PHYSICS

BOOKS - GK PUBLICATIONS PHYSICS (HINGLISH)

WAVE OPTICS

Illustrative Example

1. Determine the resulting intensity due to interference of the two waves at a point given below :

$y_1 = 3\sin(100\pi l)$

$y_2 = 4\sin\left(100\pi l + \frac{\pi}{3}\right)$

Given that intensity due to first wave is I_0.

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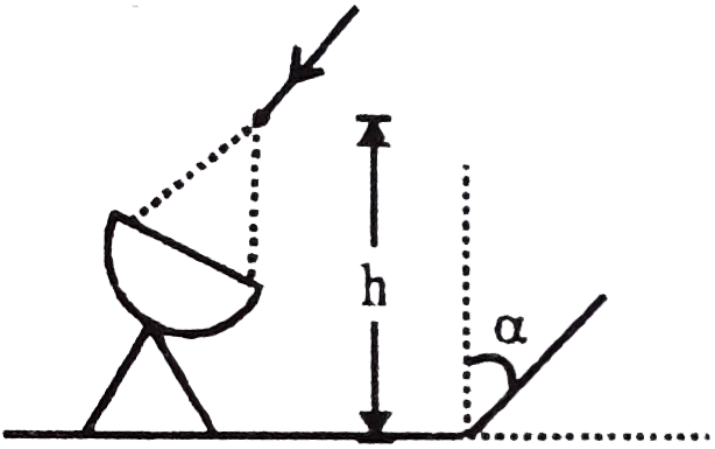
2. Radio waves coming at $\angle_\alpha$ to vetical are received by a radar after reflection from a nearby water surface and directly .what should be height of antenna from water surface so that it records a maximum intensity.(Wavelength =λ)



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3. Two coherent light beams of intensities I and 4I superpose in a region. Find the maximum and minimum possible intensities due to superposition in this region.

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4. Two coherent waves are described by the expressions.

$$E_1 = E_{0\sin}\left(\frac{2\pi x_1}{\lambda} - 2\pi ft + \frac{\pi}{6}\right)$$ and

$$E_2 = E_0 \sin\left(\frac{2\pi x_2}{\lambda} - 2\pi ft + \frac{\pi}{8}\right)$$

Determine the relationship between x_1 and x_2 that produces constructive interference when the two waves are superposed?

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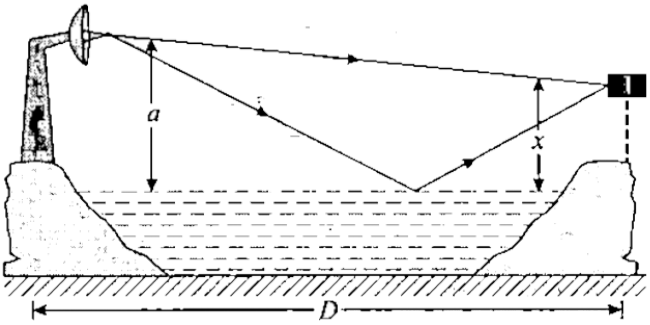
5. In figure-6.9, a microwave transmitter a height a above the water level of a wide lake transmits microwaves of wavelength λ towards a receiver on the opposite shore, a distance x above the water level. The microwaves reflecting from the water interface with the microwaves arriving directly from the transmitter. Assuming that the lake width D is much greater than a and x, that $\lambda > > a$, at what values of x is the signal at the

receiver maximum?



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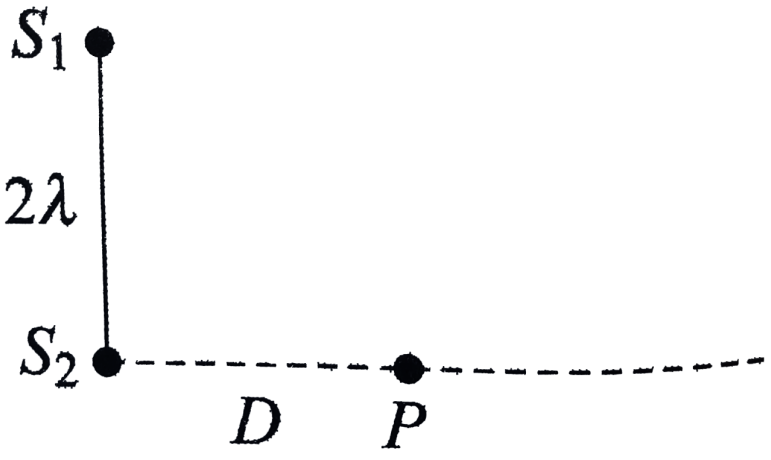
6. Two coherent point sources S_1 and S_2 vibrating in phase emit light of wavelength λ. The separation between the sources is 2λ. Consider a line passing through S_2 and perpendicular to line S_1S_2. Find the position of farthest and nearest minima.



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7. A double-slit experiment, arrangement produces interference fringes for sodium light $(\lambda = 589nm)$ that have an angular separation of 3.50×0^{-3} rad . For what wavelength would the angular separation to $10\,\%$ greater?

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8. In a YDSE setup sodium light of wavelength 5893Å is being used. The interference pattern is obtained on a screen which is located at a distance 1 m from the slit plane. In the interference pattern it is observed that 10^{th} bright fringe is located at a distance of 12mm from the central maximum. Find the slit separation.

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9. Two slits in Young's experiment have width in the ratio $1:25$. The ratio of intensity at the maxima and minima in the interference pattern $\frac{I_{\max}}{I_{\min}}$ is :

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10. In Young's experiment, interference bands are produced on the screen placed at 1.5 m from the two slits 0.15 mm apart and illuminated by light of wavelength 6599Å. Find (a) the fringe width and (b) the change in the fringe width if the screen is taken away from the slit by 50 cm.

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11. In Young's double slit experiment the slits are 0.5 mm apart and interference is observed on a screen placed at a distance of 100 cm from the slits. It is found that the 9^{th} bright fringe is at a distance of 8.835 mm from the second dark fringe from the centre of the fringe pattern. Find the wavelength of light used.

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12. A double slit arrangement produces interference fringes for sodium light $(\lambda = 5890\text{Å})$ that are 0.40° apart. What is the angular fringe separation if the entire arrangement is immersed in water?

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13. A YDSE setup is immersed in water $(\mu = 1.33)$. If has slit separation 1 mm and distance between slits and screen is 1.33m. Incident light on slits have wavelength 6300Å. Find the fringe width on screen.

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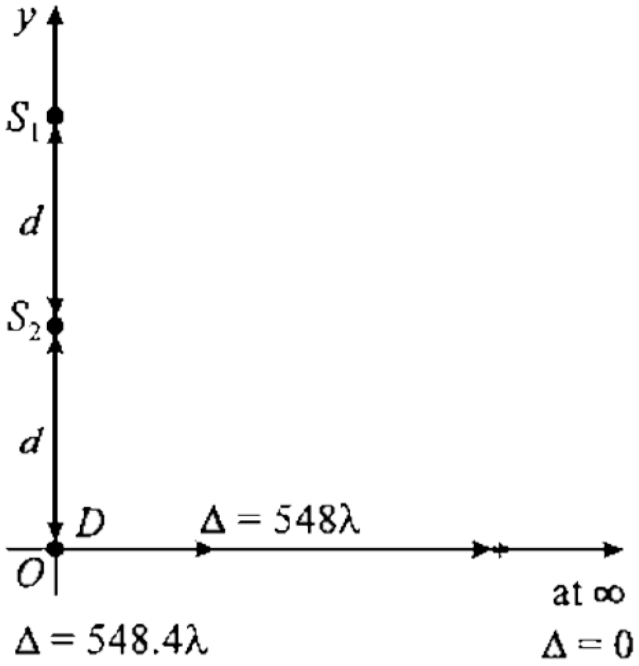
14. There are two coherent sources S_1 and S_2 which produce waves in same phase placed on Y axis at points (0, 2d) and (0, d) as shown in figure-6.23. A detector D is placed at origin which moves along X direction, find the number of maxima recorded by detector excluding points x = 0

and $x = \infty$. Given that wavelength of light produced is 6200Å and separation between sources is 0.34 mm.



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15. In YDSE setup slits are illuminated by a light of wavelength 4000Å and a light of unknown wavelength. It is observed that fourth dark fringe of known wavelength coincide with second bright fringe of unknown wavelength. Find the unknown wavelength.

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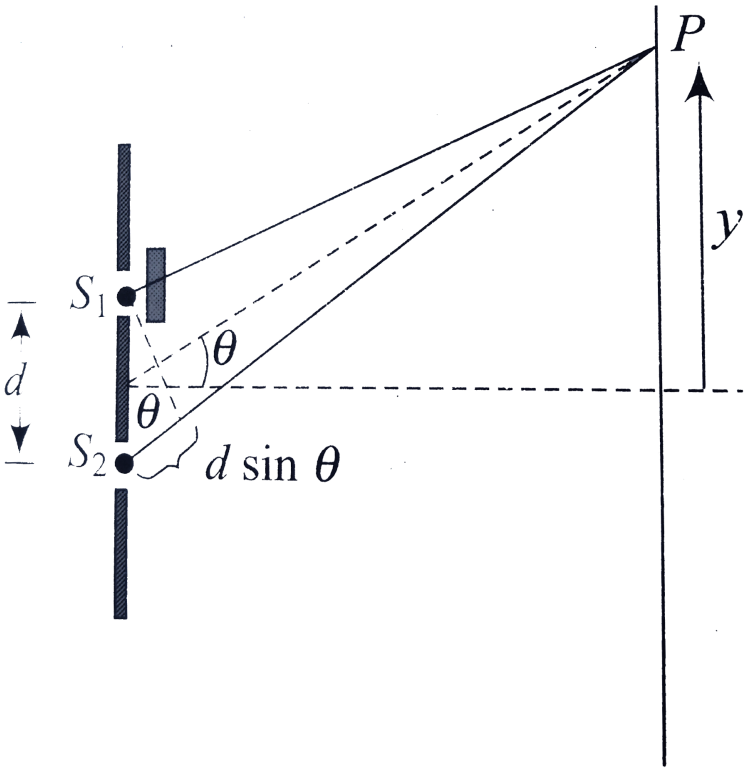
16. In YDSE, light of wavelength $\lambda = 5000\text{Å}$ is used, which emerges in phase from two slits distance $d = 3 \times 10^{-7} m$ apart. A transparent sheet of thickness $t = 1.5 \times 10^{-7} m$, refractive index $n = 1.17$, is placed over one of the slits. Where does the central maxima of the interference now appear from the center of the screen? (Find the value of y?)



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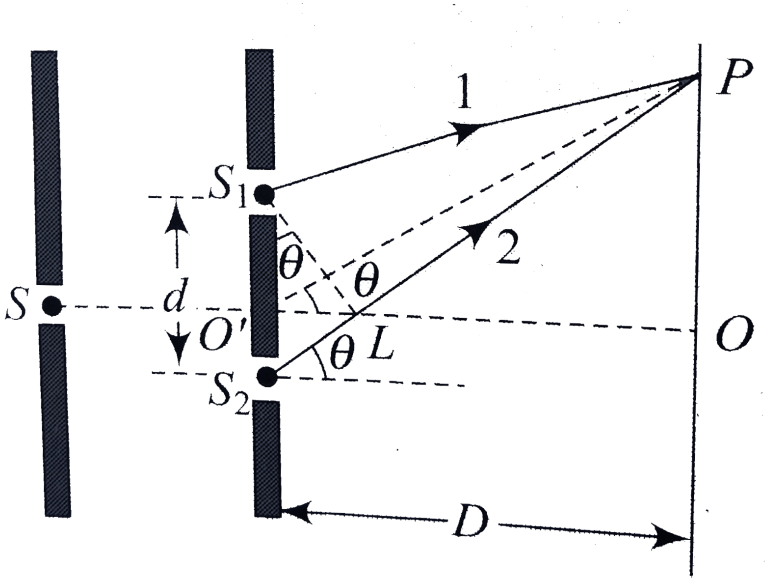
17. In Young's experiment, find the distance between two slits that results in the third minimum for $420nm$ violet light at an angle 30°



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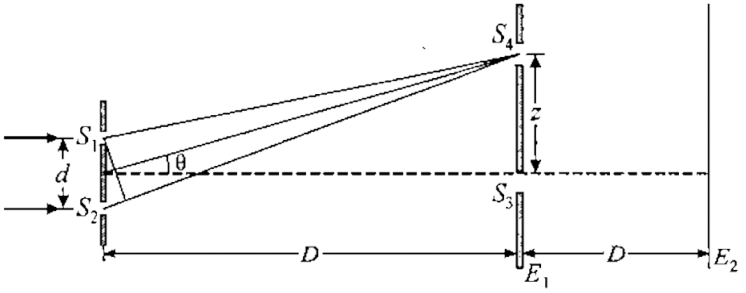
18. Consider the situation shown in figure-6.35. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by a monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted by the slits falls on a screen E_1 placed at a distance D from the slits. The slit S_3 is at the central line and the slit S_4 is

at a distance z from S_3. Another screen E_2 is placed a further distance D away from E_1. Find the ratio of the maximum to minimum intensity observed on E_2 if z is equal is : $(a)\frac{\lambda D}{2d}$ $(b)\frac{\lambda D}{d}$ $(c)\frac{\lambda D}{4d}$



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19. The two coherent sources of monochromatic light of wavelength λ are located at a separation λ. The two sources are placed on a horizontal line and screen is placed perpendicular to the line joining the sources. Find position of the farthest minima from the centre of the sources.

