the intensity of the waves reaching a point P far away on the +x axis from each of the four sources is almost the same, and equal to I_0. Then,

A. If $d = \lambda/4$ the intensity at P is $4I_0$

B. If $d = \lambda/6$ the intensity at P is $3I_0$

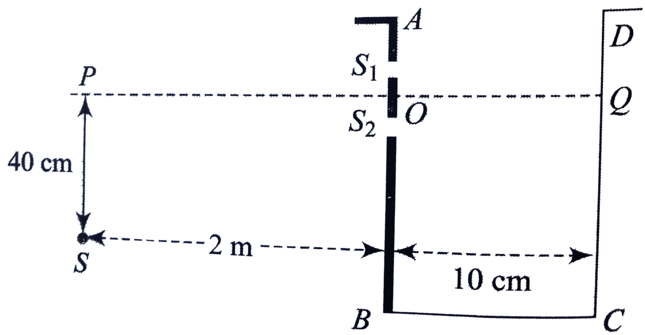
C. If $d = \lambda/2$, the intensity at P is $3I_0$

D. none of these is true .

Answer: B

Watch Video Solution

29. A vessel ABCD of 10 cm width has two small slits S_1 and S_2 sealed with identical glass plates of equal thickness. The distance between the slits is 0.8 mm. POQ is the line peropendicular to the plane AB and passing through O, the middle point of S_1 and S_2. A monochromatic light source is kept at S, 40 cm below P and 2 m form the vessel to illuminate the slits as shown in figure .Calculate the position of the central bright fringe on the other wall CD with respect to line OQ. Now , a liquid is poured into the vessel and filled up to OQ. The central bright fringe is found to be at Q. Calculate the refractive index of the liquid to the liquid.



A. 4 cm

B. 6 cm

C. 5 cm

D. 2 cm

Answer: D

Watch Video Solution

30. In the above problem, now a liquid is poured into the vessel and filled up to OQ. The central bright fringe is found to be at Q. The refractive index of the liquid is

A. 1.0016

B. 1.016

C. 1.16

D. 1.6

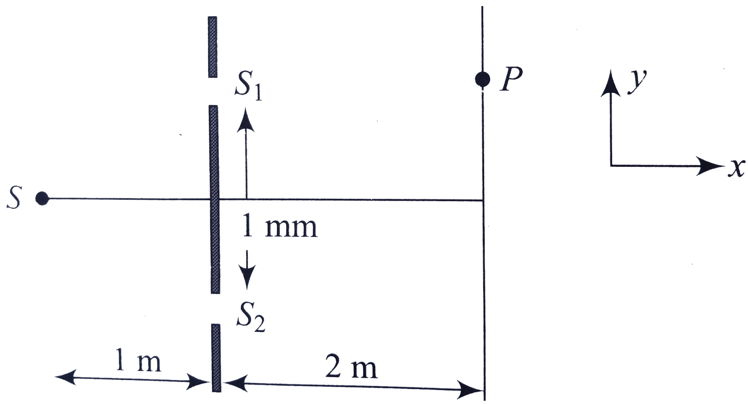
Answer: A

Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -II) (ADVANCED)

More than one correct answer Type Questions

1. In young's double-slit experiment set up, sources S of wavelength 50 nm illumiantes two slits S_1 and S_2 which act as two coherent sources. The sources S oscillates about its own position according to the equation $y = 0.5 \sin \pi t$, where y is in nm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exaclty in front of the upper slit becomes minimum is



A. 1 s

B. 2s

C. 3 s

D. 1.5 s

Answer: A

Watch Video Solution

2. If the source of light used in a Young's Double Slit experiment is changed from red to blue, then

A. the frings will become brighter

B. consecutive fringes will come closer

C. the number of maxima formed on the screen increases

D. the central bright fringe

Answer: B::C

Watch Video Solution

3. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance $d(> > b)$ from the slits At a point on the screen directly in front of one of the slits, certain wavelengths are missing some of these missing wavelengths are

A. $\frac{d^2}{D}$

B. $\frac{2d^2}{D}$

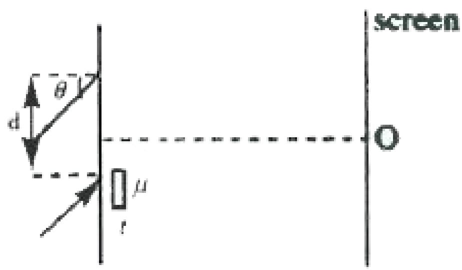
C. $\frac{d^2}{3D}$

D. $\frac{2d^2}{3D}$

Answer: A::C

Watch Video Solution

4. A monochromatic beam of light falls on YDSE apparatus at some angle (θ) as shown, a thin sheet of glas (R.I. = μ, thickness = t) is insdted in front of the lower slit S_2. Select the correct alternative.



A. Central maxima will be at O always

B. If $(\mu - 1)t = d\sin\theta$, central maxima will be at O

C. If $(\mu-1)t > d\sin\theta$ central maxima will be below O

D. If $(\mu-1)t = d\sin\theta + \lambda$, a maxima is formed at O

Answer: B::C::D

Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -II) (ADVANCED)

Linked Comprehension Type Questions

1. Two monochromatic coherent point sources S_1 and S_2 are separated by a distance L. Each sources emits light of wavelength λ, where $L > > \lambda$. The line S_1S_2 when extended meets a screen perpendicular to it at point A. Then

A. The interference frings are circular in shape

B. Interference fringes are straight lines perpendicualr to line S_1S_2

C. On the point A intensity is maximum if $L = n\lambda$ (n is an integar)

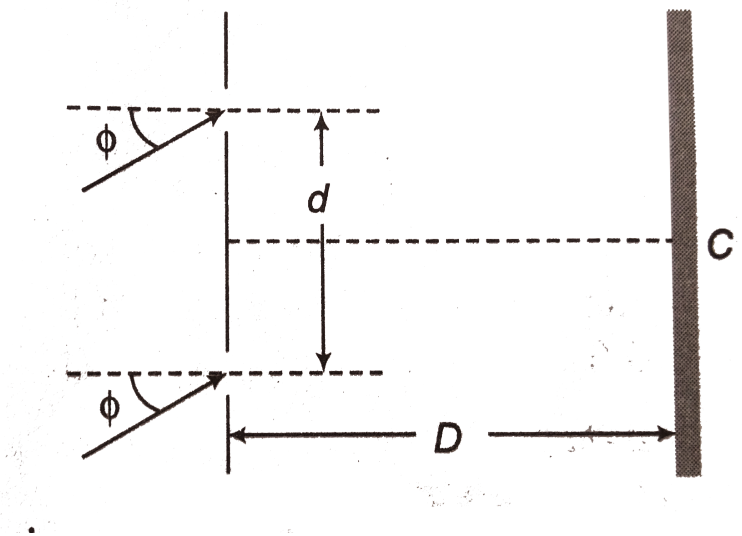
D. Point A is always an intensity maximum for any separtion L

Answer: A::D

Watch Video Solution

2. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^\circ$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 30° above OB

B. 45° below OB

C. 45° above OB

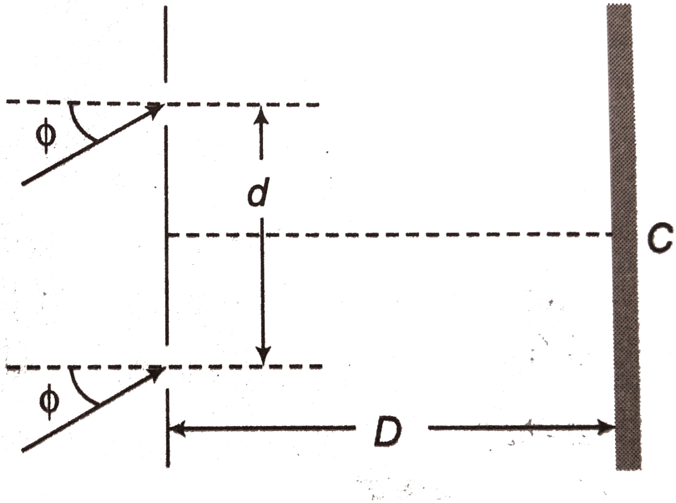
D. 30° below OB

Answer: D

Watch Video Solution

3. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^{\circ}$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 50th minima

B. 49th minima

C. 51 st minima

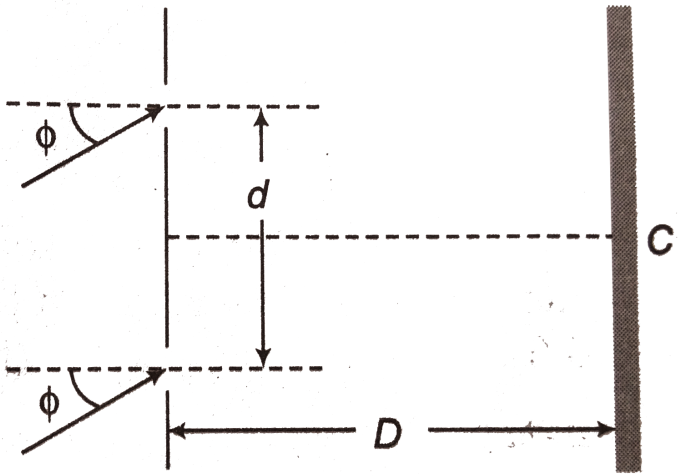
D. 1st minima

Answer: A

Watch Video Solution

4. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^{\circ}$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

A. 50

B. 40

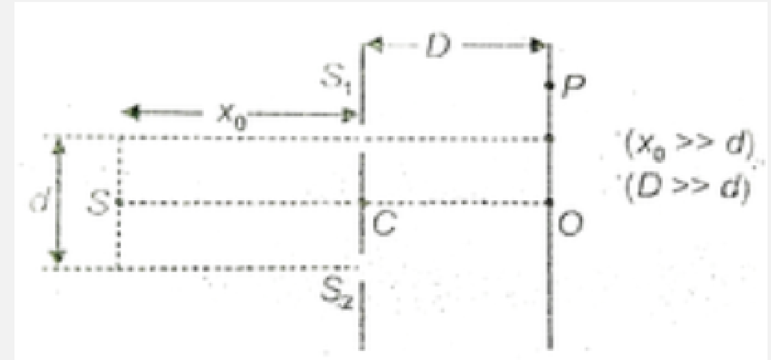
C. 100

D. 80

Answer: C

Watch Video Solution

5. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the resultant intensity at P is same as that O, then the distance OP can not be

A. $\dfrac{\lambda D}{d}$

B. $\dfrac{2\lambda D}{d}$

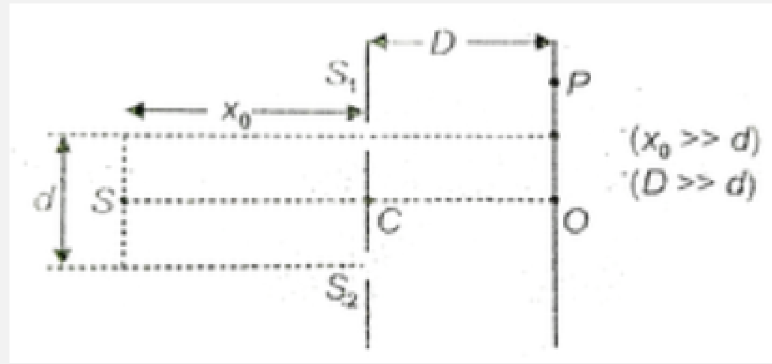
C. $\frac{3\lambda D}{d}$

D. $\frac{1.5\lambda D}{d}$

Answer: D

Watch Video Solution

6. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the source is moved up by a very small distance y_0, the central maxima will shift

A. Up by $\frac{y_0 d}{x_0}$

B. Down by $\frac{y_0 d}{x_0}$

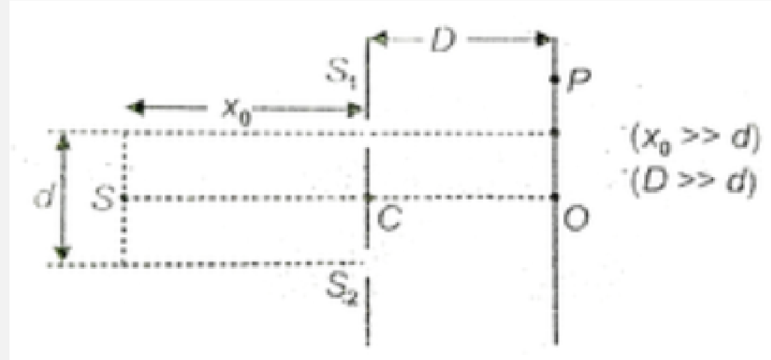
C. Up by $\frac{y_0 D}{x_0}$

D. Down by $\frac{y_0 D}{x_0}$

Answer: D

Watch Video Solution

7. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the size of slits S_1 is slightly decreased, then

A. Intensity at central maxima will ramain same

B. Intensity at sentral maxima will increase

C. Intensity at first minima will slightly increase from zero .

D. Intensity at first minima will remain zero .

Answer: C

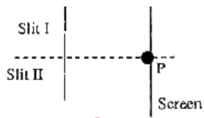
Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -II) (ADVANCED)

Matrix Matching Type Questions

1. A double slit interference pattern is produced on a screen, as shown in the figure, using momochromatic light of wavelength 500 nm. Point P is the location of the central bright fringe, that is produced when light waves arrive in phase without any path difference. A choice of the three strips A, B and C of transparent materials with different thickness and refractive indices is available, as shown in the table. These are placed over one or both of the slits, singularly or in conjunction causing the interference pattern to be shifted across the

screen from the original pattern. In the Column - I, how the strips have been placed, is mentioned whereas in the Column-II, order of the fringe at point P on the screen that will be produced due to the placement of the strip(s), is shown. Correctly match both the column.

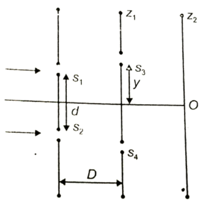


Film	A	B	C
Thickness (in μm)	5	1.5	0.25
Refractive Index	1.5	2.5	2

Column - I	Column - II
A) Only strip B is placed over slit -I	p) First Bright
B) Strip A is placed over slit-I and strip C is placed over slit-II.	q) Fourth Dark
C) Strip A is placed over the slit-I and strip B and strip C are placed over the slit-II	r) Fifth Dark
D) Strip A and strip C are placed over slit-I (in conjuction) and strip B is placed over slit-II	s) Central Bright

Watch Video Solution

2. In the arrangement shown in figure, z_1 and z_2 are two screens. Line PO is the bisector line of $s_1 s_2$ and $s_3 s_4$, s_1 is removed, resultant intensity at O due to slits s_1 and s_2 is I. now z_1 is placed. For different values of y given in column-I match the resultant intensity at O given in column -II.