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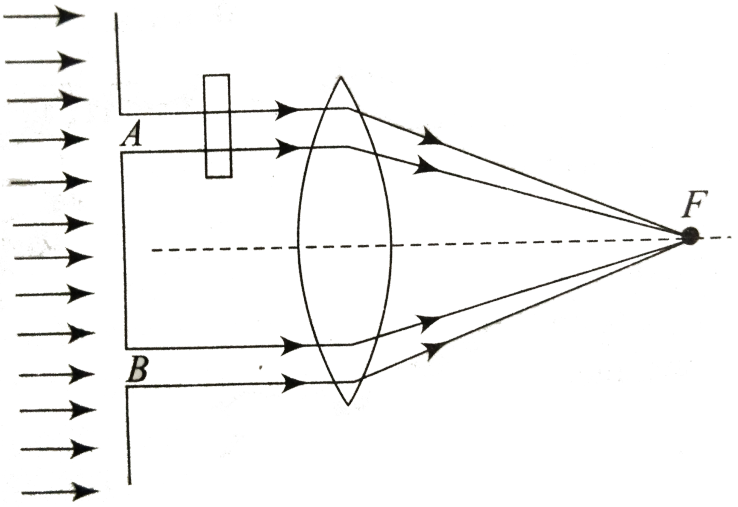
20. In a modified Young's double-slit experiment, a monochromatic uniform and parallel beam of light of wavelength 6000Å and intensity $(10/\pi)$ W m^{-2} is incident normally on two circular apertures A and B of radii 0.001 m and 0.002 m, respectively. A perfectly transparent film of thickness 2000Å and refractive index 1.5 for the wavelength of 6000Å is placed in front of aperture A (see the figure). Calculate the power (in mW) received at the focal spot F of the lens. Then lens is symmetrically placed with respect to the aperture. Assume that 10% of the power received by each aperture goes in the original direction and is brought to the focal spot.



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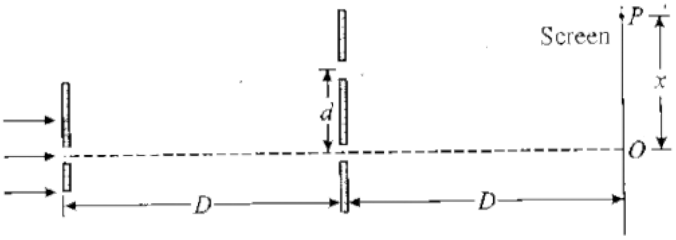
21. Consider the arrangement shown in figure-6.38. The distance D is large compared to the separation d between the slits.

(a) Find the minimum value of d so that there is a dark fringe at O.

(b) Suppose d has this value. Find the distance x at which the next bright fringe is formed.

(c) Find the fringe width.



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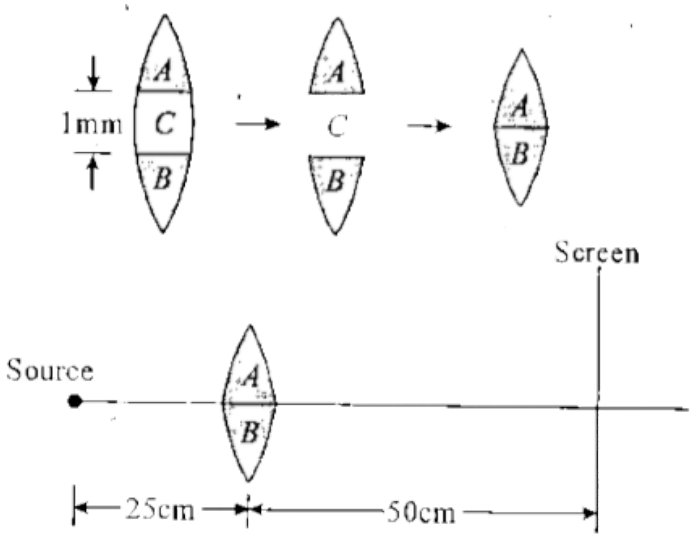
22. In Billet's Lens Arrangement, a convex lens of focal length 50 cm is cut along the diameter into two indentical halves Å and B and in the process a layer C of the lens thickness 1 mm is lost. Then the two halves A and B are put together to form a composite lens. Now, infront of this composite lens a source of light emitting wavelength $\lambda = 6000\text{Å}$ is placed at a

distance of 25 cm as shown in the figure. Behind the lens there is a screen at a distance 50 cm from it. Find the fringe width fo the interference pattern obtained on the screen.



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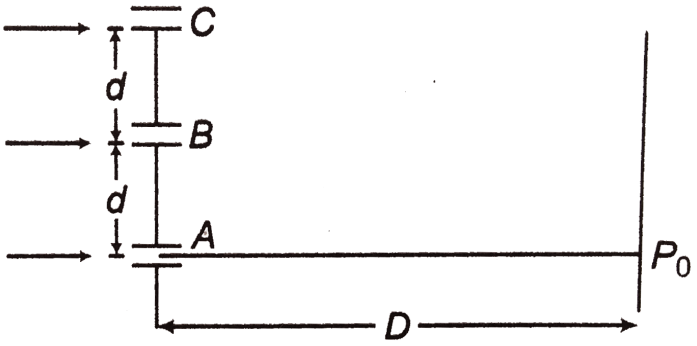
23. figure shows three equidistant slits illuminated by a monochromatic parallel beam of light. Let $BP_0 - AP_0 = \frac{\lambda}{3}$ and $D > > \lambda$.



(a) Show that d = $\sqrt{(2\lambda D)/3}$

(b) Show that the intensity at P_0 is three times the intensity due to any of the three slits

individually.

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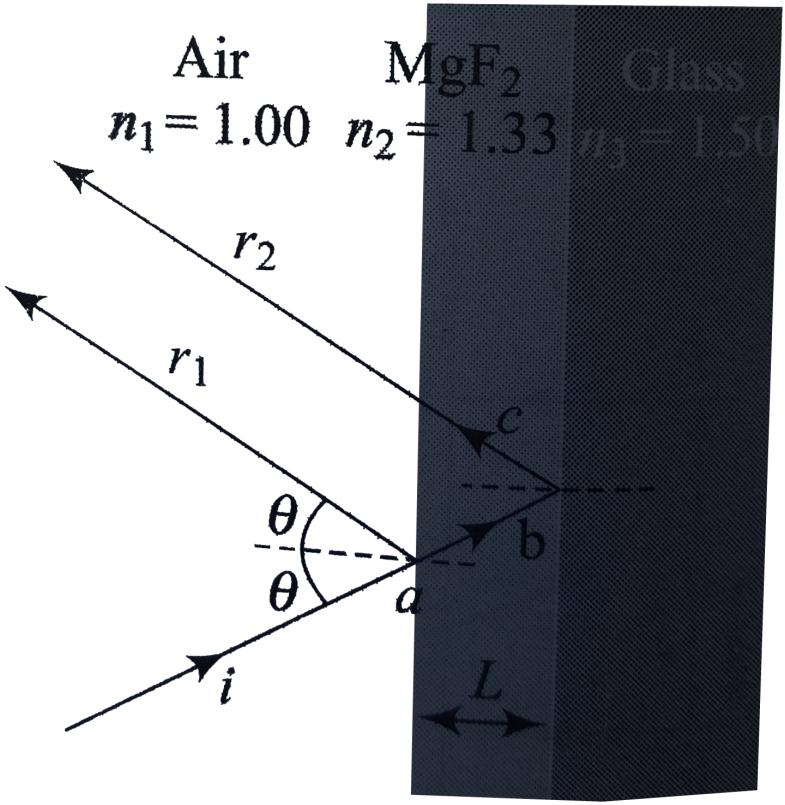
24. A glass lens is coated on one side with a thin film of magnesium fluoride $(MgF_2)$to reduce reflection from the lens surface (Fig. 2.26). The Index of refraction of MgF_2 is 1.38, that of the glass is 1.50. What is the least coating thickness that eliminates (via interference) the reflections at the middle of the visible specturm $(\lambda = 550nm)$? Assume that the light

is approxmately perpendicular to the lens surface.



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25. Refractive index of a thin soap film of a uniform thickness is 1.34. Find the smallest thickness of the film that gives in interference maximum in the reflected light when light of wavelength 5360Å fall at normal incidence.

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26. A wedge of angle 0.5° is illuminated with sodium light whose two lines corresponds to the wavelengths 5890Å and 5896Å. Find the distance from the apex at which the maxima due to the two wavelengths first coincide when observed in the reflected light. (the wedge contains air)

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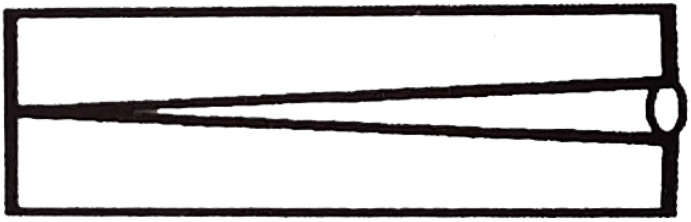
27. A broad sources of light of wavelength $680nm$ illuminated normally two glass plates.$120nm$long that meet at one end and are separated by a wire$0.048mm$in diameter at the other end,Find the number of bright

fringes formed over the $120nm$distance.



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28. A parallel beam of monochromatic light of wavelength $4500Å$ is allowed to incident on a long slit of width 0.2 mm. Find the angular divergence in which most of the light is diffracted.

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29. Angular width of central maximum in the Fraunhoffer 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.

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30. A convex lens of diameter 8.0 cm is used to focus a parallel beam of light of wavelength 620 nm. If the light be focused at a distance of 20 cm from the lens, what would be the radius of the central bright spot formed ?

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31. The axes of a polarizer and an analyzer are oriented at 30° to each other.

(a) If unpolarized light of intensity I_0 is incident on them, what is the intensity of the transmitted light?

(b) Polarized light of intensity I_0 is incident on this polarizer-analyzer

system. If the amplitude of the light makes an angle of 30° with the axis of the polarizer, what is the intensity of the transmitted light?

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32. A beam of plane polarised light falls normally on a polariser (cross sectional area $3 \times 10^{-4} m^2$) which rotates about the axis of the ray with an angular velocity of $31.4 rad/s$. Find the energy of light passing through polariser per revolution and the intensity of emergent beam, if flux of energy of the incident ray is $10^{-3} W$.

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33. The axes of a polarizer and an analyzer are oriented at right angles to each other. A third Polaroid sheet is placed between them with its axis at 45° to the axes of the polarizer and analyzer.

(a) If unpolarized light of intensity I_0 is incident on this system, what is the intensity of the transmitted light?

(b) What is the intensity of the transmitted light when the middle Polaroid sheet is removed?

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Practice Exercise 6 1

1. If the two slits in Young's experiment have width ratio $1:4$, deduce the ratio of intensity at maxima and minima in the intereference pattern.

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Practice Exercise

1. In YDSE setup a light of wavelength 6000Å is used. What should be the separation between the slits so that on screen in front of one of the slit there will be third bright fringe. Take D = 1m.

$[0.6\sqrt{10}mm]$

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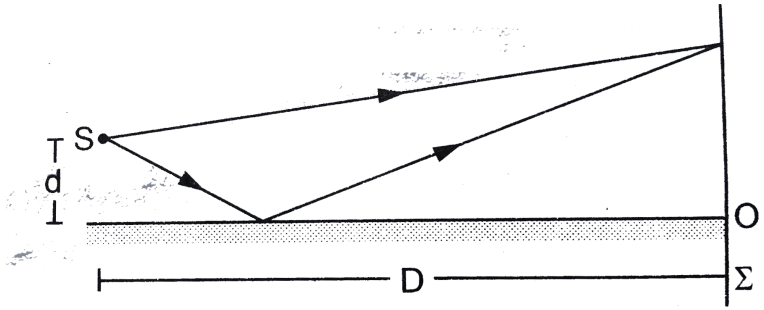
2. A narrow slit S transmitting light of wavelength λ is placed a distance d above a large plane mirror as shown in figure. The light coming directly from the slit and that coming after the reflection interference at a screen $\sum$ placed at a distance LD from the slit. a. What will be the intensity at a poiint just above the mirror. i.e., just above O? b. At what distance from O does the first maximum occur?



?

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3. In YDSE experiment a uniform intensity light beam is incident on slit plane which has two slits having width ratio $9:4$. Find the ratio of

intensities of bright and dark fringes on screen.

[25]

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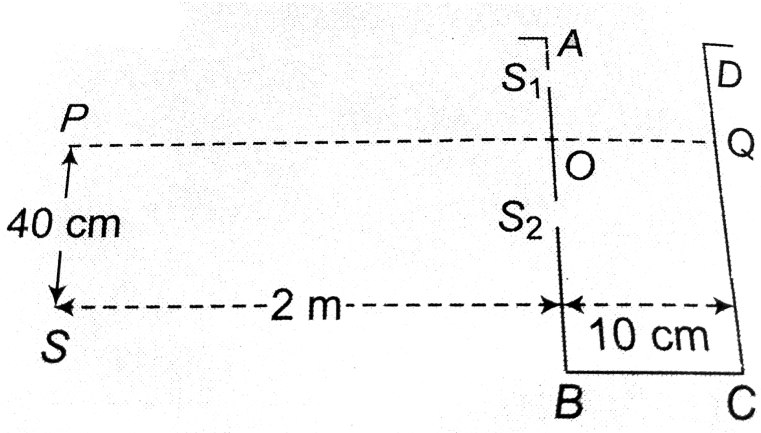
4. A vessel ABCD of $10cm$ width has two small slits S_1 and S_2 sealed with idebtical glass plates of equal thickness. The distance between the slits is $0.8mm$. POQ is the line perpendicular to the plane AB and passing through O, the middle point of S_1 and S_2. A monochromatic light source is kept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

at Q. Calculate the refractive index of the liquid.



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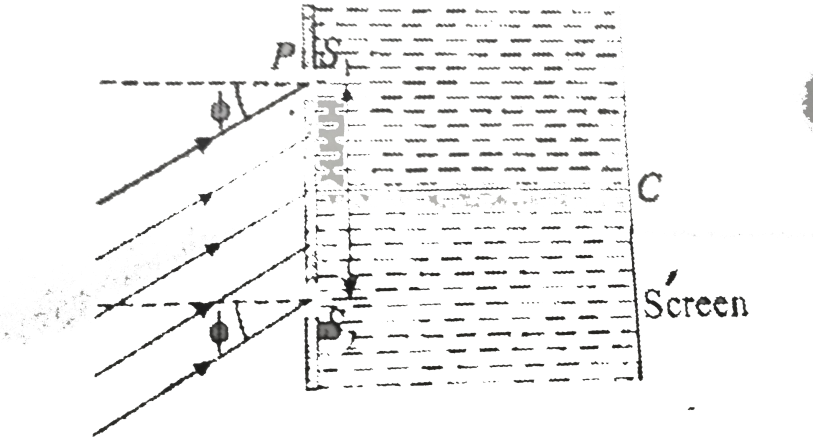
5. In a YDSE setup a parallel light beam containing two wavelength 4000Å and 5600Å is allowed to incident at an angle 30° on a diaphragm having two narrow slits at a separation 2 mm as shown in figure-6.46. The screen is placed at a distance 40 cm from the slits. A mica film of thickness 5 mm is placed in front of one of the slits and the whole apparatus is submerged in water. If the central bright fringe is observed at point C, which is equidistant from both the slits. Calculate

(a) The refractive index of the slab.

(b) The distance of the first black line from C.



[(a) 1.6, (b) 210 μm]

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6. A monochromatic light of wavelength 5000Å incident normally on slit plane of YDSE setup. If $d = 5 \times 10^{-4} m$ and D = 1 m and a thin film thickness $1.5 \times 10^{-6} m$ and $\mu = 1.5$ is place in front of one of the slits, find intensity of light at the centre of screen if each slit produces an intensity I_0 on screen. [0]

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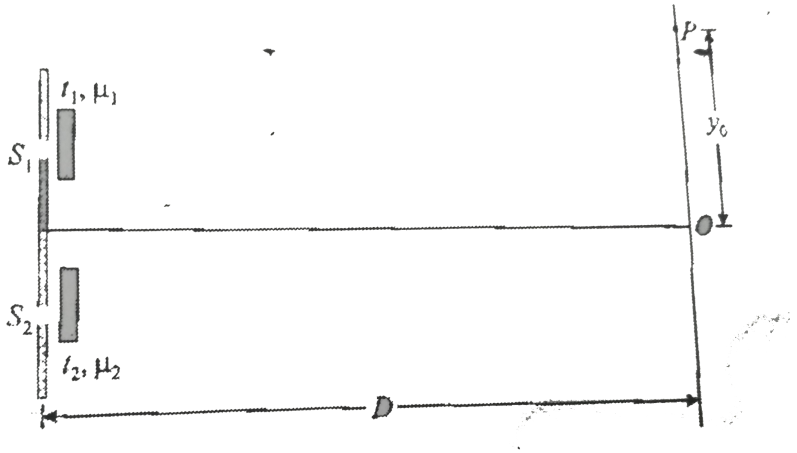
7. Two transparent sheets of thickness t_1 and t_2 and refractive indexes μ_1 and μ_2 are placed infront of the slits in YDSE setup as shown in figure-6.47. If D is the distance of the screen from the slits, then find the distance of zero order maxima from the centre of the screen. What is the condition that zero order maxima is formed at the centre O?



$$\left[\frac{D[(\mu_1-1)t_1-(\mu_2-1)t_2]}{d}, (\mu_2-1)t_2\right]$$

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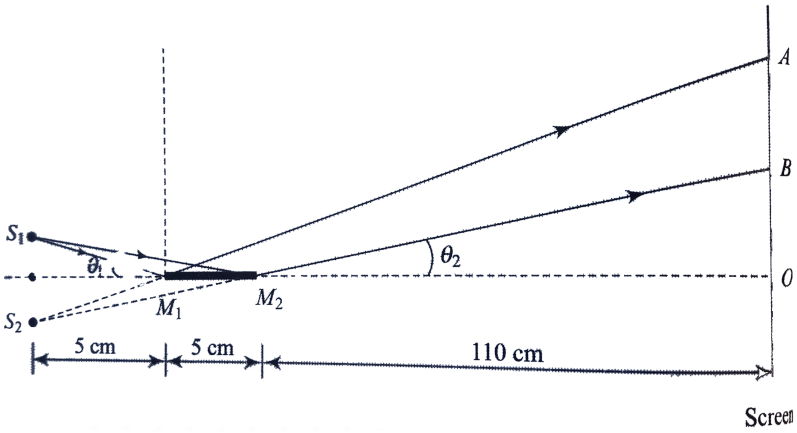
8. A Lloyd's mirror or length 5 cm is illuminated with mon ochromatic light of wavelength $\lambda\left(=6000\text{Å}\right)$ from a narrow 1 mm slit in its plane and 5 cm plane from its near edge. Find the fringe width on a screen 120

cm from the slit and width of interference pattern on the screen.



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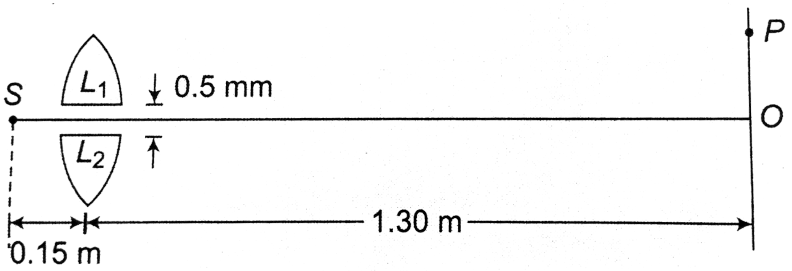
9. In figure S is a monochromatic point source emitting light of wavelength $\lambda = 500nm$. A thin lens of circular shape and focal length $0.10m$ is cut into two identical halves L_1 and L_2 by a plane passing through a doameter. The two halves are placed symmetrically about the central axis SO with a gap of $0.5mm$. The distance along the axis from A to L_1 and L_2 is $0.15m$, while that from L_1 and L_2 to O is $1.30m$. The screen at O is normal to SO.

(a) If the 3^{rd} intensity maximum occurs at point P on screen, find distance OP.

(b) If the gap between L_1 and L_2 is reduced from its original value of $0.5mm$, will the distance OP increases, devreases or remain the same?



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10. In Young's experiment, the source is red light of wavelength $7 \times 10^{-7}m$. When a thin glass plate of refractive index 1.5 at this wavelength is put in the path of one of the intering beams, the central bright fringe shiffts by $10^{-3}m$ to the position previously occupied by the 5^{th} bright fringe.

When the source is now changed to green light of wavelength $5 \times 10^{-7}m$, the central fringe shifts to position initially occupied by the 6^{th} bright fringe to red light. Find the refractive index of glass for green light.

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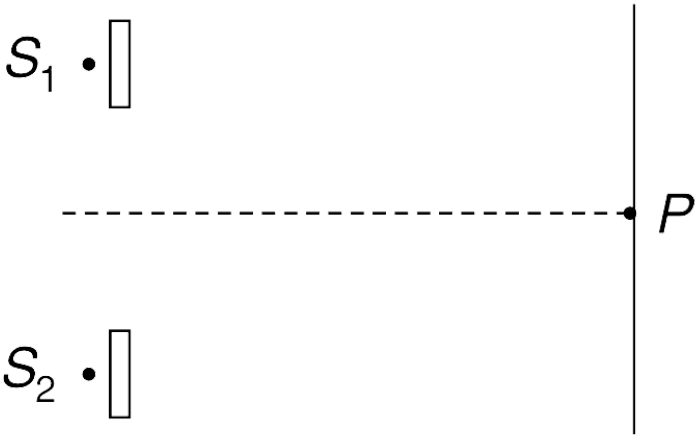
11. In Young's double slit experiment, the upper slit is covered by a thin glass plate of refractive index 1.4 while the lower slit is covered by another glass plate having same thickness as the first one but having refractive index 1.7.

Interference pattern is observed using light of wavelength $5400\overset{\circ}{A}$. It is found that the point P on the screen where the central maximum fell before the glass plates were inserted, now has $\frac{3}{4}$ the original intensity. It is also observed that what used to be 5^{th} maximum earlier, lies below the point P while the 6_{th} minimum lies above P. Calculate the thick- ness of glass plates. Absorption of light by glass plate may be neglected.



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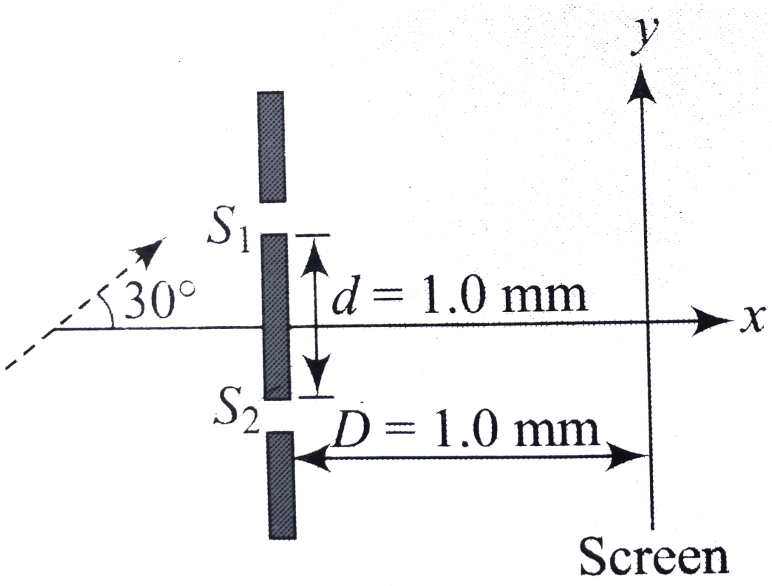
12. A coherent parallel beam of microwaves of wavelength $\lambda = 0.5mm$ falls on aYoung's double- slit apparatus. The separation between the slits is 1.0 mm. The intensity of microwaves is measured on a screen placed parallel to the plane of the slits at a distance of 1.0 m from it as shown in Fig. 2.42.

If the incident beam makes an angle or 30° with the x-axis (as in the dotted arrow shown in the figure), find the y-coordinates of the first minima on either side of the central maximum.



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13. A slit of width d is illuminated by white light (which consists of all the wavelengths in the visible range).

(a) For what value of d will the first minimum for red light of wavelength $\lambda = 6500\text{Å}$ appear at $\theta = 15^\circ$?

(b) What is the wavelength λ of the light whose first side diffraction maximum is at 15°, thus coinciding with the first minimum for the red light?

$\left[(a) 2.5\mu m,\ (b) 4300\text{Å}\right]$

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14. Our disscusssion of the techniques for determining cosntructive and destructive by reflection from a thin film in air has been confused to rays striking the film a nearly the normal incidence.Assume that a ray is incident at an angle of 45° (relative to the normal) on a film with an index of refraction of $\sqrt{2}$.Calculate the minimum thickness fro constructive interference for light of wavelength $600nm$.

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15. A soap film of thickness 0.0011 mm appears dark when seen by reflected light of wavelength 5800Å. What is the refractive index of soap solution if it is between 1.2 and 1.5. $[\mu = 1.318]$

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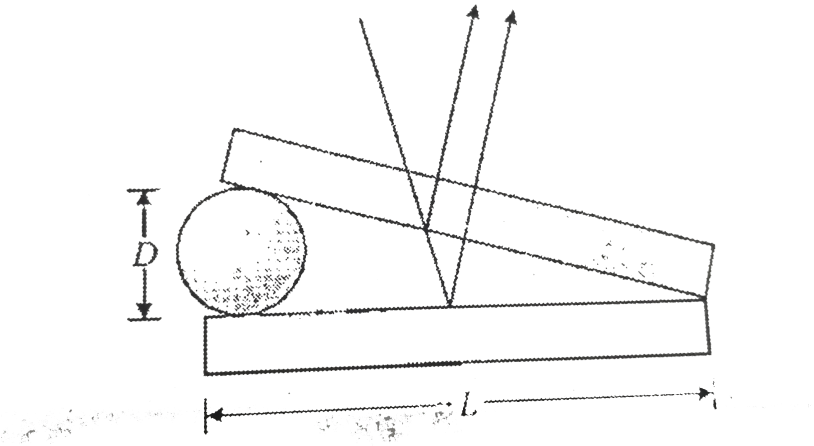
16. A wedge-shaped film of air is produced by placing a fine wire of diameter D between the ends of two flat glass plates of length $L = 20cm$, as shown in the figure-6.68. When the air film is illuminated with light of wavelength $\lambda = 5500\text{Å}$, there are 12 dark fringes found per centimeter on the wedge. Find the wire diameter D.