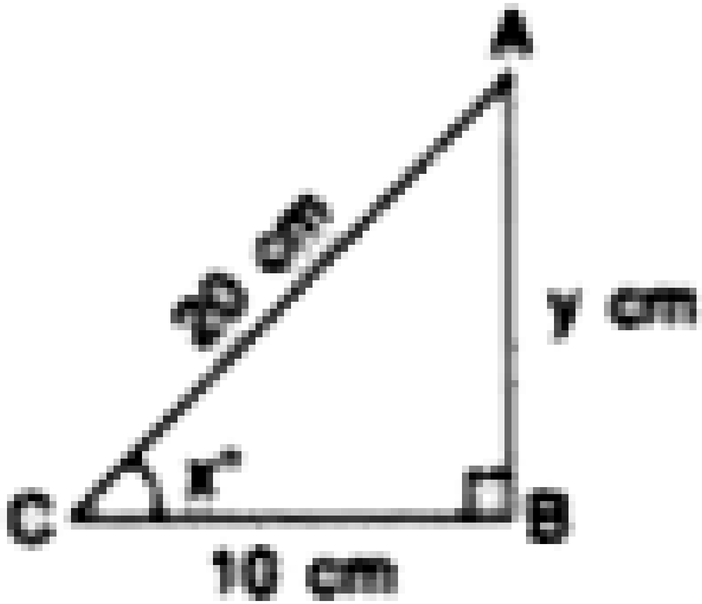
Column-I	Column-II
(A) $y = \frac{D\lambda}{2d}$	(p) $3I$
(B) $y = \frac{D\lambda}{6d}$	(q) Zero
(C) $y = \frac{D\lambda}{4d}$	(r) I.
(D) $y = \frac{D\lambda}{3d}$	(s) None of these

Watch Video Solution

LECTURE SHEET EXERCISE-I (LEVEL -II) (ADVANCED)

Interger Type Questions

1. From the given figure, find :



x°

Watch Video Solution

LECTURE SHEET EXERCISE-II (LEVEL -I) (MAIN) (Straight Objective Type Questions)

1. Ratio of intensities in consecutive maxima in a diffraction pattern due to a single slit is

A. $1:2:3$

B. $1:4:9$

C. $1:\frac{2}{x^2}:\frac{3}{\pi^2}$

D. $1:\frac{4}{9\pi^2}:\frac{4}{25\pi^2}$

Answer: D

Watch Video Solution

2. The fringes produced in diffraction patterns

________.

A. λ

B. $\lambda/2$

C. $\lambda/4$

D. 2λ

Answer: A

Watch Video Solution

3. The average path difference between two waves coming from third and fifth fresnel zones of a wave front at the centre of the screen is

A. $\frac{\lambda}{2}$

B. 2λ

C. λ

D. 4λ

Answer: C

Watch Video Solution

4. The main difference in the phenomenon of interference and diffraction is that

A. diffraction is due to interaction of light from the same wavefront whereas interference is the interaction of waves from wave isolated sources

B. diffraction is due to interaction of light from same wavefront , whereas the interference is the interaction of two waves dcrived from the same source

C. diffraction is due to interaction of waves derived from the same source , whereas the interference is the bending of light from the same wavefront

D. diffraction is caused by refelcted waves from a source whereas interference caused is due to refraction of waves from a surface .

Answer: B

Watch Video Solution

5. With both light and sound show wave character, diffraction is much harder to observer in light. This is because

A. wavelength of light is smaller

B. waves of light are transverse

C. speed of light is far greater

D. light does not require any medium

Answer: A

Watch Video Solution

6. A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?

A. no change

B. diffraction bands become narrower and crowded together

C. bands become broader and father apart

D. bands disapear

Answer: B

Watch Video Solution

7. A slit 5cm wide is irradiated normally with microwaves of wavelength 1cm. Then the angular spread of the central maxima on either side of the incident light is nearly

A. $\frac{1}{5}$ radian

B. 5 radian

C. 4 radian

D. 6 radian

Answer: A

Watch Video Solution

8. A screen is at a distance of 2m from a narrow slit illuminated with light of 600nm. The first minimum lies 5mm on either side of the central maximum. The width of slit is

A. 0.024 mm

B. 0.24 mm

C. 2.4 mm

D. 24 mm

Answer: B

Watch Video Solution

9. The first diffraction minimum due to a single slit Fraunhoffer diffraction is at the angle of diffraction 30° for a light of wavelength $5460 A^\circ$. The width of the slit is

A. 1.082×10^{-4} cm

B. 2.164×10^{-4}cm

C. 1.082×10^{-3} cm

D. 0.546 cm

Answer: A

Watch Video Solution

10. In the case of single slit Franuhoffer diffraction the angle of diffreaction is θ for the second secondary maximum. If 'a' is the width of the slit, the wavelength of the light is

A. $\frac{2a\sin\theta}{3}$

B. $\frac{3a\sin\theta}{2}$

C. $\frac{2a\sin\theta}{5}$

D. $\frac{2a\cos\theta}{3}$

Answer: C

Watch Video Solution

LECTURE SHEET EXERCISE-II (LEVEL -II) (MAIN) (Straight Objective Type Questions)

1. In a Fraunhoffer diffraction experiment at a single slit using light of wavelength 400 nm, the first minimum is formed at an angle of 30° Then the direction θ of the first secondary maximum is

A. $\tan^{-1}\left(\frac{4}{3}\right)$

B. 60°

C. $\sin^{-1}\left(\frac{3}{4}\right)$

D. $\tan^{-1}\left(\frac{3}{4}\right)$

Answer: C

Watch Video Solution

2. Light of wavelength $5900 \times 10^{-10} m$ falls normally on a slit of width $11.8 \times 10^{-7} m$. The resulting diffraction pattern is received on a screen. The angular position of the first minimum is.

A. 30°

B. 60°

C. 45°

D. 90°

Answer: A

Watch Video Solution

3. In the above the angular width of the central maximum is

A. 30°

B. 60°

C. 45°

D. 90°

Answer: B

Watch Video Solution

4. A slit whose width is 5.0 cm is irradiated with microwaves of wavelength 2 cm . The angular spread of the central maximum ? (Assume that the incidence is along the normal)

A. $2\sin^{-1}(2/5)$

B. $\sin^{-1}(2/5)$

C. $\cos^{-1}(4/5)$

D. $\cos^{-1}(2/5)$

Answer: A

Watch Video Solution

5. Light of wavelength $5000A^{\circ}$ is diffracted by a slit. In diffraction pattern fifth minimum is at a distance of 5 mm from central maximum. If the distance between the screen and the slit is 1m. The slit width is

A. 0.5 mm

B. 0.55 mm

C. 0.25 mm

D. 0.6 mm

Answer: A

Watch Video Solution

6. In a Fraunhoffer diffraction experiment at a single slit using light of wavelength 400 nm, the first minimum is formed at an angle of 30° Then the direction θ of the first secondary maximum is

A. $\sin^{-1}(3/2)$

B. $\sin^{-1}(3/4)$

C. $\cos^{-1}(3/4)$

D. $\cos^{-1}(3/2)$

Answer: B

Watch Video Solution

7. In a single slit diffraction experiment first minima for $\lambda_1 = 660nm$ coincides with first maxima for wavelength λ_2. Calculate the value of λ_2.

A. 990 nm

B. 440 nm

C. 330 nm

D. 550 nm

Answer: B

Watch Video Solution

8. Plane microwaves are incident on a long slit having a width of 5.0 cm. Calculate the wavelength of the microwaves if the first diffraction minimum is formed at $\theta = 30^{\circ}$.

A. 2.5 cm

B. 5 cm

C. 1.25 cm

D. 7.5 cm

Answer: A

Watch Video Solution

LECTURE SHEET EXERCISE-III (LEVEL -I) (MAIN) (Straight Objective Type Questions)

1. From brewster's law for polarisation, it follows that the angle polarisation depends upon

A. the wavelength of light

B. plane of polarisation.s orientation

C. plane of vibration.s orientation

D. None of above

Answer: A

Watch Video Solution

2. The refractive index of glass is 3/2. What is the polarising angle for glass

A. $56^{\circ} 18$

B. 60°

C. 30°

D. None

Answer: A

Watch Video Solution

3. The angle between polariser and analyser is 30°. The ratio of intensity of incident light and transmitted by the analyser is

A. $3:4$

B. $4:3$

C. $\sqrt{3}:2$

D. $2:\sqrt{3}$

Answer: B

Watch Video Solution

4. The axes of the polariser and analyser are inclined to each other at 45° . If the amplitude of the unpolarised light incident on the polariser is A , the amplitude of the light transmited through the analyser is

A. $\frac{A}{2}$

B. $\frac{A}{\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$ A

D. $\frac{3A}{4}$

Answer: A

Watch Video Solution

5. Plane polarised light is incident on an analyser . The intensity then becomes three fourth . The angle of the axis of the analyser with the beam is

A. 30°

B. 45°

C. 60°

D. 0°

Answer: C

Watch Video Solution

6. Two polarising plates have polarising directions parallel score to trasmit maxmum intensity of light through what angle most either plate be turned in the intensites of the transmitted beam is to drop by half?

A. 30°

B. 45°

C. 135°

D. Both (2) and (3) are correct

Answer: D

Watch Video Solution

7. (a) Show using a proper diagram how unpolarised light can be linearly polarised by reflection from a transparent glass surface.

(b) The figure shows a ray of light falling normally on. the face AB of an equilateral glass prism having refractive index 3/2, placed A in water of refractive index 4/3. Will this ray suffer total internal reflection on striking the face AC? Justify your answer.

A. reflected and refracted rays are mutually perpendicular

B. Both refelcted and refracted rays are palne polarised

C. refracted ray is partially polarised

D. The R.I of transparent surfaces is equal to tangent of Brewster.s angle

Answer: B

Watch Video Solution

8. Consider the following statement A and B and identify the correct answer

A) The refractive index of the extra-ordinary ray depends on the angle of incidence in double refraction

B) The vibrations of light waves acquire one sidedness fro both ordinary and extraordinary rays in double refraction

A. A and B , are true

B. A and C are true

C. B and C are true

D. A,B and C are true

Answer: D

Watch Video Solution

9. Arrange the intensities of the transmitted light in their increasing order of magnitudes when they are passed through a system of two polarisers

(A) When incident light is unpolarised and of intensity I and the angle between the polarisers is 30°

(B) When incident light is polarised of intensity 2I and the angle between the polarisers is 45°

(C) When polarised light of intensity 4I is incident and the angle between the polarisers is 90°

(D) When incident light is unpolarised and of intensity 3I and the angle between the polarisers is 30°

A. C,D,A,B

B. C,A,D,B

C. B,C,A,D

D. C,A,B,D

Answer: D

Watch Video Solution

LECTURE SHEET EXERCISE-III (LEVEL -II) (MAIN) (Straight Objective Type Questions)

1. Unpolarised light of intensity $32 W m^{-2}$ passes through three polarisers such that the transmission axis of the last polariser is crossed with first. If the intensity of the emerging light is $3 W m^{-2}$, the angle between the axes of the first two polarisers is

A. 45°

B. 60°

C. 30°

D. Zero

Answer: C

Watch Video Solution

2. The axes of the polariser and analyser are inclined to each other at 60°. If the amplitude of the polarised light emergent through analyser is A. The amplitude of unpolarised light incident on polariser is

A. $\frac{A}{2}$

B. A

C. 2A

D. $2\sqrt{2}A$

Answer: D

Watch Video Solution

3. An analyser is inclined to a polariser at an angle of 30°. The intensity of light emerging from the analyser is 1/nth of that is incident on the polariser. Then n is equal to

A. 4

B. $4/3$

C. $8/3$

D. $1/4$

Answer: C

Watch Video Solution

4. A beam of unpolarised light is incident on a tourmaline crystal C_1. The intensity of the emergent light is I_0 and it is incident on another tourmaline crystal C_2. It is found that no light emerges from C_2. If now C_1 is rotated through 45° towards C_2, the intensity of the light emerging from C_2 is

A. Zero

B. $\frac{I_0}{4}$

C. $\frac{I_0}{2}$

D. $\frac{3I_0}{4}$

Answer: C

Watch Video Solution

5. Two nicol prisms are inclined to each other at an angle 30°. If I is the intensity of ordinary light incident on the first prism, then the intensity of light emerges from the second prism will be

A. $\frac{3I}{4}$

B. $\frac{I}{2}$

C. $\frac{I}{4}$

D. $\frac{3I}{8}$

Answer: D

Watch Video Solution

Watch Video Solution

6. A polarizer and an analyser are inclined to each other at 60° The intensity of the polarized light emerging from the analyser is I. What is the intensity of the unpolarized light of incident on the polarizer?

A. 8I

B. 4I

C. 2I

D. I

Answer: B

Watch Video Solution

7. Estimate the distance for which ray optics is good approximation for an aperture of 4 mm and wavelength 400 nm ?

A. 0.01 m

B. 1600 m

C. 40 m

D. 100 m

Answer: C

Watch Video Solution

8. The aperture of telescope is of 1m diameter and wavelength of light incident on the on the paerture is $5500A^0$. The angular limit if resolution of the telescope is

A. 6.71×10^{-7} radian

B. 3.35×10^{-7} radians

C. 6.71×10^{-5} radian

D. 3.35×10^{-5} radians

Answer: A

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL I - MAIN) (Straight Objective Type Questions)

1. The displacement of two interfering light waves are $y_1 = 4 \sin \omega t$ and $y_2 = 3 \cos \omega t$. The amplitude of the resultant wave is (y_1 and y_2 are in CGS system)

A. 5 cm

B. 7 cm

C. 1 cm

D. zero

Answer: A

Watch Video Solution

2. In the case of interference, the maximum and minimum intensities are in the ratio 16 : 9. Then

A. The maximum and minimum amplitudes will be in the ratio $9:5$

B. The intensities of the individual waves will be in the ratio $4:3$

C. The amplitudes of the individual waves will be in the ratio $7:1$

D. The amplitudes of the individual waves will be in the ratio $4:1$

Answer: C

Watch Video Solution

3. Four light sources produce the following four waves :

i. $y_1 = a\text{'}\sin(\omega t + \phi_1)$

ii. $y_2 = a\text{'}\sin(2\omega t)$

iii. $y^3 = a\text{'}\sin(\omega t + \phi_2)$

iv $y_4 = a\text{'}\sin(3\omega + \phi)$

Superposition of which two waves give rise to interfernce ?

A. (i) and (ii)

B. (ii) and(iii)

C. (i) and (iii)

D. (iii) and (iv)

Answer: C

Watch Video Solution

4. A screen is at a distance of 2m that are narrow slit illuminated with light of $6000A^{\circ}$. The first maximum lies at 0.005mm on either side of the central maximum, then the distance between the slits will be

A. 0.024 mm

B. 0.24 mm

C. 2.4 mm

D. 24 mm

Answer: B

Watch Video Solution

5. In Young's double slit experiment with a mono - chromatic light of wavelength $4000A^{\circ}$, the fringe width is found to be 0.4 mm. When the slits are now illuminated with a light of wavelength $5000 A^{\circ}$ the fringe width will the

A. 0.32 mm

B. 0.5 mm

C. 0.6mm

D. 0.8mm

Answer: B

Watch Video Solution

6. The intensity of central fringe in the interference pattern produced by two indetical slits is I. When one of the slits is closed then the intensity at the same points is I_0. The relation between I and I_0 is

A. $I = 4I_0$

B. $I = 2I_0$

C. $I = I_0$

D. $I = \frac{I_0}{2}$

Answer: A

Watch Video Solution

7. In Young's double slit experiment, the 10^{th} maximum of wavelength λ_1 is at a distance y_1 from its central maximum and the 5^{th} maximum of wavelength λ_2 is at a distance y_2 from its central maximum. The ratio y_1 / y_2 will be

A. $\frac{2\lambda_1}{\lambda_2}$

B. $\frac{2\lambda_2}{\lambda_1}$

C. $\frac{\lambda_1}{2\lambda_2}$

D. $\frac{\lambda_2}{2\lambda_1}$

Answer: A

Watch Video Solution

8. In Young's double - slit experiment, the intensities at two points P_1 and P_2 on the screen are I_1 and I_2 respectively. If P_1 is located at the central bright fringe and P_2 is located at a distance equal to quarter of fringe width from P_1, then $\frac{I_1}{I_2}$ is

A. 2

B. $1/2$

C. 4

D. 16

Answer: A

Watch Video Solution

9. A mixture of light, consisting of wavelength 590 nm and an unknown wavelength, illuminates Young's double slit and gives rise to two overlapping interference patterns on the screen. The central maximum of both lights coincide. Further, it is observed that the third bright fringe of known light coincides with the 4^{th} bright fringe of the unknown light. From this data, the wavelength of the unknown light is

A. 885.0 nm

B. 442.5nm

C. 776.8nm

D. 393.4nm

Answer: B

Watch Video Solution

10. The maximum numbers of possible interference maxima for slit separation equal to twice the wavelength in Young's double slit experiment is

A. infinite

B. five

C. three

D. zero

Answer: C

Watch Video Solution

11. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 mm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will:

A. remain unshifted

B. shift downward bu nearly two fringes

C. shift upward by nearly two fringes

D. shift downward by 10 fringes

Answer: C

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL II - ADVANCED) (Straight Objective Type Questions)

1. A beam of light consisting of two wavelength , $6500A^\circ$ and $5200A^\circ$ is used to obtain interference fringes in a Young's double slit experiment $(1\text{Å} = 10^{-10}m)$. The distance between the slits 2.0 mm and the distance between the plane of the slits and the screen is 120 cm. Find the distance of the third bright fringe on the screen from the central maximum for the wavelength 6500Å.

A. 0.117 cm

B. 0.28 cm

C. 0.05 cm

D. 0.3 cm

Answer: A

Watch Video Solution

2. Find the angular separation between the consecutive bright fringes in a Young's double slit experiment with blue-green light of wavelength 500 nm. The separation between the slits is 2.0×10^{-3} m.

A. 0.14^0

B. 0.014^0

C. 0.28^{0}

D. 0.028^{0}

Answer: B

Watch Video Solution

3. Find the thickness of a plate which will produce a change in optical path equal to half the wavelength λ of the light passing through it normally. The refractive index of the plate is μ

.

A. $\frac{\lambda}{4(\mu - 1)}$

B. $\frac{2\lambda}{\mu - 1}$

C. $\frac{\lambda}{\mu - 1}$

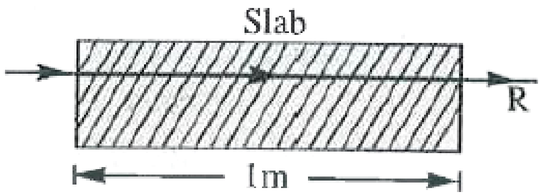
D. $\frac{\lambda}{2(\mu - 1)}$

Answer: D

Watch Video Solution

4. The figure shows a transparent slab of length m placed in air whose refractive index in x direction varies as $\mu = 1 + x^2 (0 < x < 1)$.

The optical path length of ray R will be



A. 1m

B. $\frac{2}{3}$m

C. $\frac{4}{3}$ m

D. $\sqrt{2}$ m

Answer: C

Watch Video Solution

5. Two light waves having the same wavelengths λ in vacuum are in phase initially. Then the first wave travels a path L_1 through a medium of refractive index n_1 while the second wave travels a path of length L_2 through a medium of refractive index n_2. After this the phase difference between the two waves is :

A. $\frac{2\pi}{\lambda}(L_1 - L_2)$

B. $\frac{2\pi}{\lambda}(\mu_1 L_1 - \mu_1 L_2)$

C. $\frac{2\pi}{\lambda}(\mu_2 L_1 - \mu_1 L_2)$

D. $\frac{2\pi}{\lambda}\left[\frac{L_1}{\mu_1} - \frac{L_2}{\mu_2}\right]$

Answer: C

Watch Video Solution

6. Two transparent slabs having equal thickness but different refractive indices μ_1 and μ_2, are pasted side by side to form a composite slab. This slab is placed just after the double slit in a Young's experiment so that the light from one slit goes through one material and the light from the other slit goes through the other material. What should be the minimum thickness of the slab so that there is a minimum at the point P_0 which is equidistant from the slits ?

A. $\frac{2\lambda}{\mu_1 - \mu_2}$

B. $\frac{\lambda}{4(\mu_1 - \mu_2)}$

C. $\frac{\lambda}{\mu_1 - \mu_2}$

D. $\frac{\lambda}{2(\mu_1 - \mu_2)}$

Answer: D

Watch Video Solution

7. Young's double slit experiment is carried out using microwaves of wavelength $\lambda = 3cm$. Distance between the slits is $d = 5cm$ and the distance between the plane of slits and the screen is $D = 100cm$.

(a) Find total number of maxima and

(b) their positions on the screen.

A. $0, \ + 25cm, \ - 25$ cm

B. $0, 25cm, 75cm$

C. $0, \ + 75cm, \ - 75cm$

D. $0, 25cm, 50cm$

Answer: C

Watch Video Solution

8. Light of wavelength λ_0 in air enters a medium of refractive index n. If two points A and B in this medium lie along the path of this light at a distance x, then phase difference ϕ_0 between these two points is:

A. $\phi_0 = \frac{1}{n}\left(\frac{2\pi}{\lambda_0}\right)x$

B. $\phi_0 = n\left(\frac{2\pi}{\lambda_0}\right)x$

C. $\phi_0 = (n-1)\left(\frac{2\pi}{\lambda_0}\right)x$

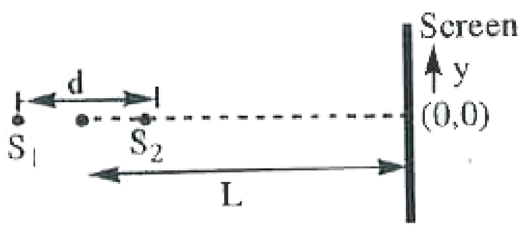
D. $\phi_0 = \frac{1}{(n-1)}\left(\frac{2\pi}{\lambda_0}\right)x$

Answer: B

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL II - ADVANCED) (More than one correct answer Type Questions)

1. The figure shows two points source which emit light of wavelength λ in phase with each other and are at a distance $d = 5.5\lambda$ apart along a line which is perpendicular to a large screen at a distance L from the centre of the source. Assume that d is much less than L. Which of the following statement is (are) correct ?



A. Only five bright fringes appear on the screen

B. Only ten bright appear on the screen

C. Point y = 0 corresponds to bright fringe

D. Point y = 0 corresponds to dark fringe .

Answer: B::D

Watch Video Solution

2. In Young's double-slit experiment, let A and B be the two slit. A thin film of thickness t and refractive index μ is placed in front of A. Let $\beta =$ fringe width. Then the central maxima will shift

A. towards A

B. towards B

C. by $t(\mu - 10)\frac{\beta}{\lambda}$

D. by $\mu t\frac{\beta}{\lambda}$

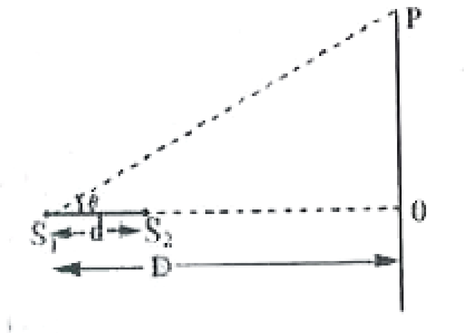
Answer: A::C

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL II - ADVANCED)

(Linked Comprehension Type Questions)

1. In the arrangement shown, a screen is placed normal to the line joining the two point coherent sources S_1 and S_2. The interference pattern consist of concentric circles. λ is the wavelength of light $(D > > d)$.



The phase difference of the interfering light at point P is

A. $\frac{2\pi}{\lambda} d \cos \theta$

B. $\frac{2\pi}{\lambda} d.\cos^3 \theta$

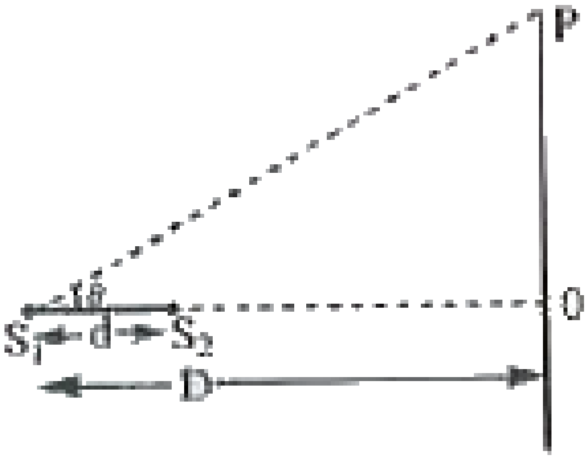
C. $\frac{2\pi}{\lambda} d \cos^2 \theta$

D. $\frac{2\pi}{\lambda} (d)$

Answer: A

Watch Video Solution

2. In the arrangement shown ,a screen is placed normal to the joining the two point coherent sources S_1 and S_2 .The interference pattern consists circles. λ is the wavelength of light $(D > > d)$.



The radius of the n^{th} bright ring is

A. $\frac{n\lambda D}{d}$

B. $d\left(1-\frac{n\lambda D}{d}\right)$

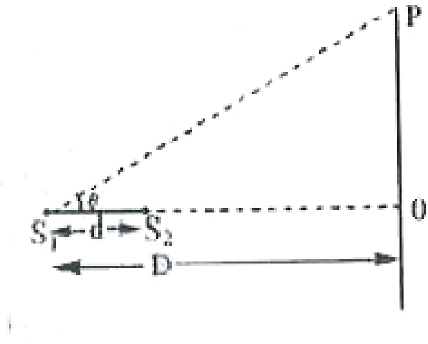
C. $D\sqrt{1-\frac{n\lambda}{d}}$

D. $D\sqrt{2\left(1-\frac{n\lambda}{d}\right)}$

Answer: D

Watch Video Solution

3. In the arrangement shown, a screen is placed normal to the line joining the two point coherent sources S_1 and S_2. The interference pattern consist of concentric circles. λ is the wavelength of light $(D >> d)$.



The phase difference of the interfering light at point P is

A. 1000th dark fringe

B. 1000th bright fringe

C. 998th dark fringe

D. 998th bright fringe

Answer: B

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL II - ADVANCED) (Matrix matching Type Questions)

1. List - I List -II

a) spherical wave front e) location of new wave front

b) plane wave front f) line source

c) cylindrical wave front g) point source at finite distance

d) Huygen's principle h) point source at infinite distance

Watch Video Solution

PRACTICE SHEET EXERCISE -I (LEVEL II - ADVANCED) (Integer Type Questions)

1. In a double-slit experiment, fringes are produced using light of wavelength $4800 A^{\circ}$. One slit is covered by a thin plate of glass of refractive index 1.4 and the other slit by another plate of glass of double thickness and of refractive index 1.7. On doing so, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the center. find the thickness of the glass plates.

Watch Video Solution

2. Two coherent monochromatic light sources are located at two vertices of an equilateral triangle if the intensity due to each of the sources independently is $1W/m^2$ at the third vertex, the resultant intensity due to both the sources at that point (i.e at the third vertex) is

Watch Video Solution

3. In a modified YDSE, monochromatic uniform and parallel beam of light of wavelength $6000A^\circ$ and intensity $\left(\frac{10}{\pi}\right)W/m^2$ is incident normally on two circular apertures A and B of radii 1 mm and 2 mm respectively. Find the ratio of the intensity of the sources $\left[\frac{I_B}{I_A}\right]$?

Watch Video Solution

PRACTICE SHEET EXERCISE -II(LEVEL I - MAIN) (Straight Objective Type Questions)

1. Light waves of wave length λ propagate in a medium. If M end N are two points on the wave front and they are separated by a distance $\lambda/4$, the phase difference between them will be (in radian)

A. $\pi / 2$

B. $\pi / 8$

C. $\pi/4$

D. Zero

Answer: A

Watch Video Solution

2. Both light and sound waves suffer diffraction. Why it is more difficult to observe diffraction with light waves?

A. Light wave do not require medium

B. Wavelength of light waves is far smaller

C. Light waves are transverse

D. Speed of light if far greater

Answer: B

Watch Video Solution

3. The crystal structure can be studied by using

A. diffraction of visible light

B. diffraction of x - rays

C. interference of sound waves

D. refraction of radio waves

Answer: B

Watch Video Solution

PRACTICE SHEET EXERCISE -II(LEVEL II - MAIN) (Straight Objective Type Questions)

1. A slit of width d is placed in front of a l ens of focal length 0.5m and is illuminated normally with light of wavelength $5.89 \times 10^{-7} m$. The first diffraction minima on either side of the central diffraction maximum are separated by $2 \times 10^{-3} m$. The width d of the slit is ________m.