$[6.6 \times 10^{-5} m]$

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17. A thin soap film of thickness $3 \times x10^{-7} m$ and $\mu = 1.5$ is spreaded on a glass surface. When white light is normally incident on this sheet, find the colour which will be reflected strongly by the film.

$[4500Å]$

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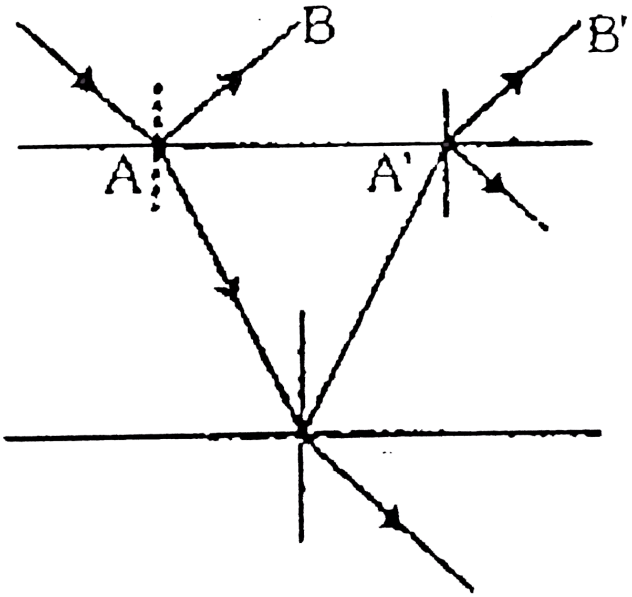

18.

A ray light of intensity I is incident on a parallel glass-slab at a point A as shown in figure it undergoes partial reflection and refraction. At each reflection 20% of incident energy is refracted rays AB and A'B' undergo interference find the ratio $I_{\max} / I_{\min}$

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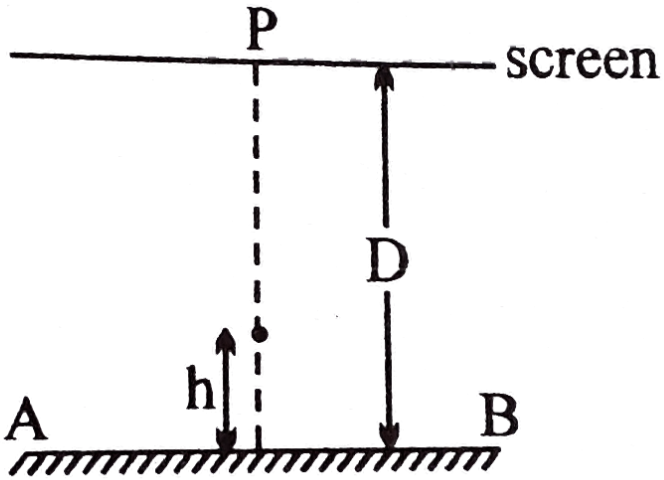
19. A point sources S emitting light of wavelength $600nm$ is placed at a very small height h above the flat reflecting surface AB(see figure).The

intensity of the reflected light is $36\ \%$ of the intensity.interference firnges are observed on a screen placed parallel to the reflecting surface a very large distance D from it.

(A)What is the shape of the interference fringes on the screen?



(B)Calculate the ratio of the minimum to the maximum to the maximum intensities in the interference fringes fromed near the point P (shown in the figure) (c) if the intenstities at point P corresponds to a maximum,calculate the minimum distance through which the reflecting surface AB should be shifted so that the intensity at P again becomes maximum.

Watch Video Solution

20. A slit is located 'at infinity' in front of a lens of focal length 1 m and is illuminated normally with light of wavelength 6000Å. The first minima on either side of the central maximum of the diffraction pattern observed in the focal plane of the lens are separated by 4 mm. What is the width of the slit?

[0.3 mm]

Watch Video Solution

21. From large distance microwaves fall on a long slit of width 5cm. If the first diffraction minima is obtained at an angle 30° form the direct vision slit line then find the wavelength of the microwaves.

[2.5 cm]

Watch Video Solution

22. A parallel beam of monochromatic light of wavelength 5900Å falls normally on a convex lens of diameter 10cm which focusses the light on a

flat normal screen located at a distance of 20cm from the lens. What would be the radius of the central bright spot formed on the screen?

Watch Video Solution

23. Three nicols prisms are placed such that, first and third are mutually perpendicular. Unpolarised light is incident on first nicol's prism, the intensity of light emerges from third nicol's prism is $1/16$ the intensity of incident light. Find the angle between first and second nicol's prisms.

$[22.5^\circ]$

Watch Video Solution

24. Polarized light of intensity I_0 is incident on a pair of Polaroid sheets. Let θ_1 and θ_2 be the angles between the incident amplitude and the axes of the first and second sheet, respectively. Show that the intensity of the transmitted light is $I = I_0 \cos^2\theta_1 \cos^2(\theta_1 - \theta_2)$.

Watch Video Solution

25. A mixture of plane polarised and unpolarised light falls normally on a polarising sheet. On rotating the polarising sheet about the direction of the incident beam, the transmitted intensity varies by a factor 4. Find the ratio of the intensities I_P and I_0 respectively of the polarized and unpolarised components in the incident beam. Next the axis of polarising sheet is fixed at an angle of 45° with the direction when the transmitted intensity is maximum. Then obtain the total intensity of the transmitted beam in terms of I_0.

$\left[\frac{3}{2}, \frac{5I_0}{4}\right]$

Watch Video Solution

Practice Exercise 6 2

1. A glass of refractive index 1.5 is coated with a thin layer of thickness t and refractive index 1.8 . Light of wavelength λ travelling in air is incident normally on the layer. It is partly reflected at the upper and the lower

surfaces of the layer. It is partly reflected at the upper and the lower surfaces of the layer ant the two reflected rays interface . If $\lambda = 648nm$, obtain the least value of $t\left(\text{in}10^{-8}m\right)$ which the rays interface constructively.

Watch Video Solution

Practice Exercise 6 3

1. A narrow slit of width 0.025 mm is illuminated by a parallel beam of light. The diffraction pattern is observed through a telescope. It is found that to reach the first minimum, the telescope has to be rotated through $1^\circ 24'$ from the direction of the direct ray. Calculate the wavelength of light used.

$\left[6100\text{Å}\right]$

Watch Video Solution

Practice Exercise 6 4

1. (a) Ordinary light incident on one Polaroid sheet falls on a second Polaroid whose plane of vibration makes an angle of 30° with that of the first Polaroid. If the Polaroids are assumed to be ideal, what is the fraction of the original light transmitted through both Polaroids?

(b) If the second Polaroid is rotted until the transmitted intensity is 10 percent of the incident intensity, what is the new angle?

$[(a) 3/8, (b) 63.4^\circ]$

Watch Video Solution

Discussion Question

1. Why does an aeroplane flying at a great altitude not cast a shadow on the earth ?

Watch Video Solution

2. When sun rays pass through a small hole in the foliage at the top of a high tree, they produce an elliptical spot of light on the ground. Explain why. When will the spot be a circle?

Watch Video Solution

3. If a mirror reverses right and left, why doesn't it reverse up and down?

Watch Video Solution

4. How can we see a virtual image when it cannot be obtained on a screen ?

Watch Video Solution

5. Is is possible for a given lens to act as a converging lens in one medium, and as a diverging lens in another?

Watch Video Solution

6. A camera lens is marked $f/1.8$. What is the meaning of this mark?

Watch Video Solution

7. If these are scratches on the lens of a camera, they do not appear on a photograph taken with the camera. Explain. Do the scratches affect the photograph at all ?

Watch Video Solution

8. The sum seems to rise before it actually rises and it seems to set long after it actually sets. Explain why.

Watch Video Solution

9. Does the focal length of a lens depend on the medium in which the lens is immersed? Is it possible for a lens to act as a conversing lens in one medium and a diverging lens in another medium?

Watch Video Solution

10. Explain why the use of goggles enables an underwater swimmer to see clearly under the surface of a lake.

Watch Video Solution

11. Some motor cars have additional yellow headlights. Why?

Watch Video Solution

12. Why does a column of smoke rising above the roof of houses sseem blue against the dark background of the surrounding objects, and yellow

or even reddish against the background of a bright sky?

Watch Video Solution

13. What are primary colours ? Why are they so called ?

Watch Video Solution

14. A beam of white lighe passing through a hollow prism gives no spectrum.

Watch Video Solution

15. Ordinary paper becomes transparent when it is oiled. Explain why.

Watch Video Solution

16. Why does the moon, purely white during the day, have a yellowish hue after sunset ?

Watch Video Solution

17. What is the best position of the eye for viewing an object through a microscope?

Watch Video Solution

18. What is the function of the circular stop at the focal plane of the objective of a telescope? Givereasons.

Watch Video Solution

19. Why is the aperture of objective lens of a telescope taken large ?

Watch Video Solution

20. Can the optical length between two points even be less than the geometrical path between these points?

Watch Video Solution

Conceptual Mcq Single Option Correct

1. 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 the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is

A. 0

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

C. π

D. 2π

Answer: D

Watch Video Solution

2. In Fraunhofer diffraction experiment, L is the distance between screen and the obstacle, b is the size of obstacle and λ is wavelength of incident light. The general condition for the applicability of Fraunhofer diffraction is :

A. $\frac{b^2}{L\lambda} > > 1$

B. $\frac{b^2}{L\lambda} = 1$

C. $\frac{b^2}{L\lambda} < < 1$

D. $\frac{b^2}{L\lambda} \neq 1$

Answer: D

Watch Video Solution

3. In a Fraunhofer diffraction experiment at a single slit using a light of wavelength 400 nm, the first minimum is formed at an angle of 30°. The direction θ of the first secondary maximum is given by :

A. $\sin^{-1}\left(\frac{2}{3}\right)$

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

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

D. $\sin^{-1}\left(\frac{2}{3}\right)$

Answer: C

Watch Video Solution

4. If we observe the single slit Fraunhofer diffraction with wavelength λ and slit width d, the width of the central maxima is 2θ. On decreasing the slit width for the same λ

A. θ increases

B. θ remains unchanged

C. θ decreases

D. θ increases or decreases depending on the intensity of light

Answer: B

Watch Video Solution

5. Angular width (β) of central maximum of a diffraction pattern on a single slit does not depend upon

A. λ of light used

B. Width of slit

C. Distance of slits from screen

D. Ratio of λ and slit width

Answer: A

Watch Video Solution

6. The critical angle of a certain medium is $\sin^{-1}\left(\frac{3}{5}\right)$. The polarizing angle of the medium is :

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

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

C. $\tan^{-1}\left(\frac{5}{3}\right)$

D. $\tan^{-1}\left(\frac{4}{5}\right)$

Answer: B

Watch Video Solution

7. Which of the following cannot be polarised?

A. Ultraviolet rays

B. Ultrasonic waves

C. X-rays

D. Radiowaves

Answer: A

Watch Video Solution

8. An unpolarised beam of intensity I_0 falls on a polariod. The intensity of the emergent light is :

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

B. I_0

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

D. Zero

Answer: D

Watch Video Solution

9. Which of the following is a dichroic crysral?

A. Quartz

B. Tourmaline

C. Mica

D. Selenite

Answer: A

Watch Video Solution

10. An unpolarised beam of intensity I_0 is incident on a pair of nicols making an angle of 60° with each other. The intensity of light emerging from the pair is

A. I_0

B. $I_0/2$

C. $I_0/4$

D. $I_0 / 8$

Answer: A

Watch Video Solution

11. When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which does not get transmitted is

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

B. $\frac{1}{4} I_0$

C. Zero

D. I_0

Answer: B

Watch Video Solution

12. An optically active compound

A. Rotates the plane polarised light

B. Changing the direction of polarised light

C. Do not allow plane polarised light to pass through

D. None of the above

Answer: C

Watch Video Solution

13. A $20cm$ length of a certain solution causes right-handed rotation of 38°. A $30cm$ length of another solution causes left-handed rotation of 24°. The optical rotation caused by $30cm$ length of a mixture of the above solutions in the volume ratio $1:2$ is

A. Left handed rotation of 14°

B. Right handed rotation of 14°

C. Left handed rotation of 3°

D. Right handed rotation of 3°

Answer: A

Watch Video Solution

14. Specific rotation of sugar solution is 0.5 deg m^2/kg. $200kgm^{-3}$ of impure sugar solution is taken in a sample polarimeter tube of length 20 cm and optical rotation is found to be 19°. The percentage of purity of sugar is :