A. 2.945×10^{-4}m

B. $2.945 \times 10^{-3} m$

C. 2.945×10^{-2}m

D. None

Answer: A

Watch Video Solution

2. Light of wavelength 600 nm is incident normally on a slit of width 0.2 mm. The angular width of central maxima in the diffraction pattern is (measured from minimum to minimum)

A. 0.36 degress

B. 0.18 degress

C. 0.725 degress

D. 0.09 degress

Answer: A

Watch Video Solution

3. light wavelength 5000 A incident normally on a single .The light by a convex on a sreen placed on focal minimum will be formed the angle of diffraction equal to

A. 0^0

B. 15^0

C. 30^0

D. 50^0

Answer: C

Watch Video Solution

4. In YDSE , ten maxima of two pattern (Interference) is formed in central maxima of single slit pattern (diffraction) If separtion between two slits is 1mm, then what is the width of each slit ?

A. 0.2 mm

B. 0.4 mm

C. 0.1mm

D. 0.02 mm

Answer: A

Watch Video Solution

PRACTICE SHEET EXERCISE-III (LEVEL -I) (MAIN) (Straight Objective Type Questions)

1. The critical angle of a transparent crystal is 45°. Then its polarizing angle is

A. $\theta = \tan^{-1}(\sqrt{2})$

B. $\theta = \sin^{-1}(\sqrt{2})$

C. $\theta = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

D. $\theta = \cot^{-1}(v/c)$

Answer: A

Watch Video Solution

2. The phenomenon of polarisation of electromagnetic wave proves that the electromagnetic waves are

A. longitudinal

B. transverse

C. neither longitudinal nor transverse

D. both longitudinal and transverse

Answer: B

Watch Video Solution

3. Suppose θ is the polarizing angle for a transparent medium and the speed of light in that medium is v. (Then according to Brewster law)

A. $\theta = \cot^{-1}(v/c)$

B. $\theta = \cos^{-1}(v/c)$

C. $\theta = \sin^{-1}(v/c)$

D. $\theta = \operatorname{cosec}^{-1}(v/c)$

Answer: A

Watch Video Solution

4. The amplitude of polarised light transmitted through a polariser is A. The amplitude of unpolarised light incident on it is

A. $\frac{A}{2}$

B. $\frac{A}{\sqrt{2}}$

C. $2A$

D. $\sqrt{2}A$

Answer: D

Watch Video Solution

5. Two beams, A and B, of plane polarized light with mutually perpendicular planes of polarization are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of Polaroid through 30^0 makes the two beams appear equally bright. If the initial intensities of the two beams are I_A and I_B respectively, then I_A / I_B equals :-

A. $1:3$

B. $3:1$

C. $\sqrt{3} : 1$

D. $1 : \sqrt{3}$

Answer: A

Watch Video Solution

PRACTICE SHEET EXERCISE-III (LEVEL -II) (MAIN) (Straight Objective Type Questions)

1. A ray of light in air is incident on a glass plate at polarising angle of incidence. It suffers a deviations of 22° on entering glass. The angle of polarisation is

A. 90°

B. 56°

C. 68°

D. zero

Answer: B

Watch Video Solution

2. At what angle to the horizon the sun be for is reflected rays from the surface of pond to be completely polarized (μ of water =1.33)

A. $16^\circ 56$

B. $26^\circ 56$

C. $36^\circ 56$

D. $46^\circ 56$

Answer: C

Watch Video Solution

3. An analyser is inclined to a polariser at an angle of 30°. The intensity of light emerging from the analyser is 1/nth of that is incident on the polariser. Then n is equal to

A. 10^{-4} joule

B. 10^{-3} joule

C. 10^{-2} joule

D. 10^{-1} joule

Answer: B

Watch Video Solution

4. A beam of plane polarized light having flux 10^{-3} Watt falls normally on polarizer of cross sectional area $3 \times 10^{-4} m^2$. Polarizer rotates with angular frequency of 31.4 rad/s. Energy of light passes through the polarizer per revolution will be

A. 10^{-4} Joule

B. 10^{-3} joule

C. 10^{-2}joule

D. 10^{-1} joule

Answer: A

Watch Video Solution

5. Two polaroids are kept crossed to each other . If one of them is rotated an angle 60° , the percentage of incident light now transmitted through the system is

A. 37.5%

B. 0.4

C. 0.2

D. 0.5

Answer: A

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL - I) (MAIN) (Straight Objective Type Questions)

1. The phase difference between two waves reaching a point is $\frac{\pi}{2}$. What is the resultant amplitude. If the individual amplitude are 3 mm and 4mm ?

A. 1 mm

B. 2 mm

C. 3 mm

D. 5 mm

Answer: D

Watch Video Solution

2. Three coherent waves having amplitudes 12mm, 6mm and 4mm arrive at a given point with successive phase difference of $\frac{\pi}{2}$. Then, the amplitude of the resultant wave is

A. 7 mm

B. 10 mm

C. 5 mm

D. 4.8 mm

Answer: B

Watch Video Solution

3. For destructive interference to take place between two monochronic light waves of wavelength the path difference should be

A. $\frac{(2n-1)\lambda}{2}$

B. $2n\lambda$

C. $\frac{(2n+1)\lambda}{4}$

D. $n\lambda$

Answer: C

Watch Video Solution

4. If the amplitude ratio of two sources producing interference is $3:5$ then the ratio of intensities at maxima and minima is

A. $25:16$

B. $5:3$

C. $16:1$

D. $25:9$

Answer: C

Watch Video Solution

5. Young's double slit experiment is made in a liquid. The tenth bright fringe in liquid lies in screen where 6th dark fringe lies in vacuum. The refractive index of the liquid is approximately

A. 1.8

B. 1.54

C. 1.67

D. 1.2

Answer: A

Watch Video Solution

6. In Young's double slit experiment, the intensity of light at a point on the screen where path difference is λ is I. If intensity at another point is I/4, then possible path differences at this point are

A. $\frac{\lambda}{2}, \frac{\lambda}{3}$

B. $\frac{\lambda}{3}, \frac{2\lambda}{3}$

C. $\frac{\lambda}{3}, \frac{\lambda}{4}$

D. $\frac{2\lambda}{3}, \frac{\lambda}{3}$

Answer: B

Watch Video Solution

7. In Young's double slit experiment the distance between slits is $2 \times 10^{-3} m$, the distance between screen and slits is 200 cm. When the light of wave length $5000 A^{\circ}$ is used, the central maximum is at x=0 . the third maximum will be at x equal to

A. 2 mm

B. 0.05 mm

C. 1 mm

D. 0.5 mm

Answer: D

Watch Video Solution

8. In Young's double slit experiment, when light of wavelength $4000A^{\circ}$ is used 90 fringes are seen on the screen. When light of 3000 A is used, the number of fringes seen is

A. 70

B. 120

C. 140

D. 68

Answer: B

Watch Video Solution

9. In Young`s double slit experiment, the phase different between two coherent sources of equal intensity is $\pi/3$.The intensity at a point which is at equal distance from the two slits is

(I0 is maximum intensity)

A. $\frac{\sqrt{3}}{2}I_0$

B. $\frac{I_0}{\sqrt{2}}$

C. $\frac{1}{2}I_0$

D. $\frac{3}{4}I_0$

Answer: D

Watch Video Solution

10. Monochromatic green light of wavelength $5 \times 10^{-7} m$ illuminates a pair of slits 1 mm apart. The separation of bright lines on the interference pattern formed on a screen 2m away is

A. 0.25 mm

B. 0.1 mm

C. 1.0 mm

D. 0.01 mm

Answer: C

Watch Video Solution

11. 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

A. 2λ

B. λ

C. $\frac{2}{3}\lambda$

D. $\frac{\lambda}{3}$

Answer: A

Watch Video Solution

12. In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to

400 nm, number of fringes observed in the same segment of the screen is given by

A. 18

B. 12

C. 24

D. 30

Answer: A

Watch Video Solution

13. Young's double-slit experiment is carried ot by using green, redj and blue light, one color at a time. The fringe widths recorded are β_G, β_R and β_B, respectively. Then,

A. $\beta_G > \beta_\beta > \beta_R$

B. $\beta_B > \beta_G > \beta_{R0}$

C. $\beta_R > \beta_B > \beta_G$

D. $\beta_R > \beta_G > \beta_B$

Answer: D

Watch Video Solution

14. It is belived that the Universe is expanding and hence the distant stars receding from us. Light form such a star will show

A. shift in frequency towards longer wavelength

B. shift in frequency towards shorter wavelength

C. No shift in frequency but a decrease in intensity

D. A shift in frequency sometimes towards longer and sometimes towards shorter wavelength

Answer: A

Watch Video Solution

15. The 6563 $\overset{o}{A}$ line emitted by hydrogen atom in a star is found to be red shifted by 5 $\overset{o}{A}$. The speed with which the star is receding from the earth is:

A. 17.3×10^3 m/s

B. 4.29×10^7 m/s

C. 3.39×10^5 m/s

D. 2.29×10^5 m/s

Answer: D

Watch Video Solution

16. In context of Doppler's effect in light, the term 'red shift' sighifies

A. Decrease in frequency

B. Increase in frequency

C. Decrease in intensity

D. Increase in intensity

Answer: A

Watch Video Solution

17. Light enters in a glass slab of refractive index 3/2 and covers a distance 20 cm. The optical path of it is

A. 40 cm

B. 30 cm

C. 40/3 cm

D. 60 cm

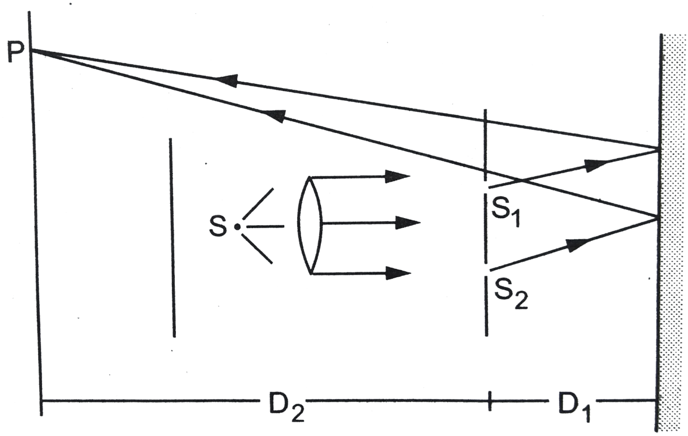
Answer: B

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL - II) LECTURE SHEET (ADVANCED) (Straight Objective Type Questions)

1. A double slit $S_1 - S_2$ is illuminated by a coherent light of wavelength λ. The slits are separated by a distance d. A plane mirror is placed in front of the double slit at a distance D_1, from it and a screen $\sum$ is placed behind the double slit at a distance D_2, from it . The screen $\sum$ receives only the light reflected by the mirror. Find the fringe-width of the

interference pattern on the screen.



A. $\dfrac{\lambda}{d}(D_1 + D_2)$

B. $\dfrac{2\lambda}{d}(D_1 + 2D_2)$

C. $\dfrac{\lambda}{d}(2D_1 + D_2)$

D. $\dfrac{\lambda}{2d}(D_1 + D_2)$

Answer: C

Watch Video Solution

2. The coherent point sources S_1 and S_2 vibrating in same phase emit light of wavelength λ. The separation between the sources is 2λ. Consider a line passing through S_2 and perpendicular to the line S_1S_2. What is the smallest distance from S_2 where a minimum of intensity occurs due to interference of waves from the two sources?

A. $\frac{5\lambda}{2}$

B. $\frac{3\lambda}{2}$

C. $\frac{7\lambda}{12}$

D. $\frac{3\lambda}{4}$

Answer: C

Watch Video Solution

3. In a Young's double slit interference experiment the fringe pattern is observed on a screen placed at a distance D from the slits. The slits are separated by a distance d and are illuminated by monochromatic light of wavelength λ. Find the distance from the central point where the intensity falls to (a) half the maximum, (b) one fourth of the maximum.

A. $\frac{D\lambda}{4d}, \frac{D\lambda}{3d}$

B. $\frac{D\lambda}{d}, \frac{D\lambda}{2d}$

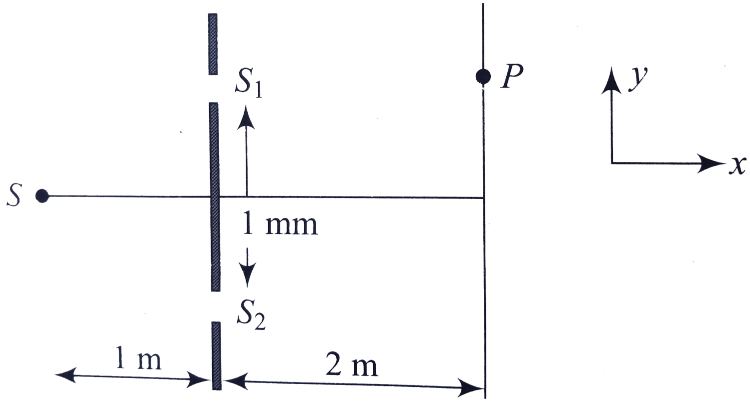
C. $\frac{D\lambda}{d}, \frac{D\lambda}{2d}$

D. $\frac{D\lambda}{4d}, \frac{D\lambda}{d}$

Answer: A

Watch Video Solution

4. In young's double-slit experiment set up, sources S of wavelength 50 nm illumiantes two slits S_1 and S_2 which act as two coherent sources. The sources S oscillates about its own position according to the equation $y = 0.5 \sin \pi t$, where y is in nm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exaclty in front of the upper slit becomes minimum is



A. $y = (\cos 2\pi t) mm$

B. $y = -(\sin \pi t) mm$

C. $y = -(\cos 2\pi t) mm$

D. $y = (\sin 2\pi t) mm$

Answer: B

Watch Video Solution

5. In the above problem, minimum value of t for which the intensity at point P on the screen exactly in front of the upper slit becomes maximum.