A. 0.2

B. 0.8

C. 0.95

D. 0.89

Answer: D

Watch Video Solution

15. Two polaroids are placed in the path of unpolarized beam of intensity I_0 such that no light is emitted from the second polarid. If a third polaroid whose polarization axis makes an angle θ with the polarization axis of first polaroid, is placed between these two polariods then the intensity of light emerging from the last polaroid will be

A. $\left(\frac{I_0}{8}\right)\sin^2 2\theta$

B. $\left(\frac{I_0}{4}\right)\sin^2 2\theta$

C. $\left(\frac{I_0}{2}\right)\cos^4 \theta$

D. $I_0 \cos^4 \theta$

Answer: D

Watch Video Solution

16. Two light waves arrives at a certain point on a screen. The waves have the same wavelength. At the arrival point, their amplitudes and phase differences are :

(I) $2a_0, 6a_0$ and π rad (II)$3a_0, 5a_0$ and π and

(III) 9a_(0), 7a_(0), " and "3pi " rad"$(IV) 2a_0, 2a_0$ and $0.$

The pair/s which has greatest intensity is/are :

A. I

B. II

C. II,III

D. I, IV

Answer: B

Watch Video Solution

17. Two beam of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$

at point A and π at point B. Then the difference between resultant intensities at A and B is : $(2001, 2M)$

A. 3I

B. 4I

C. 5I

D. 6I

Answer: D

Watch Video Solution

18. A plane electromagnetic wave of frequency w_0 falls normally on the surface of a mirror approaching with a relativisitic velocity v. Then frequency of the reflected wave will be (given $\beta = \frac{v}{c}$):

A. $\left(\frac{1-\beta}{1+\beta}\right)w_0$

B. $\frac{1+\beta}{(1-\beta)w_0}$

C. $\frac{(1+\beta)w_0}{(1-\beta)}$

D. $\frac{(1-\beta)}{(1+\beta)w_0}$

Answer: A

Watch Video Solution

19. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and theh 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. $\frac{b^2}{d}, \frac{b^2}{bd}$

B. $\frac{b^2}{d}, \frac{b^2}{4d}$

C. $\frac{b^2}{2d}, \frac{b^2}{3d}$

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

Answer: A

Watch Video Solution

20. Ratio of intensities between a point A and that of central fringe is 0.853. If we consider slits are of equal width then path difference between two waves at point A will be :

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

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

C. $\frac{\lambda}{8}$

D. λ

Answer: C

Watch Video Solution

21. Two waves of same intensity produce interference. If intensity at maximum is 4I, then intensity at the minimum will be:

A. 0

B. 2I

C. 3I

D. 4I

Answer: B

Watch Video Solution

22. Intensity of central bright fringe due to interference of two identical coherent monochromatic sources is I. If one of the source is switched off, then intensity of central bright fringe becomes :

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

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

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

D. I

Answer: C

Watch Video Solution

23. In a Young's double slit experiment, the separation of the two slits is doubled. To keep the same spacing of fringes, the distance D of the screen from the slits should be made

A. D

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

C. 2D

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

Answer: A

Watch Video Solution

24. In a Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen when light of wavelength

600nm is used. If the wavelength of light is changed to 400nm, number of fringes observed in the same segment of the screen is given by

A. 18

B. 24

C. 30

D. 36

Answer: A

Watch Video Solution

25. In Young's double slit experiment the interference pattern is found to have an intensity ratio between bright and dark fringes as 9. This implies

A. 1

B. 2

C. 9

D. 3

Answer: C

Watch Video Solution

26. If A is the amplitude of the wave coming from a line source at a distance r, then :

A. $A \propto r^{-2}$

B. $A \propto r^{-1}$

C. $A \propto r^{2}$

D. $A \propto r^{1}$

Answer: B

Watch Video Solution

27. If A is the amplitude of the wave coming from a line source at a distance r, then :

A. $A \propto r$

B. $A \propto r^{-1/2}$

C. $A \propto r^{-2}$

D. $A \propto r^{1/2}$

Answer: B

Watch Video Solution

28. Phase difference between two waves having same frequency (v) and same amplitude (A) is $2\pi/3$. If these waves superimpose each other, then resultant amplitude will be–

A. 2A

B. 0

C. A

D. A^2

Answer: C

Watch Video Solution

29. Widths of two slits in Young's experiment are in the ratio $4:1$. What is the ratio of the amplitudes of light waves from them ?

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: B

Watch Video Solution

30. Two slits S_1 and S_2 illuminated by a white light source give a white central maxima. A transparent sheet of refractive index 1.25 and thickness t_1 is placed in front of S_1. Another transparent sheet of refractive index 1.50 and thickness t_2 is placed in front of S_2. If central maxima is not effected, then ratio of the thickness of the two sheets will be :

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: B

Watch Video Solution

31. When a transparent parallel plate of uniform thickness t and refractive index μ is interposed normally in the path of a beam of light, the optical path is

A. μt

B. μ / t

C. $(\mu - 1)t$

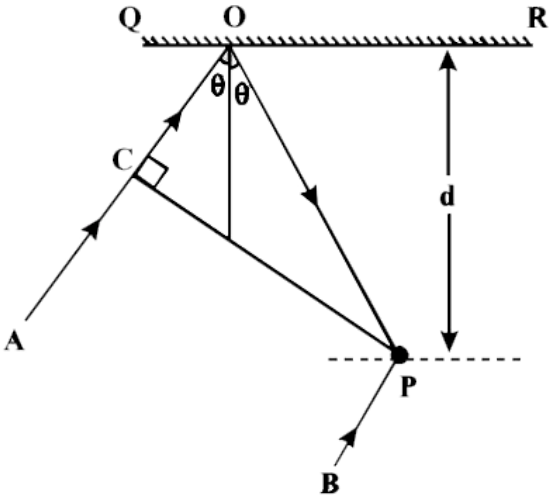
D. None of these

Answer: A

Watch Video Solution

32. In the adjacent diagram, CP represents a wavefront and AO & BP, the corresponding two rays. Find the condition on θ for constructive

interference at P between the ray BP and reflected ray OP.



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

B. $\cos\theta = \frac{2\lambda}{4d}$

C. $\sec\theta - \cos\theta = \frac{\lambda}{d}$

D. $\sec\theta - \cos\theta = \frac{4\lambda}{d}$

Answer: A

Watch Video Solution

33. In a Young's double slit experiment, D equals the distance of screen and d is the separation between the slits. The distance of the nearest point to the central maximum where the intensity is same as that due to a single slit is equla to

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

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

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

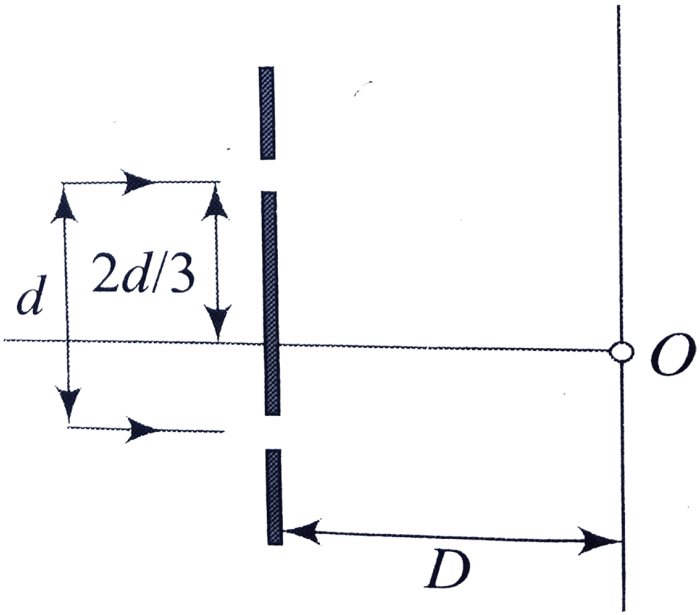
D. $\frac{2D\lambda}{d}$

Answer: A

Watch Video Solution

34. In figure, if a parallel beam of white light is incident on the plane of the slit, then the distance of the nearest white spot on the screen form O

is [assume $d << D, \lambda << D$]



A. 0

B. $d/2$

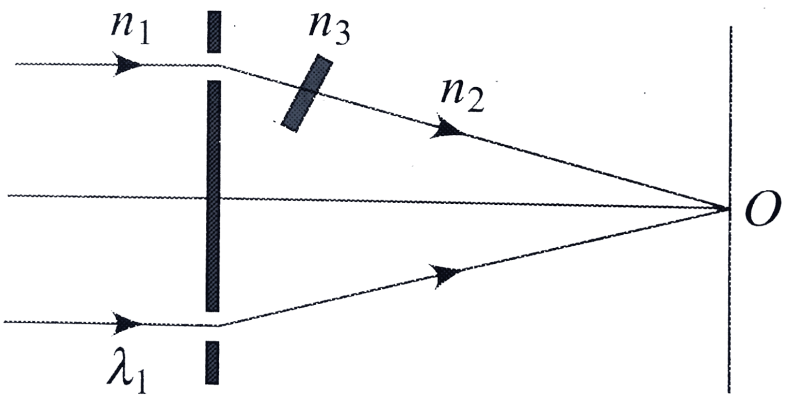
C. $d/3$

D. $d/6$

Answer: A

Watch Video Solution

35. In YDSE shown in figure a parallel beam of light is incident on the slits from a medium of refractive index n_1. The wavelength of light in this medium is λ_1. A transparent of thickness t and refractive index n_3 is put in front of one slit. The medium between the screen and the plane of the slits is n_2. The phase difference between the light waves reaching point O (symmetrical, relative to the slits) is



A. $\frac{2\pi}{n_1\lambda_1}(n_3 - n_2)t$

B. $\frac{2\pi}{\lambda_1}(n_3 - n_2)t$

C. $\frac{2\pi n_1}{n_2\lambda_1}\left(\frac{n_3}{n_2} - 1\right)t$

D. $\frac{2\pi n_1}{\lambda_1}(n_3 - n_1)t$

Answer: A

Watch Video Solution

Numerical Mcqs Single Options Correct

1. In Young's double-slit experiment the angular width of a fringe formed on a distant screen is 1°. The wavelength of light used is 6000Å. What is the spacing between the slits?

A. 0.241 mm

B. 0.344 mm

C. 0.519 mm

D. 0.413 mm

Answer: C

Watch Video Solution

2. In a Young's double slit experiment, two narrow vertical slits placed 0.800 mm apart are illuminated by the same source of yellow light of wavelength 589 run. How far are the adjacent bright bands in the interference pattern observed on a screen 2.00 m away ?

A. 14.73 mm

B. 14.73 cm

C. 1.473 mm

D. 147.3 mm

Answer: A

Watch Video Solution

3. Two stars are situated at a distance of 8 light years from the earth. These are to be just resolved by a telescope of diameter 0.25 m. If the wavelength of light used is 5000 Å, then the distance between the stars must be

A. $3 \times 10^{10} m$

B. $3.35 \times 10^{11} m$

C. $1.95 \times 10^{11} m$

D. $4.32 \times 10^{10} m$

Answer: D

Watch Video Solution

4. A beam of light of wavelength $600 nm$ from a distant source falls on a single slit $1 mm$ wide and the resulting diffraction pattern is observed on a screen $2 m$ away. The distance between the first dark fringes on either side of the central bright fringe is

A. 1.2 cm

B. 1.2 cm

C. 2.4 cm

D. 2.4 mm

Answer: B

Watch Video Solution

5. A single slit of width a is illuminated by violet light of wavelength $400nm$ and the width of the diffraction pattern is measured as y. When half of the slit width is covered and illuminated by yellow light of wavelength $600nm$, the width of the diffraction pattern is

A. The pattern vanishes

B. $y/3$

C. 3y

D. None of the above

Answer: D

Watch Video Solution

6. A beam of natural light falls on a system of 5 polaroids, which are arranged in succession such that the pass axis of each polaroid is turned through 60° with respect to the precending one. The friction of the incident light intensity that passes through the system is :

A. $\frac{1}{64}$

B. $\frac{1}{32}$

C. $\frac{1}{512}$

D. $\frac{1}{128}$

Answer: C

Watch Video Solution

7. 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. $\left[\frac{3}{\sqrt{2}}\right] \times 10^8$

C. $\sqrt{3} \times 10^8$

D. 0.5×10^8

Answer: A

Watch Video Solution

8. A double slit experiment is done with monochromatic light of wavelength 6000Å. Slits are 2 mm apart and fringes are observed on a screen placed 10 cm away from the slits. If a transparent plate of thickness 0.5 mm is placed in front of one of the slit, interference pattern shifts by 5 mm. Then refractive index of transparent plate should be :

A. 1.1

B. 1.2

C. 1.3

D. 1.5

Answer: B

Watch Video Solution

9. A ray of light is incident on a medium boundry at polarising angle such that its deviation is 24°, then angle of incidence is :

A. 24°

B. 57°

C. 60°

D. 30°

Answer: D

Watch Video Solution

10. If the polarizing angle of a piece of glass for green light is 54.74°, then the angle of minimum deviation for an equilateral prism made of same glass is : $[\text{Given}: \tan 54.74^\circ = 1.414]$

A. 45°

B. 54.74°

C. 60°

D. 30°

Answer: B

Watch Video Solution

11. In Young's double slit experiment the light emitted from source has $\lambda = 6500\text{Å}$ and the distance between th two slits is 1 mm. Distance between the screen and slit is 1 metre. Distance between third dark and fifth birth fringe will be :

A. 3.2 mm

B. 1.63 mm

C. 0.585 mm

D. 2.31 mm

Answer: B

Watch Video Solution

12. In Young's double slit experiment, if the slit widths are in the ratio $1:9$, then the ratio of the intensity at minima to that at maxima will be

A. $25:1$

B. $9:4$

C. $3:2$

D. $81:16$

Answer: C

Watch Video Solution

13. A light source approaches the observer with velocity 0.5 cm. Doppler shift for light of wavelength $550Å$ is :

A. $616Å$

B. $1833Å$

C. $5500Å$

D. $6160Å$

Answer: B

Watch Video Solution

14. A plane monochromatic light falls normally on a diaphragm with two narrow slits separated by a distance d = 2.5 mm. A fringe pattern is formed on the screen placed at D = 100 cm behind the diaphragm. If one

of the slits is covered by a glass plate of thickness $10\mu m$, then distance by which these fringes will be shifted will be :

A. 2 mm

B. 3 mm

C. 4 mm

D. 5 mm

Answer: C

Watch Video Solution

15. In a single slit diffraction pattern the angular width of a central maxima is 30°. When the slit is illuminated by light of wavelength 6000Å. Then width of the slit will be approximately given as :

A. $12 \times 10^{-6} m$

B. $12 \times 10^{-7} m$

C. $12 \times 10^{-8} m$

D. $12 \times 10^{-9} m$

Answer: B

Watch Video Solution

16. Light of wavelength $6000 A^{\circ}$ is incident on a single slit. The first minimum of the diffraction pattern is obtained at 4 mm from the centre. The screen is at a distance of 2 m from the silt. The slit width will be

A. 1.0 m

B. 1.5 m

C. 2.0 m

D. 2.3 m

Answer: D

Watch Video Solution

17. If velocity of a galaxy relative to earth is $1.2 \times 10^6 ms^{-2}$ then percentage increase in wavelength of light from galaxy as compared to the similar source on earth will be :

A. 0.003

B. 0.004

C. 0.005

D. 0.006

Answer: B

Watch Video Solution

18. Light of wavelength 5000Å is incident normally on a slit. First minimum of diffraction pattern is formed at a distance of 5 mm from the central maximum. If slit width is 0.2 mm, then distance between slit and screen will be :

A. 1 m

B. 1.5 m

C. 2.0 m

D. 2.5 m

Answer: B

Watch Video Solution

19. Doppler shift for the light of wavelength 6000Å emitted from the sun is 0.04Å. If radius of the sun is $7 \times 10^8 m$ then time period of rotation of the sun will be :

A. 30 days

B. 365 days

C. 24 hours

D. 25 days

Answer: D

Watch Video Solution

20. A thin mica sheet of thickness $2 \times 10^{-6} m$ and refractive index $(\mu = 1.5)$ is introduced in the path of the first wave. The wavelength of the wave used is 5000Å. The central bright maximum will shift

A. 1

B. 2

C. 5

D. 10

Answer: D

Watch Video Solution

21. A radar operates at wavelength 50.0 cm. If the beat frequency between the transmitted singal and the singal reflected from aircraft (Δv) is 1 kHz, then velocity of the aircraft will be :

A. 800 km/hr

B. 900 km/hr

C. 1000 km/hr

D. 1032 km/hr

Answer: B

Watch Video Solution

22. A parallel beam of light of wavelength 6000Å gets diffracted by a single slit of width 0.3 mm. The angular position of the first minima of diffracted light is :

A. 6×10^{-3} rad

B. 1.8×10^{-3} rad

C. 3×10^{-3} rad

D. 2×10^{-3} rad

Answer: A

Watch Video Solution

23. When a spectral line of wavelength $\lambda = 0.59\mu m$ is observed in the directions to the opposite edges of the solar disc along its equator, there is a difference in wavelengths equal to $\delta\lambda = 8.0pm$. Find the period of the sun's revolution about its own axis.

A. 30 days

B. 24 hours

C. 25 days

D. 365 days

Answer: C

Watch Video Solution

24. If light with wavelength 0.50 mm falls on a slit of width 10 mm and at angle $\theta = 30^\circ$ to its normal. Then angular position of first minima located on any sides of the central Fraunhoffer's diffraction will be at :

A. 33.4°

B. 26.8°

C. 39.8°

D. None of these

Answer: D

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25. Angular width of central maxima 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%. The wavelength of this light will be

A. 3500Å

B. 4200Å

C. 4700Å

D. 6000Å

Answer: B

Watch Video Solution

26. A parallel beam of white of white light falls on a thin film whose refractive index is 1.33. If angle of incidence is 52° then thickness of the film for the reflected light to be coloured yellow $(\lambda = 6000\text{Å})$ most intensively must be :

A. $14(2n+1)m$

B. $1.4(2n+1)m$

C. $0.14(2n+1)m$

D. $142(2n+1)m$

Answer: C

Watch Video Solution

27. Light wavelength 6000 Å is incident normally on a slit of width 24×10^{-5} cm. find out the angular position of seconds minimum from central maximum?

A. $12 \times 10^{-5} cm$

B. $18 \times 10^{-5} cm$

C. $24 \times 10^{-5} cm$

D. $36 \times 10^{-5} cm$

Answer: C

Watch Video Solution

28. The interference fringes for sodium light $(\lambda = 5890\text{Å})$ in a double slit experiment have an angular width of 0.2°. For what wavelength will width be $10\,\%$ greater.

A. 5892Å

B. 4000Å

C. 8000Å

D. 6479Å

Answer: A

Watch Video Solution

29. In YDSE 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 plane of slits and the screen is doubled. It is found that the

distance between successive maxima (or minima) now is the same as the observed fringe shift upon the introduction of the mica sheet. Calculate the wavelength of the light.

A. $4000Å$

B. $5500Å$

C. $5892Å$

D. $6071Å$

Answer: C

Watch Video Solution

30. In a two slit experiment with monochromatic light fringes are obtained on a screen placed at some distance from the sits. If the screen is moved by m $5 \times 10^{-2}m$ towards the slits, the change in fringe width is m $3 \times 10^{-5}m$. If separation between the slits is $10^{-3}m$, the wavelength of light used is

A. 4000Å

B. 6000Å

C. 5890Å

D. 8000Å

Answer: B

Watch Video Solution

31. A monochromatic light of $\lambda = 500nm$ is incident on two identical slits separated by a distance of $5 \times 10^{-4}m$. The interference pattern is seen on a screen placed at a distance of $1m$ from the plane of slits. A thin glass plate of thickness $1.5 \times 10^{-6}m$ and refractive index $\mu = 1.5$ is placed between one of the slits and the screen. Find the intensity at the centre of the screen if the intensity is I_0 in the absence of the plate. Also find the lateral shift of the central maxima and number of fringes crossed through centre.

A. 0

B. I_0

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

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

Answer: C

Watch Video Solution

32. In a YDSE, the separation between slits is $2mm$ where as the distance of screen from the plane of slits is $2.5m$. Light of wavelengths in the range $200 - 800nm$ is allowed to fall on the slits. Find the wavelengths in the visible region that will be present on the screen at $1mm$ from central maximum. Also find the wavelength that will be present at that point of screen in the infrared as well as in the ultraviolet region.

A. $4000Å$

B. $5000Å$

C. $6000Å$

D. 8000Å

Answer: D

Watch Video Solution

33. A double-slit apparatus is immersed in a liquid of refractive index 1.33. in It has slit separation of 1 mm and distance between the plane of slits and screen is 1.33 m. The slits are illuminated by a parallel beam or light whose wavelength in air is 6300Å.

a. Calculate the fringe width.

b. One of the slits of the apparauts is covered by a thin glass sheet of refractive index 1.53. Find the smallest thickness of the sheet to bring the adjacent minimum on the axix.

A. 6.3 mm

B. 63 mm

C. 0.63 mm

D. None of these

Answer: C

Watch Video Solution

34. In a YDSE arrangement, incident yellow light is composed of two wavelength 5890Å and 5895Å. Distance between the slits is 1 mm and the screen is placed 1 m away. Order upto which fringes can be seen on the screen will be :

A. 384

B. 486

C. 512

D. 589

Answer: B

Watch Video Solution

35. When light is incident on a soap film of thickness $5 \times 10^{-5} cm$, wavelength which is maximum reflected in the visible region is $5320 Å$. The refractive index of the film will be :

A. 1.22

B. 1.33

C. 1.51

D. 1.83

Answer: B

Watch Video Solution

36. A ray of unpolarised light is incident on a glass plate of refractive index 1.54 at polarising angle, then angle of refraction is :

A. 33°

B. 44°

C. 57°

D. 90°

Answer: B

Watch Video Solution

37. First diffraction minima due to a single slit of width $1.0 \times 10^{-5} cm$ is at 30°. The wavelength of light used is :

A. 400Å

B. 500Å

C. 600Å

D. 700Å

Answer: D

Watch Video Solution

38. Light of wavelength 6328Å is incident normally on a slit of width 0.2 mm. Angular width of the central maximum on the screen will be :

A. 0.9°

B. 0.18°

C. 0.54°

D. 0.36°

Answer: B

Watch Video Solution

39. Light of wavelength λ is incident on a slit. First minima of the diffraction pattern is found to lie at a distance of 6 mm from the central maximum on a screen placed at a distance of 2 m from the slit. If slit width is 0.2 mm, then wavelength of the light used will be :

A. 4000Å

B. 6000Å

C. 7000Å

D. 7400Å

Answer: D

Watch Video Solution

40. A slit 5 cm wide when irradiated by waves of wavelength 10 mm results in the angular spread of the central maxima on either side of incident light by about :

A. $1/2$ radian

B. $1/4$ radian

C. 3 radian

D. $1/5$ radian

Answer: A

Watch Video Solution

41. In Young's double slit experiment, ten slits separated by a distance of 1 mm are illuminated by a monochromatic light source of wavelength $5 \times 10^{-7} m$. If the distance between slit and screen is 2 metre, then separation of bright lines in the interference pattern will be :

A. 0.5 mm

B. 1.0 mm

C. 1.5 mm

D. 1.75 mm

Answer: B

Watch Video Solution

42. A star is moving away from earth and shift in spectral line of wavelength 5700Å is 1.90Å. Velocity of the star is :

A. $50kms^{-1}$

B. $70kms^{-1}$

C. $80kms^{-1}$

D. $100kms^{-1}$

Answer: A

Watch Video Solution

43. In two separate set-ups of the Young's double slit experiment, fringes of equal width are observed when lights of wavelength in the ratio of $1:2$ are used. If the ratio of the slit separation in the two cases is $2:1$, the ratio of the distance between the plane of the slits and the screen in the two set-ups are

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: D

Watch Video Solution

44. In a young's double slit experiment, two slits are illuminated by a mixture of two wavelength 12000Å and 10000Å. At 6.0 mm from the common central bright fringe on a screen 2 m away from the slits, a bright fringe of one interference pattern coincides with the bright fringe of other. Distance between the slits should by :

A. 1.0mm

B. 1.5mm

C. 2.0mm

D. 2.5mm

Answer: A

Watch Video Solution

45. In a young's double slit experiment, slits are illuminated by a monochromatic source of wavelength 6000Å and fringes are obtained. If screen is moved by a distance of 5 cm towards slits, change in fringe width is $3 \times 10^{-5} m$. Then separation between the slits will be :

A. 1 mm

B. 1.2 mm

C. 1.5 mm

D. 1.63 mm

Answer: C

Watch Video Solution

46. An unpolarized beam of light is incident on a group of three polarizing sheets which are arranged in such a way that plane of rotation

of one make an angle of 60° with the adjacent one. The temperature of incident light transmitted by first polarizer will be :

A. 6.25

B. 12.5

C. 50

D. None of these

Answer: C

Watch Video Solution

47. 80 gm of impure sugar when dissolved in a litre of water gives an optical rotation of 9.9° when placed in a tube of length 20 cm. If concentration of sugar solution is 75 gm/litre then specific rotation of sugar is :

A. 44°

B. 55°

C. 66°

D. 73°

Answer: D

Watch Video Solution

48. In a YDSE setup interference fringes are obtained by sodium light of wavelength 5890Å. On screen the fringes have an angular width 0.20°. Now the wavelength of light is changed and it is found that fringe width increases by 10%, the new wavelength of incident light is :

A. 5896Å

B. 7321Å

C. 6300Å

D. 6479Å

Answer: C

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

A. 12

B. 18

C. 24

D. 30

Answer: A

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Advance Mcqs With One Or More Options Correct

1. If one of the slit of a standard Young's double slit experiment is covered by a thin parallel sided glass slab so that it transmits only one-half the light intensity of the other, then

A. The fringe pattern will get shifted towards the covered slit

B. The fringe pattern will get shifted away from the covered slit

C. The bright fringes will become less bright and the dark ones will becomes more bright

D. The fringe width will remain unchanged

Answer: A

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2. To observe a stationary interference pattern formed by two light waves, which of the following is not a necessary condition:

A. Same frequency

B. Same amplitude

C. Constant phase difference

D. Same intensity

Answer: A

Watch Video Solution

3. In YDSE setup when white light is used then which of the following statements are correct for the interference pattern obtained.