A. 0.167 s

B. 0.5 s

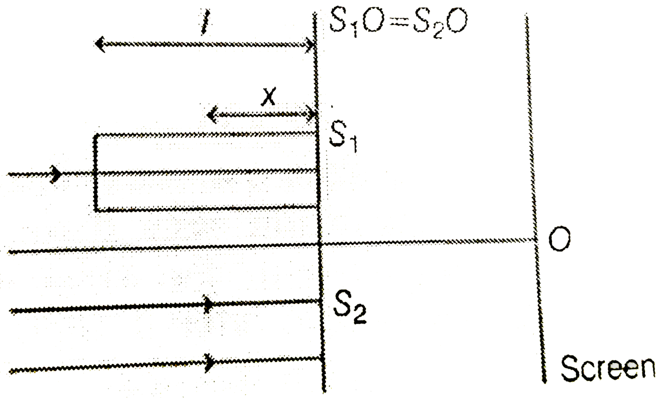
C. 0.012 s

D. 0.3 s

Answer: A

Watch Video Solution

6. In the figure shown, a parallel beam of light is incident on the plane of the slits of a Young's double slit experiment. Light incident on the slit S_1 passes through a medium of variable refractive index $\mu = 1 + ax$(where'x' is the distance from the the plane of slits as shown), upto a distance 'l' before falling on S_1. Rest of the speace is filled with air. If at O a minima is formed, then the minimum value of the positive constant a (in term of l and wavelength $'\lambda'$ in air) is:



A. $\frac{\lambda}{l}$

B. $\frac{\lambda}{l^2}$

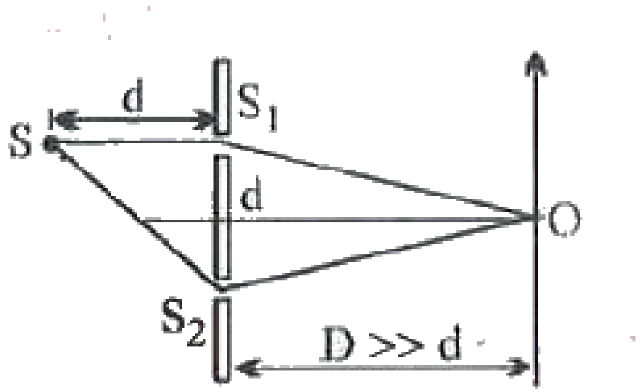
C. $\frac{l^2}{\lambda}$

D. None of these

Answer: B

Watch Video Solution

7. To make the central fringe at the center O , a mica - sheet index 1.5 is introduced .Choose the correct statement (s)



A. The thickness of sheet is $2(\sqrt{2}-1)$ d infront of S_1

B. The thickness of sheet is $(\sqrt{2}-1)$ d infront of S_2

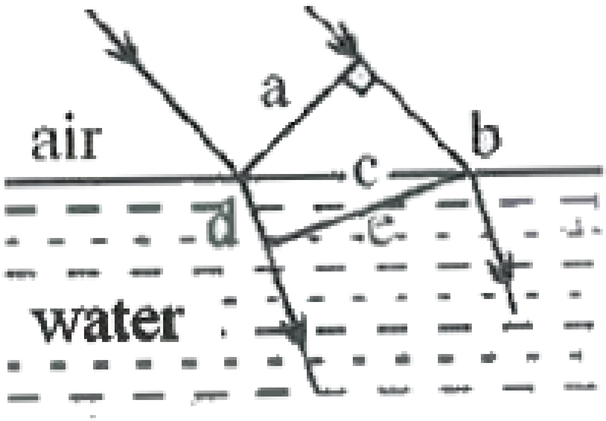
C. The thickness of sheet is $2\sqrt{2}d$ infront of S_1

D. The thickness of sheet is $(2\sqrt{2}-1)$ d front of S_1

Answer: A

Watch Video Solution

8. Figure shown plane waves refracted for air to water using Huygen.s principle a,b,c,d ,e are lengths on the diagram . The ratio of refractive index of water w.r.t air is



A. a/e

B. b/e

C. b/d

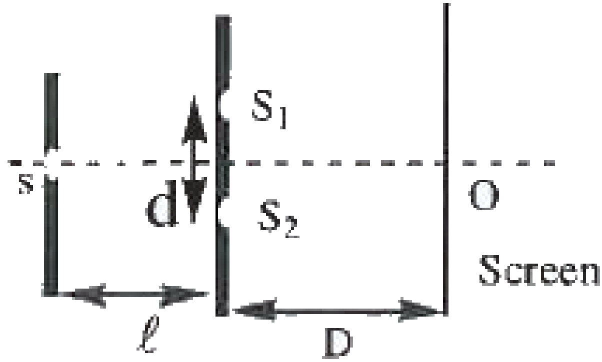
D. d/b

Answer: C

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL - II) LECTURE SHEET (ADVANCED) (More Than one correct Type Questions)

1. The figure shows a schematic diagram showing the arrangement of Young.s Double Slit Experiment



Choose the correct statement (s) related to the wavelength of light used

A. Larger the wavelength of light larger the fringe width

B. The position of central maxima depends on the wavelength of light used

C. If white light is used in YDSE , then the violet colour forms its first maxima closest to the central maxima

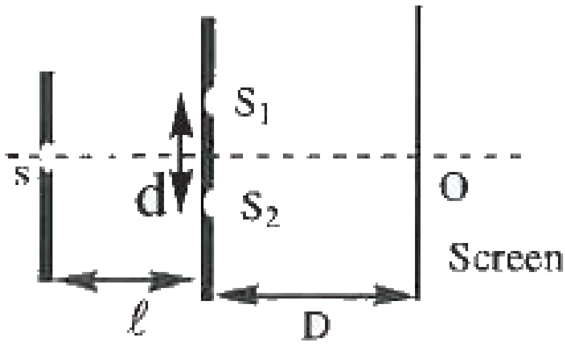
D. The central maxima of all the wavelength coincide

Answer: A::C::D

Watch Video Solution

2. The figure shows a schematic diagram showing the arrangement of Young.s Double

Slit Experiment



If the distance d is varied ,then indentify the correct statement

A. The angular width does not change

B. The fringe width changes in inverse proportion

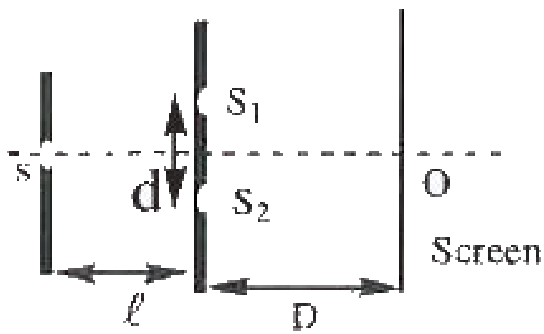
C. The position of all minima change

D. The positions of all minima change

Answer: B::D

Watch Video Solution

3. The figure shows a schematic diagram showing the arrangement of Young.s Double Slit Experiment



If the distance D is varied , then choose the correct statement (s)

A. The angular fringe width does not change

B. The fringe width changes in direct proportion

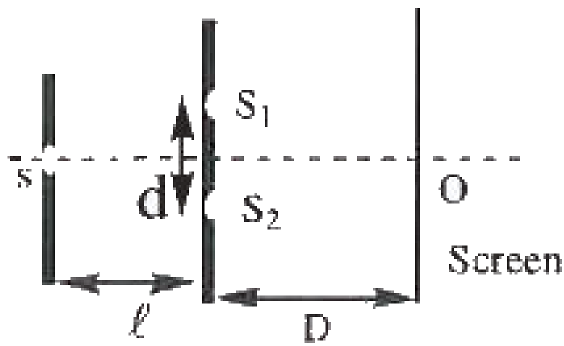
C. The change in fringe width is same for all wavelengths

D. The position of central maxima remains unchanged

Answer: A::B::D

Watch Video Solution

4. The figure shows a schematic diagram showing the arrangement of Young.s Double Slit Experiment



Identify the correct statement (s) if the source slit S moved closer to S_1S_2 i.e the distance l decreases

A. nothing happens to fringe pattern

B. fringe pattern may gets less sharp

C. fringe width remains unchanged

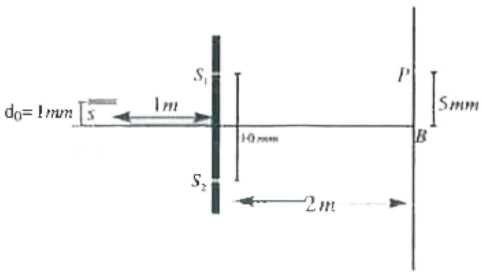
D. fringe pattern may disappear

Answer: B::C::D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL - II) LECTURE SHEET (ADVANCED) (Linked Comprehension Type Questions)

1. In Young's double slit experiment the point source is placed slightly off the central axis as shown in figure. The plane of slits (S_1, S_2) and screen are separated by a distance of 2m. The separation between the slits is 10 mm. The position of the slit above the axis is 1mm. if the wavelength $\lambda = 4000Å$ in the above arrangement



The thickness of the film in the above case is

A. 0.8 mm

B. 0.04 mm

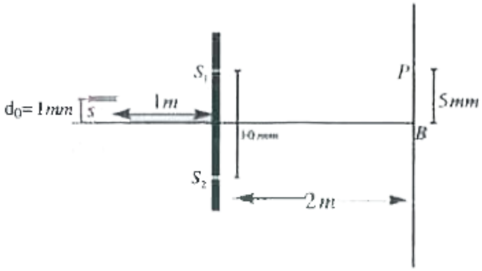
C. 0.035 mm

D. 0.045 mm

Answer: C

Watch Video Solution

2. In Young's double slit experiment the point source is placed slightly off the central axis as shown in figure. The plane of slits (S_1, S_2) and screen are separated by a distance of 2m. The separation between the slits is 10 mm. The position of the slit above the axis is 1mm. if the wavelength $\lambda = 4000 \text{Å}$ in the above arrangement



The thickness of the film in the above case is

A. S_1 to P such that

$$[SS_1 + S_1P(\mu - 1)t] - [SS_2 + S_2P] = 0$$

B. S_2 to P such that

$$[SS_2 + S_2P + (\mu - 1)t] - [SS_1 + S_1P] = 0$$

C. S_1 to P such that

$$[SS_2 + SS_1] - [S_1P + (\mu - 1)t + S_2P] = 0$$

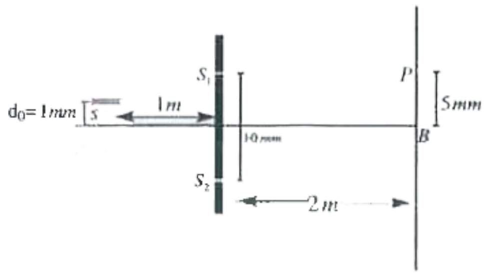
D. S_1 to P such that

$$[SS_1 + SS_2] - [S_1P + (\mu - 1)t + S_1P] = 0$$

Answer: A

Watch Video Solution

3. In Young's double slit experiment the point source is placed slightly off the central axis as shown in figure. The plane of slits (S_1, S_2) and screen are separated by a distance of 2m. The separation between the slits is 10 mm. The position of the slit above the axis is 1mm. if the wavelength $\lambda = 4000\text{Å}$ in the above arrangement



The thickness of the film in the above case is

A. 0.035 mm

B. 0.45 mm

C. 0.060 mm

D. 0.070 mm

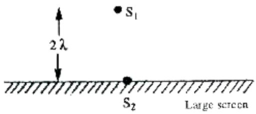
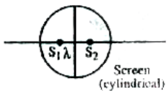
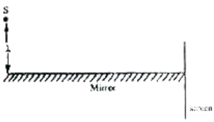
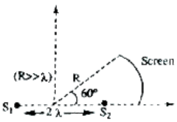
Answer: D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL - II) LECTURE SHEET (ADVANCED) (Matrix Matching Type Questions)

1. S_1 and S_2 in List I represent coherent point sources, S represents a point source λ = wavelength of light emitted by the sources.

Fringe pattern is observed on the screen. Exclude the position of source while detecting the fringe pattern.

Column - I	Column - II
A) 	p) Number of maxima = 2 and number of minima = 1
B) 	q) Number of maxima = 2 and number of minima = 4
C) 	r) Number of maxima = 4 and number of minima = 4
D) 	s) Number of maxima = 2 and number of minima = 2

Watch Video Solution

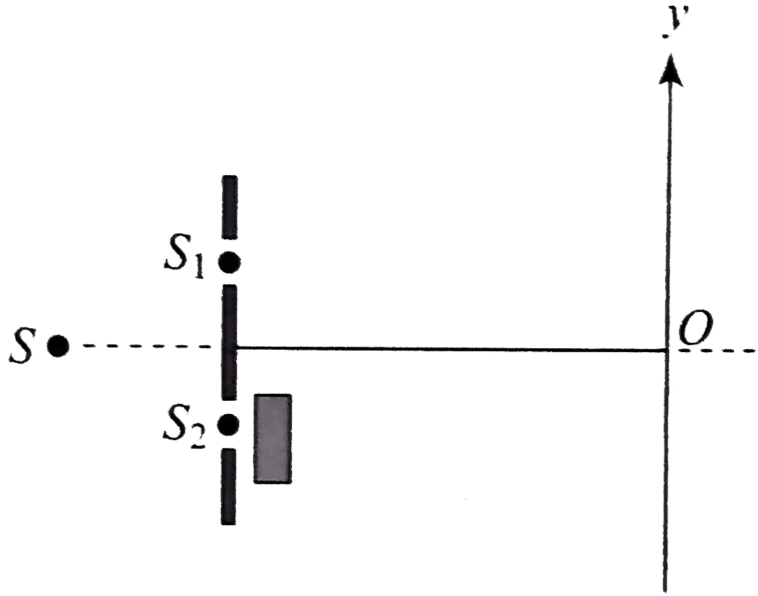
ADDITIONAL PRACTICE EXERCISE (LEVEL - II) LECTURE SHEET (ADVANCED) (Integer Type

Quesiton)

1. Two coherent sources are placed 0.9 mm apart and the fringes are observed one metre away. If it produces the second dark fringe at a distance of 10 mm from the central fringe. The wavelength of monochromatic light is $x \times 10^{-4} cm$, What is the value of x ?

Watch Video Solution

2. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



Now, if 600 nm, find the wavelength of the ligth that forms maximum exactly at point O.

Watch Video Solution

3. Two transparent slabs having equal thickness 0.45 mm and refractive indices 1.40 and 1.42 are pasted on the two slits of a double slit apparatus. The separation of slits equals 1mm. Wavelength of light used equals 600 nm. The screen is placed at a distance 1m from the plane of the slits. The central maxima from the centre of the screen is [in mm]

Watch Video Solution

ADDITIONAL PRACTICE PRACTICE SHEET (ADVANCED) Straight Objective Type Questions)

1. For what distance is ray optics a good approximation when the aperture is 4 mm wide and the wavelength is 500 nm?

A. 32 m

B. 69 m

C. 16 m

D. 8 m

Answer: A

Watch Video Solution

2. An unpolarized light with intensity $2I_0$ is passed through a polaroid. The resultant intensity of the transmitted light will be

A. I_0

B. $\frac{I_0}{2}$

C. $\frac{I_0}{4}$

D. zero

Answer: B

Watch Video Solution

3. Refractive index of material is equal to the tangent of polrasing angle. It is called

A. Brewster.s law

B. Lamber.s law

C. Malus. alw

D. Bragg.s law

Answer: A

Watch Video Solution

4. Two nicols are oriented with then principal planes making an anlge of 60°. The percentage of incident unpolarized light which passes through the system is:

A. 0.5

B. 1

C. 12.5%

D. 37.5%

Answer: C

Watch Video Solution

5. When the angle of incidence on a material is 60°, the reflected light is completely polarized. The velocity of the refracted ray inside the material is: (in ms^{-1}).

A. 3×10^8

B. $\frac{3}{\sqrt{2}} \times 10^8$

C. $\sqrt{3} \times 10^8$

D. 0.5×10^8

Answer: C

Watch Video Solution

6. A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of incident beam. At the first maximum of the diffraction pattern the phase difference between the rays coming from the edges of the slit is:

A. 0

B. $\pi/2$

C. π

D. 2π

Answer: D

Watch Video Solution

7. A slit 5cm wide is irradiated normally with microwaves of wavelength 1cm. Then the angular spread of the central maxima on either side of the incident light is nearly

A. 1/5 radian

B. 4 radian

C. 5 radian

D. 6 radian

Answer: A

Watch Video Solution

8. A narrow slit of width 1 mm is illuminated by monochromatic light of wavelength 600 nm. The distance between the first minima on either side of a screen at a distance of 2 m is

A. $1.2cm$

B. 1.2 cm

C. 2.4 cm

D. 2.4 cm

Answer: D

Watch Video Solution

9. A beam of unpolarised light passes through a tourmaline crystal A and then it passes through a second tourmaline crystal B oriented so that its principal plane is parallel to that of A. The intensity of emergent light is I_0. Now B is rotated by 45° about the ray. The emergent light will have intensity

A. $\frac{I_0}{2}$

B. $\frac{I_0}{\sqrt{2}}$

C. $I_0\sqrt{2}$

D. $2I_0$

Answer: A

Watch Video Solution

10. Two polaroid's are oriented with their planes perpendicular to incident light and transmission axis making an angle of 30° with each other. What fraction of incident unpolarized light transmitted?

A. 1

B. $1/2$

C. $1/4$

D. $1/16$

Answer: C

Watch Video Solution

11. The true statements regarding refractive index of a material are

(A) it depends on the nature of the material (B) it increases with temperature

(C) it decreases with increases in wavelength

(D) it is inversely proportional to velocity of light in the medium

A. A,C,D

B. B,C,D

C. A,B,D

D. A,B,C

Answer: A

Watch Video Solution

12. If 'b' represents the size of object interacting with light L represents the distance between object and screen X is the wavelength of light then, match the following lists.

Column - I	Column - II
a) Fraunhoffer diffraction	d) $\frac{b^2}{L\lambda} \approx 1$
b) Fresnel diffraction	e) $\frac{b^2}{L\lambda} << 1$
c) Geometrical optics	f) $\frac{b^2}{L\lambda} >> 1$

1) $a \to d, b \to e, c \to f$
2) $a \to e, b \to f, c \to d$
3) $a \to e, b \to d, c \to f$
4) $a \to f, b \to e, c \to d$

Watch Video Solution

EXAMPLE

1. A plane wave that falls on a barrier containing small circular opening of dimension d. What can be said about the behaviour of the wave if $(i) \lambda < \, < d, (ii) \lambda = d, (iii) \lambda > \, > d$

Watch Video Solution

2. An obstacle such as a telephone pole can cast a clear shadow in the light from a distant source. No such effect is noticed for the sound from a distant car horn. Why?

Watch Video Solution

3. Two coherent sources emit light waves which superimpose at a point where these can be expressed as

$$E_1 = E_0 \sin(\omega t + \pi / 4)$$

$$E_2 = 2E_0 \sin(\omega t - \pi / 4)$$

Here, E_1 and E_2 are the electric field strenghts of the two waves at the given point.

If I is the intensity of wave expressed by field strenght E_1, find the resultant intensity

Watch Video Solution

4. A beam of light consisting of two wavelength, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double - slit experiment. Find the distance of the third bright fringe on the screen from the central maximum for wavelengths 650 nm.

Watch Video Solution

5. Maximum intensity in YDSE is I_0. Find the intensity at a point on the screen where

(a) The phase difference between the two interfering beams is $\frac{\pi}{3}$.

(b) the path difference between them is $\frac{\lambda}{4}$.

Watch Video Solution

6. Two coherent sources are 0.15 mm apart and fringes are observed at 1 m away with monochromatic light of wavelength 6000Å. Find (a) the fringe width in air, (b) the fringe width in a liquid of refractive index 5/2.

Watch Video Solution

7. Two coherent sources are 0.2 mm apart and the fringes are observed on a screen 80cm away. It is found that with a certain monochromatic source of light, the fifth bright fringe is situated at a distance of 12 mm from the central fringe. Calculate the wavelength of light.

Watch Video Solution

8. Bichromatic light is used in YDSE having wavelengths $\lambda_1 = 400nm$ and $\lambda_2 = 700nm$ Find minimum order of λ_1 which overlaps with λ_2

Watch Video Solution

9. Young's double slit experiment is carried out using microwaves of wavelength $\lambda = 3cm$. Distance between the slits is $d = 5cm$ and the distance between the plane of slits and the screen is $D = 100cm$.

(a) Find total number of maxima and

(b) their positions on the screen.

Watch Video Solution

10. In YDSE, the two slits are separated by 0.1 mm and they are 0.5 m from the screen. The wavelength of light used is 5000 Å. Find the distance between 7th maxima and 11 th minima on the upper side of screen.

Watch Video Solution

11. An interference is observed due to two coherent sources S_1 placed at origin and S_2 placed at $(0, 3\lambda, 0)$. Here, lambda is the wavelength of the sources. A detector D is moved along the positive x-axis. Find x-coordinates on the x-axis (excluding $x = 0$ and $x = \infty$) where maximum intensity is observed.

Watch Video Solution

12. Two coherent fight sources A and B with separation 2λ are placed on the x-axis symmetrically about the origion. They emit light of wavelength λ. Obtain the positions of maxima on a circle of large radius, lying in the x-y plane and with centre at the origion.

Watch Video Solution

13. A thin sheet of glass $(\mu = 1.520)$ is introduced normally in the path of one of the two interfering waves. The central bright fringe is observed to shift to position originally occupied by the fifth bright fringe. If $\lambda = 5890\text{Å}$. Find the thickness of the glass sheet.

Watch Video Solution

14. A double - slit apparatus is immersed in a liquid of refractive index 1.33 it has slit separation of 1mm and distance between the plane of slits and screen 1.33 m the slits are illuminated by a parallel beam of light whose wavelength in air is 800 nm.

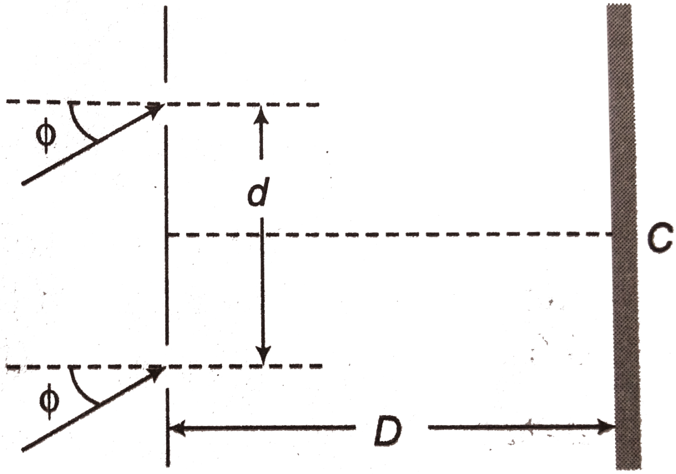
(i) Calculate the fringe width.

(ii) One of the slits of apparatus is covered by a thin glass sheet of refractive index 1.53 Find the smallest thickness of the sheet to bring the adjacent minima on the axis.

Watch Video Solution

15. Light of wavelength $\lambda = 500 nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^{\circ}$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

Watch Video Solution

16. A thin film is illuminated by wavelength 600 nm in free space at nearly normal incidence. Calculate the minimum thickness of a thin film ($\mu = 3/2$) that results in constructive interference in the reflected light.

Watch Video Solution

17. A screen is placed 50 cm from a single slit which is illuminated with light of wavelength 6000 Ã…. If the distance between the first and third minima in the diffraction pattern is 3.0 mm. The width of the slit is

Watch Video Solution

18. In a single slit diffraction experiment first minima for $\lambda_1 = 660 nm$ coincides with first maxima for wavelength λ_2. Calculate the value of λ_2.

Watch Video Solution

19. For what distance is ray optics a good approximation when the aperture is 3 mm wide and the wavelength is 500 nm?

Watch Video Solution

20. Assume that light of wavelength 6000Å is coming from a star. What is the limit of resolution of a telescope whose objective has a diameter of 100 inch

Watch Video Solution

21. A microscope has objective of aperture 8mm and focal length $2.5cm$. Estimate its resolving power. Given $\lambda = 5500\dot{A}$.

Watch Video Solution

22. Light of wavelength 589 nm is used to view an object under a microscope. The aperature of the objective has a diameter of $0.900cm$. Find The limiting angle of resolution.

Watch Video Solution

23. The objective of a microscope has a focal length of 1 cm and diameter 0.5 cm. Using light of 6000 Å, is it possible to resolve the two point objects if they are separated by a distance of $10^{-6}m$?

Watch Video Solution

24. When light of a certain wavelength is incident on a plane surface of a material at a glancing angle 30°, the reflected light is found to be completely plane polarized Determine Angle of refraction.

Watch Video Solution

25. Unpolarized light falls on two polarizing sheets placed one on top of the other. What must be the angle between the characteristic directions of the sheets if the intensity of the final transmitted light is one - third the maximum intensity of the first transmitted beam

Watch Video Solution

Watch Video Solution

26. A circular beam of light of diameter (width) falls on a plane surface of glass. The angle of incidence is .I., angle of refraction is .r. and refractive index of glass is μ. Then the diameter of the refracted beam d. is.......

Watch Video Solution

27. Two polaroid's are oriented with their planes perpendicular to incident light and

transmission axis making an angle of 30° with each other. What fraction of incident unpolarized light transmitted?

Watch Video Solution

EXERCISE (LONG ANSWER QUESTIONS (INTERFERENCE))

1. Describe Young's double slit experiment to produce interference pattern due to a monochromatic source of light. Deduce the expression for the fringe width.

Watch Video Solution

2. If one of the slits in Young's double slit experiment is fully closed, the new pattern has ----------- central maximum in angular size.

Watch Video Solution

3. What are coherent sources? How are they realized in practice?

Watch Video Solution

4. Derive an expression for the resultant intensity when two coherent beams of light are superposed for two slits of equal intensity.

Watch Video Solution

EXERCISE (LONG ANSWER QUESTIONS (DIFFRACTION))

1. Describe and explain the Fraunhoffer diffraction pattern obtained with narrow slit and illuminated by parallel beam of monochromatic light.

Watch Video Solution

EXERCISE (LONG ANSWER QUESTIONS (POLARIZATION))

1. What is polarized light. Explain how plane polarized light is obtained by reflection and refraction.

Watch Video Solution

EXERCISE (SHORT ANSWER QUESTIONS (INTERFERENCE))

1. Interference pattern can not be obtained when two different sources of same wavelength are used. Why?

Watch Video Solution

2. State one condition for obtaining a sustained interference of light.

Watch Video Solution

3. Explain optical path in denser medium

Watch Video Solution

4. Write the applications of interference.

Watch Video Solution

EXERCISE (SHORT ANSWER QUESTIONS (DIFFRACTION))

1. Do sound waves exhibit diffraction? Give reason to your answer?

Watch Video Solution

2. Write about the main features in which Fraunhoffer and Fresnel approaches of diffraction differ?

Watch Video Solution

3. Mention the applications of diffraction.

Watch Video Solution

4. Radio waves diffract more easily than visible light waves. Give reason.

Watch Video Solution

5. Draw the intensity patten for single slit diffraction and double slit interference. Hence , state two differences between interference and diffraction patterns.

Watch Video Solution

6. Define diffraction phenomenon of light. What are its type.

Watch Video Solution

7. What are the Fresnel's half period zones?

Watch Video Solution

8. Define magnifying power and resolving power of a telescope.

Watch Video Solution

9. Distinguish between geometric and physical (wave) approximations of light.

Watch Video Solution

EXERCISE (SHORT ANSWER QUESTIONS (POLARIZATION))

1. What is polarized light. Explain how plane polarized light is obtained by reflection and refraction.

Watch Video Solution

2. What is meant by refraction of light?

Watch Video Solution

3. What are the applications of polarization of light?

Watch Video Solution

4. If θ_C is the critical angle and θ_P is the polarizing angle for a transparent medium, show that $\sin\theta_C = \cot\theta_P$

Watch Video Solution

5. When a ray of ordinary light is incident on the surface of separation of two media at polarizing angle, show with the help of a labelled diagram that reflected ray and the refracted ray are mutually perpendicular to each other.

Watch Video Solution

6. State and explain law of Malus.

Watch Video Solution

7. State polarizer and analyser.

Watch Video Solution

8. Explain polarization by scattering.

Watch Video Solution

9. Write the effect of analyser on polarized light.

Watch Video Solution

EXERCISE (VERY SHORT ANSWER QUESTIONS (INTERFERENCE))

1. If we move from first order to second order bright in YDSE, how does the path difference change. Does it increase or decrease? If so, how much in terms of wavelength λ?

Watch Video Solution

2. How does the spacing between fringes in Young's double slit experiment change. (a) if the slit separation is increased? (b) if the colour of the light is changed from red to blue?

Watch Video Solution

3. A Young's double slit experiment is performed with white light.

Watch Video Solution

4. Two waves of same frequency have amplitudes A and 2A. They interfere at a point where their phase difference is 60°. What is the resultant amplitude?