A. The fringe next to the central maxima will be Reddish white

B. Central maxima will be white in colour

C. The fringe next to the central maxima will be Bluish white

D. There will be no fringe which is perfectly dark

Answer: A

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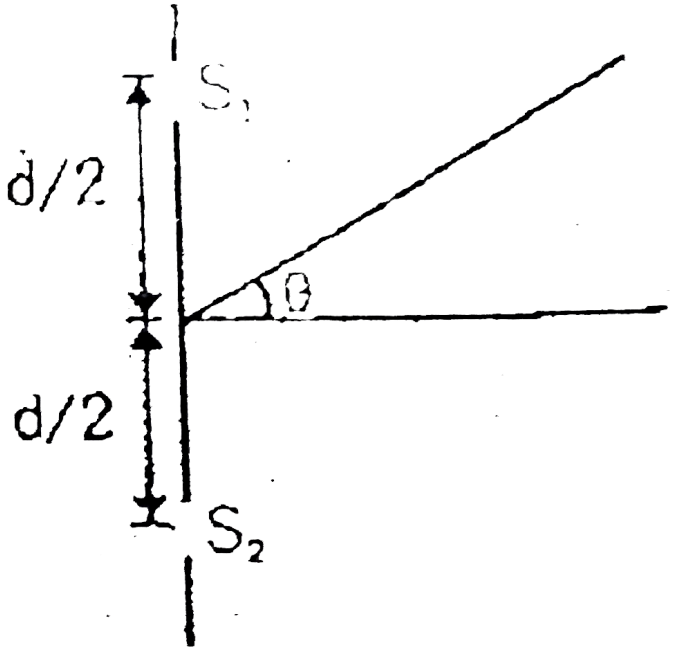


4.

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 funtion of θ, where θ is defined as shown. if I_0 is the maximum intensity then $I(\theta)$ for $0 \leq \theta \leq 90^\circ$ is given by:

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

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 values of θ

Answer: A

Watch Video Solution

5. In a given YDSE setup if the wavelength of light beam incident ons lit plane is decreased then which of the following statement is/are correct :

A. The intensity of bright fringes will decrease

B. Fringe pattern will shrink

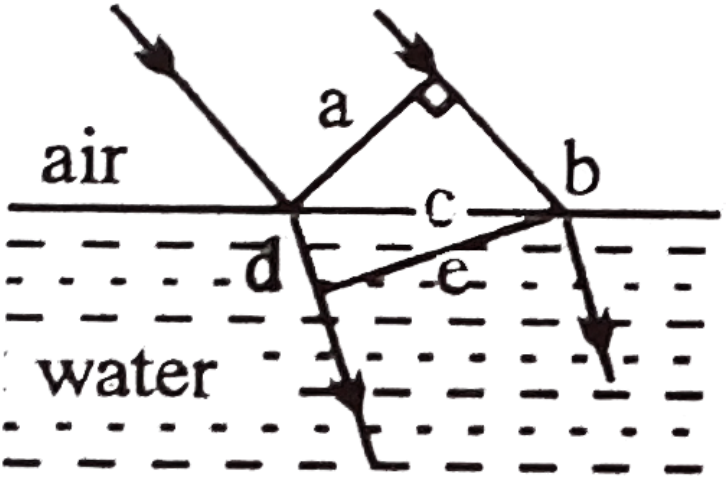
C. Total number of bright fringes appearing on screen will increase

D. Only central fringe intensity will increase

Answer: A

Watch Video Solution

6. plane waves refracted for air to water using Huygen.s principal a, b, c, d, e ae length on the diagram.The refractive index of water wrt air is the ratio.



A. a/e

B. b/e

C. b/d

D. d/b

Answer: A

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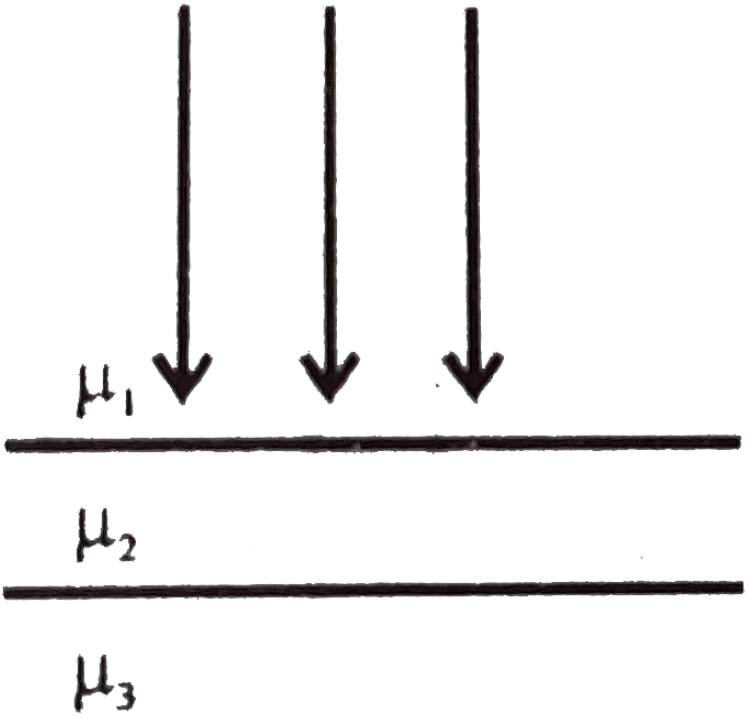
7. Consider a case of thin film interference as shown.Thickness of film is equal to wavelength of light in μ_2



A. Reflected light will be maximum if $\mu_1 < \mu_2 < \mu_3$

B. Reflected light will be maximum if $\mu_1 < \mu_2 > \mu_3$

C. Transmitted light will be maximum if $\mu_1 < \mu_2 < \mu_3$

D. Transmitted light will be maximum if $\mu_1 < \mu_2 > \mu_3$

Answer: A

Watch Video Solution

8. A light wave is travelling along - Y direction. For this light wave, which of the following equations of planes may represent its wavefront.

A. x = 6

B. $x + y + 2z = 8$

C. y = 8

D. z = 2

Answer: A

Watch Video Solution

9. In a single slit diffraction pattern obtained on a screen, if the slit width is gradually decreased, which of the following statement is/are correct:

A. Fringe pattern will expand

B. Fringe pattern will shrink

C. Fringes may disappear

D. No effect on fringe pattern

Answer: A

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10. Two coherent light waves each having intensities I_0 interfering at a point in space where resulting intensity observed is $I_0/2$, the phase difference between the two waves at the point of interference can be :

A. $\pi/3$

B. $2\pi/3$

C. $4\pi/3$

D. $5\pi/3$

Answer: A

Watch Video Solution

11. In a series of polaroids placed in such a way that optical axis of each polaroid makes same angle with the next one. When unpolarized light falls on first and if no light is coming out from the last polaroid then by using how many number of polaroids in series this can be achieved :

A. 3

B. 4

C. 5

D. 6

Answer: A

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12. Two point sources are $d = n\lambda$ apart. A screen is held at right angles to the line joining the two sources at a distance D from the nearer source. Calculate the distance of the point on the screen where the first bright fringe is observed. Assume $D > > d$.

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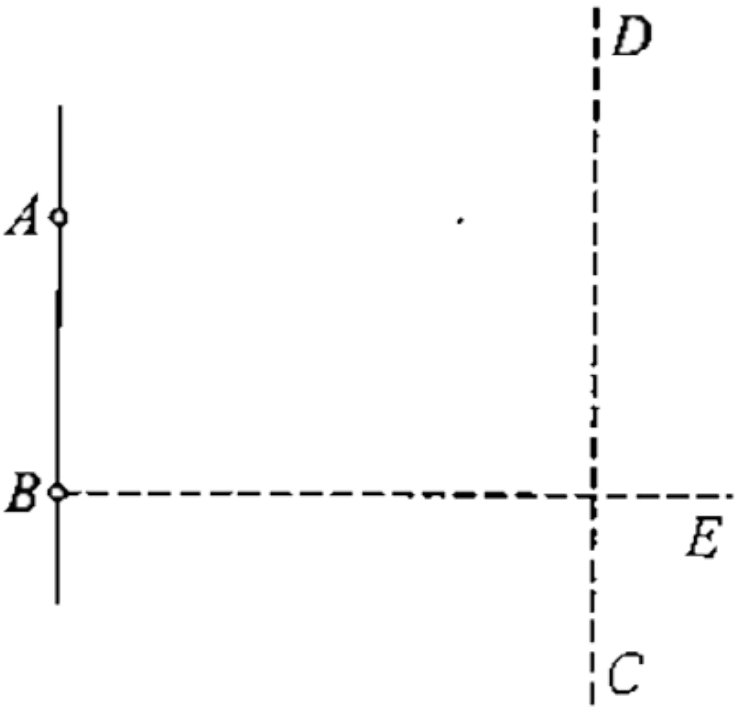
13. Two coherent monochromatic sources A and B emit light of wavelength λ. The distance beween A and B is $d = 4\lambda$.



(a) If a light detector is moved along a line CD parallel to AB, what is the maximum number of minima observed ?

(b) If the detector is moved along a line BE perpendicular to AB and passing through B, what is the number of maxima observed ?

Watch Video Solution

14. In a Young's arrangement, the distance between the slits is 1.5 mm and the distance of the screen from the slits is 2m. At what minimum distance from the central fringe will red and violet bright fringes coincide if the slit

is illuminated with white light? The wavelength range in white light is from 420 nm to 690 nm.

Watch Video Solution

15. A double slit apparatus is immersed in a liquid of refractive index 1.33. It has slit and the screen 1 mm. The slits are illuminated by a parallel beam of light whose wavelength in air is 6300Å

a. calculate the fringe width.

b. One of the slits of the apparatus is covered by a thin glass sheet of refractive index 1.53. Find the smallest thickness of the sheet to bring athe adjacent minima on the axis.

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16. In a YDSE, the separation between slits is $2mm$ where as the distance of screen from the plane of slits is $2.5m$. Light of wavelengths in the range $200 - 800nm$ is allowed to fall on the slits. Find the wavelengths in the visible region that will be present on the screen at $1mm$ from central

maximum. Also find the wavelength that will be present at that point of screen in the infrared as well as in the ultraviolet region.

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17. A narrow slit of width 0.025 mm is illuminated by a parallel beam of light. The diffraction pattern is observed through a telescope. It is found that to reach the first minimum, the telescope has to be rotated through $1^{\circ}24'$ from the direction of the direct ray. Calculate the wavelength of light used.

$[6100\text{Å}]$

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18. Angular width of central maximum in the Fraunhoffer 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.

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19. In a Young's double slits set up, the wavelength of light used is 546nm. The distance of screen from slits is 1m. The slits separation is 0.3 mm.

(a) Compare the intensity at a point P distant 10mm from the central fringe where the intensity is I_0.

(b) Find the number of bright fringes between P and the central fringe.

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20. In a double slit pattern $(\lambda = 6000\text{Å})$, the first order and tenth order maxima fall at 12.50 mm and 14.55mm from a particular reference point. If λ is changed to 5500Å, find the position of zero order and tenth order fringes, other arrangements remaining the same.

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21. 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.

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22. A Young's double slit apparatus is immersed in a liquid of refractive index μ_1. The slit plame touches the liquid surface. A parallel beam of monochromatic light of wavelength λ (in air) is incident normally on the slits.

a. Find the fringe width.

b. If one of the slits (say S_2) is covered by a transparent slab of refrative index μ_2 and thickless t as shown, find the new position of central maxima.

c. Now, the other slit, S_1 is also covered by a slab of same thickness and refractive index μ_3 as shown in Fig. 2.49 due to which the central maxima

recovers it positon, find the value of μ_3

Find the ratio of intensities at O in the three conditions (a), (b), and (c).

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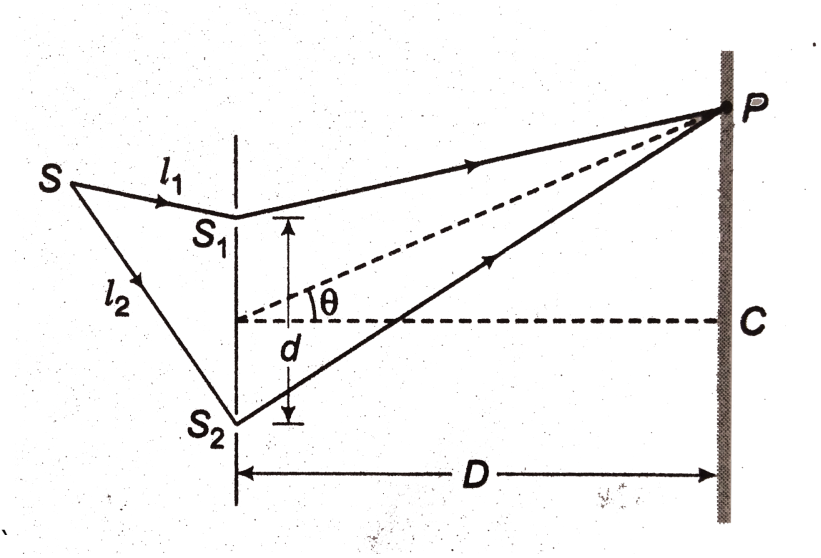
23. In a Young's double slit experiment, the light sources is at distance $l_1 = 20\mu m$ and $l_2 = 40\mu m$ form the main slit. The light of wavelength lambda = 500nm is incident on slits separated at a distance $10\mu m$. A screen is placed at a distance D = 2 away from the slits as shown in figure. Find

(a) the values of θ relative to the central line where maxima appear on the screen?