Watch Video Solution

5. Can Young's double slit experiment be conducted with sound? How can we carry out this experiment?

Watch Video Solution

6. The maximum intensity at bright fringe is 4 times that of either wave. Does this violate energy conservation? If not, why?

Watch Video Solution

7. Can the head lights of a distant car produce interference pattern? If so, how it is observed? If not, why?

Watch Video Solution

8. A beam of light consisting of two wavelength, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double - slit experiment. Find the distance of the third bright fringe on the screen from the central maximum for wavelengths 650 nm.

Watch Video Solution

9. What is the law of conservation of energy?

Watch Video Solution

10. What are coherent sources? How are they realized in practice?

Watch Video Solution

11. On reflection of light wave from rarer medium. What is the effect on its (a) path difference (b) phase.

Watch Video Solution

12. In Young's double slit experiment, if the two slits are illuminated with separate sources, no interference pattern is observed because

Watch Video Solution

13. Why are parallel slits preferable to the pin holes that Young used in demonstrating interference?

Watch Video Solution

14. Is it necessary to have two waves of equal intensity to study interfrence pattern? Will there be an effect on clarity if the waves have unequal intensity?

Watch Video Solution

15. In Young's double -slit experiment, why do we use mono chromatic light ? If while light is used, how would the pattern change ?

Watch Video Solution

16. What change in interference pattern takes place in Young's double slit experiment (a) if the experiment is performed under water instead of air and (b) if one of the slits is covered with a transparent sheet?

Watch Video Solution

17. State the principle of superposition of waves.

Watch Video Solution

18. For the sustained interference of light, the necessary condition is that the two sources should-

Watch Video Solution

19. When a thin metal plate is placed in the path of one of the interfering beams of light

Watch Video Solution

20. What is resultant intensity at a point due to two identical sources of each of intensity I_0 (a) If the sources are coherent (b) Sources are incoherent

Watch Video Solution

21. What can you say about the motion of an object if its speed- time graph is a straight line parallel to the time axis?

Watch Video Solution

22. Write the difference between coherent and incoherent waves.

Watch Video Solution

23. The initial phase difference between two coherent waves is π . What type of fringe occur at centre of the screen in YDSE.

Watch Video Solution

EXERCISE (VERY SHORT ANSWER QUESTIONS (DIFFRACTION))

1. Can diffraction be without interference? Can interference be without diffraction?

Watch Video Solution

2. In a single slit diffraction pattem

Watch Video Solution

3. In a single slit diffraction pattem

Watch Video Solution

4. In single slit diffraction what is the effect of increasing the slit width

Watch Video Solution

5. Describe what happens to a Fraunhoffer single slit diffraction pattern, if (a) the whole apparatus is immersed in water (b) red light is replaced by blue light?

Watch Video Solution

6. Would interference and diffraction effects still be observed if light waves were longitudinal instead transverse?

Watch Video Solution

7. Young's double slit experiment is known for interference. Is it also a diffraction experiment? If yes, why?

Watch Video Solution

8. What is resolution and limit of resolution?

Watch Video Solution

9. What is resolving power?

Watch Video Solution

10. Write the value of limit of resolution of human eye.

Watch Video Solution

11. What is the effect of wavelength on magnifying power and resolving power in a telescope?

Watch Video Solution

12. In a single-slit diffraction experiment, the width of the slit double the original width. How does this affect the size and of the central diffraction band ?

Watch Video Solution

EXERCISE (VERY SHORT ANSWER QUESTIONS (POLARIZATION))

1. How can the nutrient requirements of a plant be determined?

Watch Video Solution

2. When the intensity of light is low during night the light is detected by

Watch Video Solution

3. Arrange the intensities of the transmitted light in their increasing order of magnitudes when they are passed through a system of two polarisers

(A) When incident light is unpolarised and of intensity I and the angle between the polarisers is 30°

(B) When incident light is polarised of intensity 2I and the angle between the polarisers is 45°

(C) When polarised light of intensity 4I is incident and the angle between the polarisers is 90°

(D) When incident light is unpolarised and of intensity 3I and the angle between the polarisers is 30°

Watch Video Solution

4. It is well established that sound, like light, shows interference and diffraction effects. Does this also imply that sound like light will show polarization?

Watch Video Solution

5. What is O-ray and E-ray?

Watch Video Solution

6. State the plane of polarization.

Watch Video Solution

7. What is an optics axis in a crystal?

Watch Video Solution

8. If a polarizer is placed in front of each slit, what changes be observed in the interference fringes (a) when the two polarizing axes are parallel? (b) when the two polarizing axes are perpendicular?

Watch Video Solution

PROBLEMS (LEVEL - I)

1. The optical vectors of two interfering light waves are $E_1 = 2\sin\omega t$ and $E_2 = 5\sin\left(\omega t + \frac{\pi}{3}\right)$. Find the resultant amplitude.

Watch Video Solution

2. In Young.s double slit experiment, blue-green light of wavelength 500nm is used. The slits are $1.20mm$ apart, and the viewing screen is $5.40m$ away from the slits. What is the fringe width.

Watch Video Solution

3. In Young's interference experiment in a large ripple tank, the vibrating sources are in phase and 120mm apart, the distance between adjacent maxima measured 2.00m away is

180mm. If the speed of the ripples is 54 cm/s, calculate the frequency of the vibrating source.

Watch Video Solution

4. In a double slit experiment, the slit separation is 0.2 cm and the slit to screen distance is 100cm. Find the positions of the third order minima, if wavelength of the source is 500 nm.

Watch Video Solution

5. In a double slit interference experiment, the separation between the slits is 1.0 mm, the wavelength of light used is $5.0x10^{-7}$ m and the distance of the screen from the slits is 1.0 m. (a) Find the distance of the centre of the first minimum from the centre of the central maximum. (b) How many bright fringes are formed in one centimeter width on the screen ?

Watch Video Solution

6. In a two-slit interference pattern, the maximum intensity is I_0.

(a) At a point in the pattern where the phase difference between the waves from the two slits is 60°, what is the intensity?

(b) What is the path difference for 480nm light from the two slits at a point where the phase angle is 60°?

Watch Video Solution

7. (a) Why are coherent sources necessary to produce a sustained interference pattern ?

(b) In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is $\lambda/3$.

Watch Video Solution

8. In a double slit arrangement, the slits are separated by a distance equal to 100 times the wavelength of the light passing through the slits. (a) What is the angular separation in radian between the central maximum and an adjacent maximum? (b) What is the distance between these maxima on a screen 50.0 cm from the slits?

Watch Video Solution

9. In Young's double slit experiment distance between two sources is 0.1 mm. The distance of screen from the source is 20 cm. Wavelength of light used is 5460 Ã.... The angular position of the first dark fringe is

Watch Video Solution

10. A slit of width d is placed in front of a l ens of focal length 0.5m and is illuminated normally with light of wavelength $5.89 \times 10^{-7} m$. The first diffraction minima on either side of the central diffraction maximum are separated by $2 \times 10^{-3} m$. The width d of the slit is __________m.

Watch Video Solution

11. Light of wavelength 6000 Å is incident of a narrow slit. The screen is placed 2 m away from the slit. If the first minima lie 5 mm on either side of the central maximum, calculate the slit width.

Watch Video Solution

12. A slit of width d is placed in front of a l ens of focal length 0.5m and is illuminated normally with light of wavelength $5.89 \times 10^{-7} m$. The first diffraction minima on either side of the central diffraction maximum are separated by $2 \times 10^{-3} m$. The width d of the slit is ____________m.

Watch Video Solution

13. Light of wavelength 5000Å is diffracted by a slit. In diffraction pattern fifth minimum is at a distance of 5 mm from central maximum. If the distance between the screen and the slit is im. Find the slit width.

Watch Video Solution

14. Find the half angular width of the central bright maximum in the fraunhofer diffraction pattern of a slit of width $12 \times 10^{-5} cm$ when the slit is illuminated by monochromatic light of wavelength 6000 Å.

Watch Video Solution

15. In a Fraunhoffer diffraction experiment at a single slit using light of wavelength 400 nm, the first minimum is formed at an angle of 30° Then the direction θ of the first secondary maximum is

Watch Video Solution

16. In a single slit diffraction experiment first minima for $\lambda_1 = 660nm$ coincides with first maxima for wavelength λ_2. Calculate the value of λ_2.

Watch Video Solution

17. At what angle to the horizon the sun be for is reflected rays from the surface of pond to be completely polarized (μ of water =1.33)

Watch Video Solution

18. The critical angle for total internal reflection for a substance is 45° . What is the polarizing angle for this substance?

Watch Video Solution

19. What is the Brewster angle for air to glass transition? (Refractive Brewster angle for air to glass transition? (Refractive

Watch Video Solution

20. At what angle should the axes of two polaroids be placed so as to reduce the intensity of the incident unpolarized light to (a) 1/4 (b) 1/2?

Watch Video Solution

21. The axes of the polariser and analyser are inclined to each other at 60°. If the amplitude of the polarised light emergent through analyser is A. The amplitude of unpolarised light incident on polariser is

Watch Video Solution

22. Unpolarized light passes through a polarizer and analyser which are at an angle of 45° with respect to each other. The intensity of polarized light coming from analyser is $5W/m^2$. Find the intensity of unpolarized light incident on polarizer.

Watch Video Solution

23. Plane polarized light is incident on a single polarizing disc with the direction of vibrations parallel to the direction of the transmission axis. Through what angle should the disc be rotated so that the intensity in the transmitted beam is reduced by a factor of 4?

Watch Video Solution

24. A polarizer and an analyzer are oriented so that the maximum amount of light is transmitted. To what fraction of its maximum value is the intensity of the transmitted light reduced when the analyzer is rotated through $(a) 30^\circ, (b) 45^\circ, (c) 60^\circ$?

Watch Video Solution

25. Unpolarized light of intensity I_0 is incident on a polarizer and the emerging light strikes a second polarizing filter with its axis 45º to that of the first. Determine the intensity of the emerging beam

Watch Video Solution

26. A plane polarized beam of intensity I is incident on a polarizer with the electric vector inclined at 30° to the optic axis of the polarizer. Light coming out of the polarizer through an analyser whose optic axis is inclined at 30° to the polarizer. Find the intensity of light coming out of the analyser.

Watch Video Solution

PROBLEMS (LEVEL - II)

1. In Young's double-slit experiment, the y-coordinate of central maxima and 10th maxima are 2 cm and 5 cm, respectively, When the YDSE apparatus is immersed in a liquid of refractive index 1.5, the corresponding y-coordinates will be

Watch Video Solution

2. In a Young's double slit interference experiment the fringe pattern is observed on a screen placed at a distance D from the slits. The slits are separated by a distance d and are illuminated by monochromatic light of wavelength λ. Find the distance from the central point where the intensity falls to (a) half the maximum, (b) one fourth of the maximum.

Watch Video Solution

3. The maximum intensity in Young.s double slit experiment is I_0. Distance between slits is $d = 5\lambda$, where λ is the wavelenght of the monochromatic light used in the experiment. What will be the intensity of light in front of one of the slits on a screen at a distance $D = 10d$.

Watch Video Solution

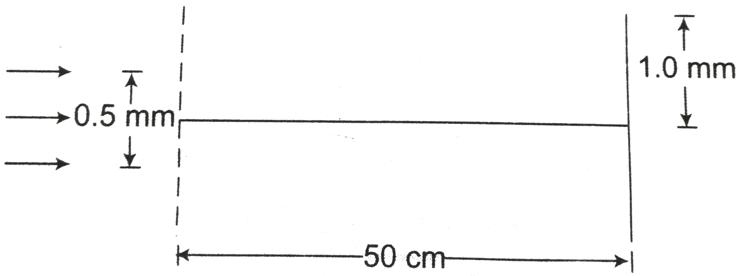
4. In a Young's double slit experiment the separation between slits is $2 \times 10^{-3} m$ whereas the distance of screen from the plane of slits is 2.5m. Light of wavelengths in the range 2000-8000 Å is allowed to fall on the slits. Find the wavelengths in the visible region that will be present on the screen at 10^{-3} m from the central maxima.

Watch Video Solution

5. White coherent light $(400nm - 700nm)$ is sent through the slits of a YDSE. $d = 0.5mm$, D=50 cm. There is a hole in the screen at a point $1.0mm$ away (along the width of the fringes) from the central line.

(a) Which wavelength will be absent in the light coming from the hole?

(b) Which wavelength(s) will have a strong intensity?



Watch Video Solution

6. Two slits 4.0×10^{-6} m apart are illuminated by light of wavelength 600nm . What is the highest order fringe in the interference pattern?

Watch Video Solution

7. 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

Watch Video Solution

8. YDSE is conducted using light of wavelength 6000Å to observe an interference pattern. The slits are $2mm$ apart. The fringes are observed on a screen $10cm$ away from the slits. When a film of some material $0.5mm$ thick was placed over one of the slits, the fringe pattern shifted by a $5mm$. What is the refractive index of the material of the film ?

Watch Video Solution

9. A transparent paper (refractive index = 1.45) of thickness 0.02 mm is pasted on one of the slits of a Young's double slit experiment which uses monochromatic light of wavelength 620 nm. How many fringes will cross through the centre if the paper is removed ?

Watch Video Solution

10. In double slit experiment, a light of wavelength λ = 600nm is used. When a film of material 3.6×10^{-3} cm thick was placed over one of the slits, the fringe pattern was displaced by a distance equal to 30 times the distance between two adjacent dark fringes. What is the refractive index of the material?

Watch Video Solution

11. A transparent paper sheet of thickness 0.03 mm and refractive index 1.45 is placed in front of one of the slits in a double slit experiment. The paper transmits 9/25 of the light energy falling on it. If the wavelength of light used is

4500 Å . What is the ratio of maximum to minimum intensity in the interference pattern.

Watch Video Solution

12. Interference pattern with Young's double slits 1.5mm apart are formed on a screen at a distance 1.5m from the plane of slits. In the path of the beam of one of the slits, a transparent film of 10 micron thickness and of refractive index 1.6 is interposed while in the path of the beam from the older slit a transparent film of 15 micron thickness and of refractive index 1.2 is interposed. Find the displacement of the fringe patten.

Watch Video Solution

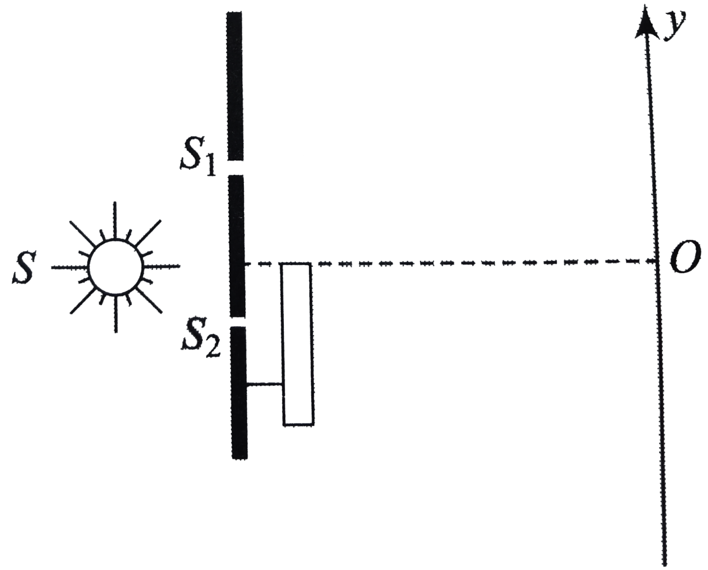
13. The Young's double-slit experiment is done in a medium of refractive index $4/3$. A light of 600 nm wavelength isfalling on the slits having 0.45 mm separation. The lower shift S_2 is covered by a thin glass sheet of refractive index. 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in Figure

a. Find the location of central maximum (bright fringe with zero path difference) on the y-axis.

b. Find the light intensity of point O relative to the maximum fringe intensity.

c. Now , if 600 nm light is replaced by white light of range 400 - 700 nm, find the wavelengths of the light that from maxima exaclty at point O.

(All wavelength in the problem are for the given medium of refractive index $4/3$ Ignoe dispersion.)

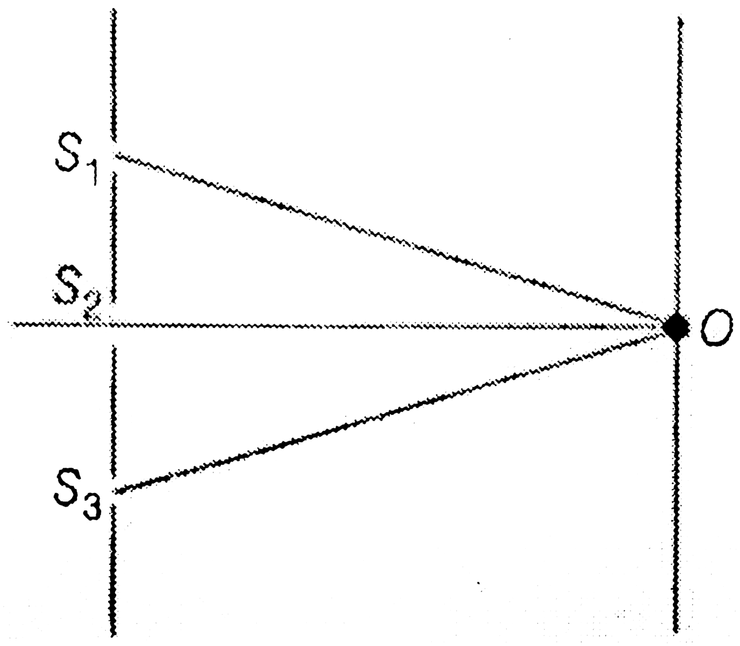


Watch Video Solution

14. In the figure shown $S_1O - S_2O = S_3O - S_2O = \frac{\lambda}{4}$, Intensity at O due to any one of the slits is I_0. What is the

intensity due to all the three coherent sources

S_1, S_2 and S_3 ?



Watch Video Solution

15. In YDSE on screen P is the point of 5th order maxima was lying at t = 0. D is the distance between slits and screen. If the screen is moved with constant speed v away from the slits perpendicular to its plane. Find the time after which 3rd order minima will be at that point.

Watch Video Solution

16. Two coherent radio point sources that are separated by 2.0 m are radiating in phase with a wavelength of 0.25m. If a detector moves in a large circle around their mid-point. At how many points will the detector show a maximum signal?

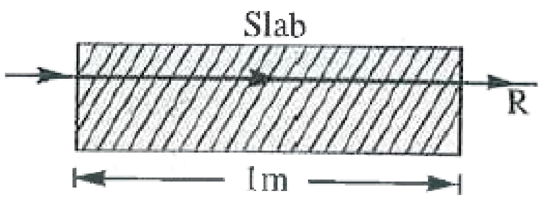
Watch Video Solution

17. Two identical coherent sources are placed on a diameter of a circle of radius R at separation x $(< < R)$ symmetrical about the center of the circle. The sources emit identical wavelength λ each. The number of points on the circle of maximum intensity is $(x = 5\lambda)$

Watch Video Solution

18. The coherent point sources S_1 and S_2 vibrating in same phase emit light of wavelength λ. The separation between the sources is 2λ. Consider a line passing through S_2 and perpendicular to the line S_1S_2. What is the smallest distance from S_2 where a minimum of intensity occurs due to interference of waves from the two sources?

19. The figure shows a transparent slab of length m placed in air whose refractive index in x direction varies as $\mu = 1 + x^2 (0 < x < 1)$. The optical path length of ray R will be

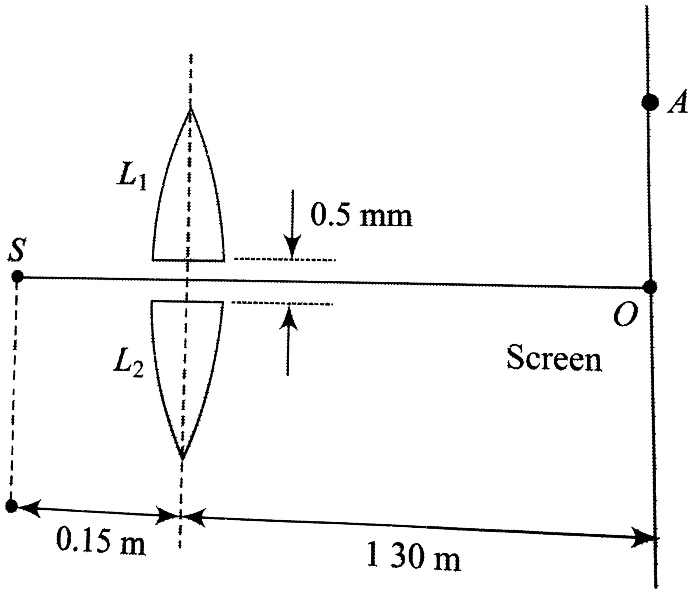


Watch Video Solution

20. In figure S is a monochromatic point source emitting light of wavelength $\lambda = 500nm$ A thin lens of circular shape and focal length 0.10 m is cut into two identical havles L_1 and L_2 a plane passing through a diameter. The two havles are placed symmetrically about the central axis SO with a gap of 0.5 mm. The distance along the axis from S TOL_1 and L_2 is 0.15 m. The screen at O is normal to SO.

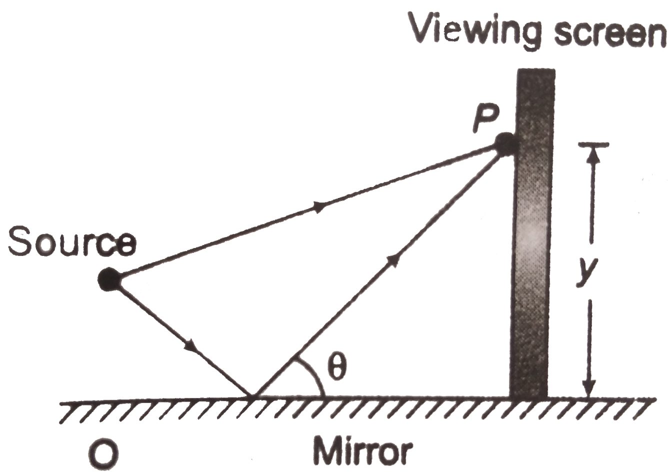
a. If the third intensity maximum occurs at point A on the screen, find the distance OA.

b. If the gap between, L_1 and L_2 is reduced from its original value of 0.5 mm, will the distance OA increase, decrease, or remain the same ?



Watch Video Solution

21. Interference effects are produced at point P on a screen as a result of direct rays from a 500 nm source and reflected rays from a mirror, as shown in figure. If the sources is 100m to the left of the screen and 1.00 cm above the mirror, find the distance y (in milimeters) to the first dark band above the mirror.



Watch Video Solution

22. A source of light of wavelength 5000Å is placed as shown in figure.

Considering interference of direct and reflected rays, determine the position of the region where the fringes will be visible and calculate the number of fringes.

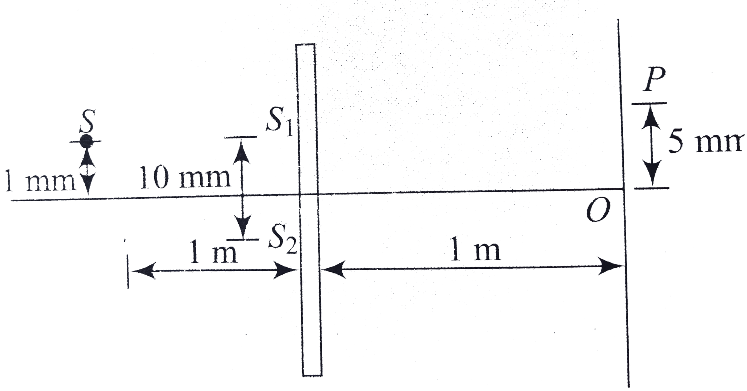
` (##DCP_V05_C32_S01_021_Q01.png" width="80%">.

Watch Video Solution

23. In Young's double-slit experiment, the point source is placed slightly off the central axis shown in Fig. 2.45.(λ=500 nm)

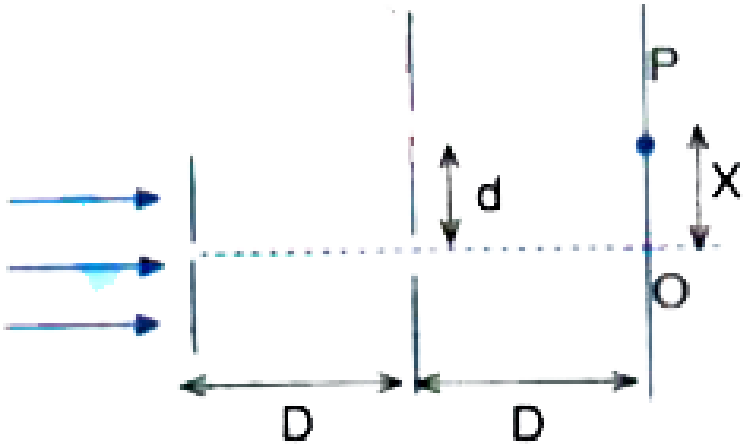
a. Find the nature and order of the interference at point P.

b. Find the nature and order of the interference at point. O.



Watch Video Solution

24. Consider the arrangement shown in figure. The distance D is large compared to the separation d between the slits.

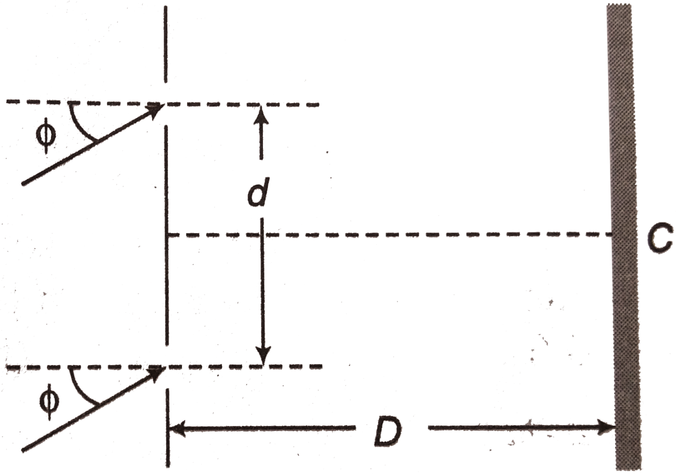


Find the minimum value of d so that there is a dark fringe at O.

Watch Video Solution

25. Light of wavelength $\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

apart, at an angle $\phi = 30^{\circ}$ relative to the slits as shown in figure. On the lower slit a transparent slab of thickness 0.1 mm and refractive index $\frac{3}{2}$ is placed. The interference pattern is observed at a distance D=2m from the slits. Then, calculate



(a) position of the central maxima.

(b) the order of maxima at point C of screen .

(c)how many fringes will pass C, if we remove the transparent slab from the lower slit?

Watch Video Solution

26. Angular width of central maximum in the Fraunhofer diffraction pattern of a slit is measured. The slit is illuminated by light of wavelength 6000Å. When the slit is illuminated by light of another wavelength, the angular width decreases by 30%. Calculate the wavelength of this light. The same decrease in the angular width of central maximum is obtained when the original apparatus is immersed in a liquid. Find the refractive index of the liquid.

Watch Video Solution

27. Estimate the distance for which ray optics is good approximation for an aperture of 4 mm and wavelength 400 nm ?

Watch Video Solution

28. The aperture of telescope is of 1m diameter and wavelength of light incident on the on the paerture is $5500A^0$. The angular limit if resolution of the telescope is

Watch Video Solution

29. Calculate the resolving power of a telescope whose objective lens has a diameter of 732 cm and $\lambda = 6000\text{Å}$

Watch Video Solution

30. A horizontal beam of vertically polarized light o intensity $43w/m^2$ is sent through two polarizing sheets. The polarizing direction of the first is 60° to the vertical, and that of the second is horizontal. What is the intensity of the light transmitted by the pair of sheets?

Watch Video Solution

31. Two polarizing sheets are placed together with their transmission axes crossed so that no light is transmitted. A third sheet is inserted between them with its transmission axis at an angle of45° with respect to each of the other axes. Find the fraction of incident unpolarized light intensity transmitted by the three sheet combination.

Watch Video Solution

32. Two beams, A and B, of plane polarized light with mutually perpendicular planes of polarization are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of Polaroid through 30^0 makes the two beams appear equally bright. If the initial intensities of the two beams are I_A and I_B respectively, then I_A / I_B equals :-

Watch Video Solution

33. A beam of ordinary light is incident on a system of four polaroids which are arranged in succession such that each polaroid is turned through 30° with respect to the preceding one. Find the percentage of the incident intensity that emerges out from the system is approximately.

Watch Video Solution