(b) how many maxima will appear on the screen?

(c) what should be the minimum thickness of a slab of refractive index 1.5

placed on the path of one of the ray so that minima occurs at C ?



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24. A screen is placed $50cm$ from a single slit, which is illuminated with 6000Å light. If the distance between the first and third minima in the diffraction pattern is $3.00mm$, what is the width of the slit ?

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25. In a double slit experiment, the distance between the slits is 5.0 mm and the slits are 1.0m from the screen. Two interference patterns can be seen on the screen one due to light with wavelength 480nm, and the other due to light with wavelength 600nm. What is the separation on the screen between the third order bright fringes of the two intergerence patterns?

Watch Video Solution

26. 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 .

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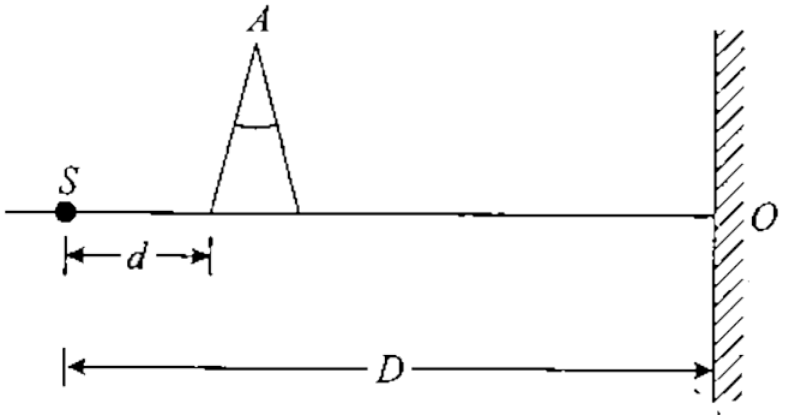
27. Two very narrow slits are spaced 1.80μm apart and are placed 35.0 cm from a screen. What is the distance between the first and second dark lines of the interference pattern when the slits are illuminated with coherent light of $\lambda = 550nm$? (Hint : The angle θ is not small).

Watch Video Solution

Unsolved Numerical Problems

1. A prism having angle A° (which is very small) is placed in front of a point source S at a small distance d. A screen is placed at a large distance D as shown in the figure-6.113. Find the fringe width of interference pattern given that source is emitting light of wavelength λ and refractive

index of prism is μ.



View Text Solution

2. A thin glass plate of thickness t and refractive index μ is inserted between screen and one of the slits in a young's experiment. If the intensity at the centre of the screen is I, what was the intensity at the same point prior to the introduction of the sheet.

Watch Video Solution

3. A double slit arrangement produces fringes for light $\lambda = 5890\text{Å}$ which are 0.2° apart. If the whole arrangement is fully dipped in a liquid of

$\mu = \frac{4}{3}$, the angular fringes separation is

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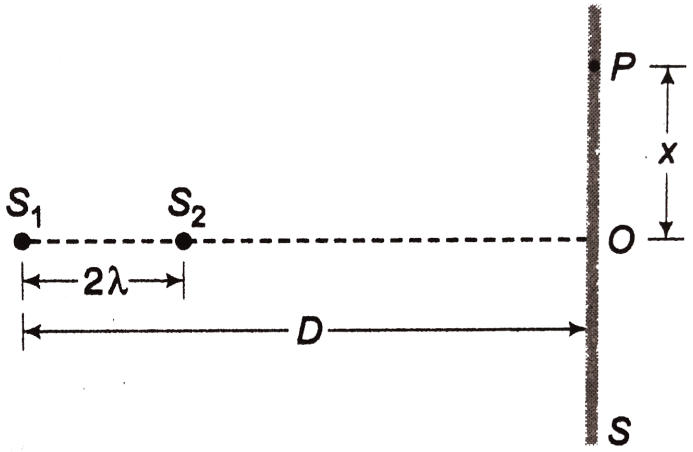
4. Two coherent narrow slits emitting light of wavelength λ in the same phase are placed parallel to each other at a small separation of 2λ. The light is collected on a screen S which is placed at a distance D($> > \lambda$) from the slit S_1 as shown in figure. Find the finite distance x such that the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



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5. In Young's double-slit experiment, the slit are 0.5 mm apart and the interference is observed on a screen at a distance of 100 cm from the slits, It is found that the ninth bright fringe is at a distance of 7.5 mm from the second dark fringe from the center of the fringe pattern. The wavelength of the light used is

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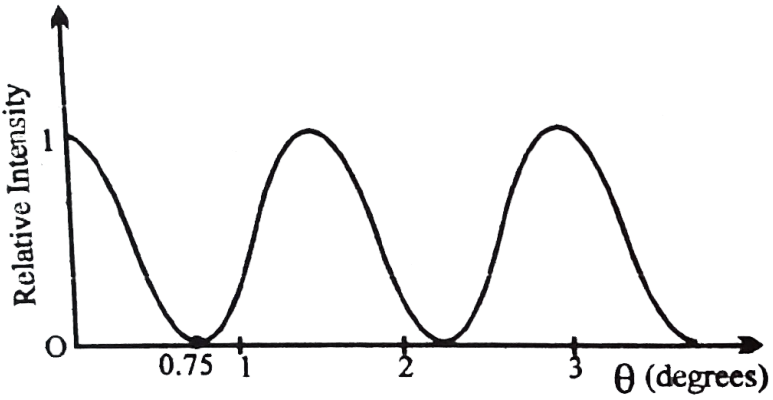
6. Light of wavelength $520nm$ passing through a double slit,produced interference pattern of relative intensity versus deflection angle θ as shown in the figure.find the separation of between the slits.



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7. The distance between two slits in a YDSE apparatus is 3mm. The distance of the screen from the slits is 1m. Microwaves of wavelength 1 mm are incident on the plane of the slits normally. Find the distance of the first maxima on the screen from the central maxima.

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8. One radio transmitter A operating $60.0MHz$is $10.0$from another similar transmitter B that is 180° out of phase with transmitter$A$.How far must be observer move from transmitter A towards transmitter B along the line connencting A andB to reach the nearest point when the two beam are in phase?

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9. The central fringe of the interference pattern produced by the light of wavelength 6000 Å is found to shift to the position of 4th dark fringe

after a glass sheet of refractive index 1.5 is introduced. The thickness of glass sheet would be

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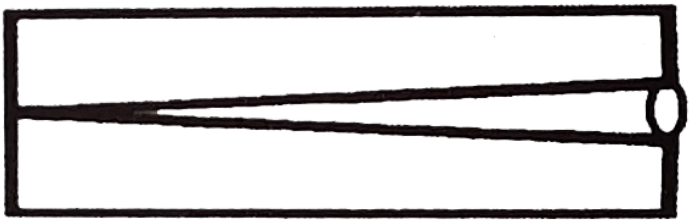
10. A broad sources of light of wavelength $680nm$ illuminated normally two glass plates.$120nm$long that meet at one end and are separated by a wire$0.048mm$in diameter at the other end,Find the number of bright fringes formed over the $120nm$distance.



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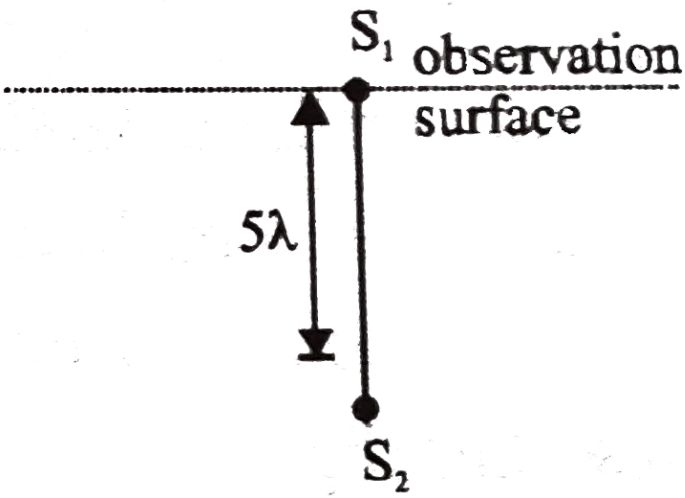
11. Two microwave coherent point sources emitting waves of wavelenths λ are placed at 5λdistance apart.The interference is being observed on a

flat non-reflecting surface along a line passing through on sources ,in a direction perpendicular to the line joining the two sources(refer figure) Considering λas$4mn$,calculate the positions of maxima and draw shape of interference pattern,takek initial phase differnce between the two sources to be zero.



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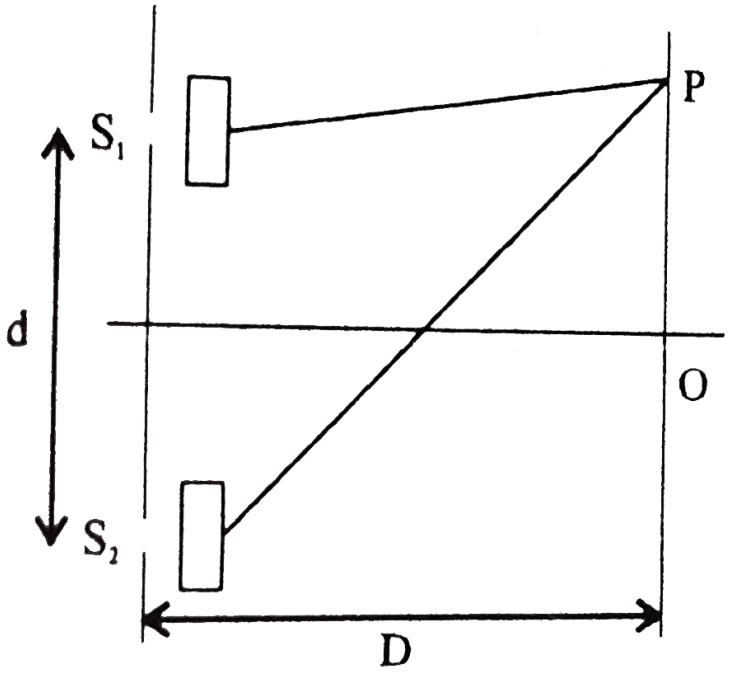
12. In a YDSE two thin transparent sheet are used in front of the slits S_1& S_2 having $\mu_1 = 1.6$and $\mu_2 = 1.4$ respectively.If both sheets have thickness$t$,the central maximum is observed at a distance of $5mm$from center$O$.Now the sheets are replaced by another two sheets each of

refractive index $\frac{\mu_1 - \mu_2}{2}$ but having thickness $t_1 \& t_2 = \frac{t_1 - t_2}{2}$.Now central maximum is observed at distance of $8mm$ from center$O$ on the same side as before.Find the thickness t_1 (inμm) [Given:d=1mm,D=1m]



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13. In a two slit experiment with monochromatic light fringes are obtained on a screen placed at some distance from the sits. If the screen is moved by m $5 \times 10^{-2} m$ towards the slits, the change in fringe width is

m $3 \times 10^{-5} m$. If separation between the slits is $10^{-3} m$, the wavelength of light used is

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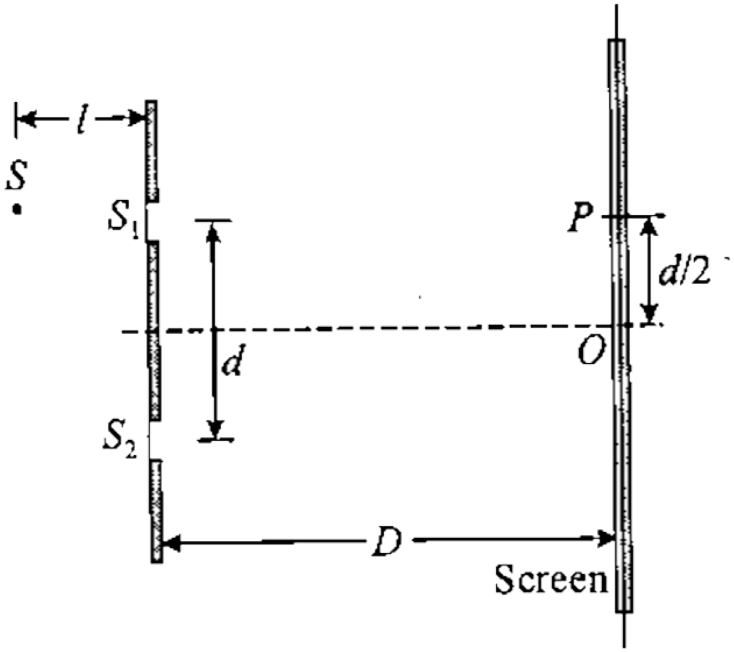
14. A source S is kept directly behind the slit S_1 in a double slit apparatus. What will be the phase difference at P, if a liquid of refraction index $\mu$is filled : (wavelength of light in aire is λ due to the source, assume $l > > d, D > > d$).



(a) Between the screen and the slits.

(b) Between the slits & the source S. In this case, find the minimum distance between the points on the screen where the intensity is half the maximum intensity on the screen.

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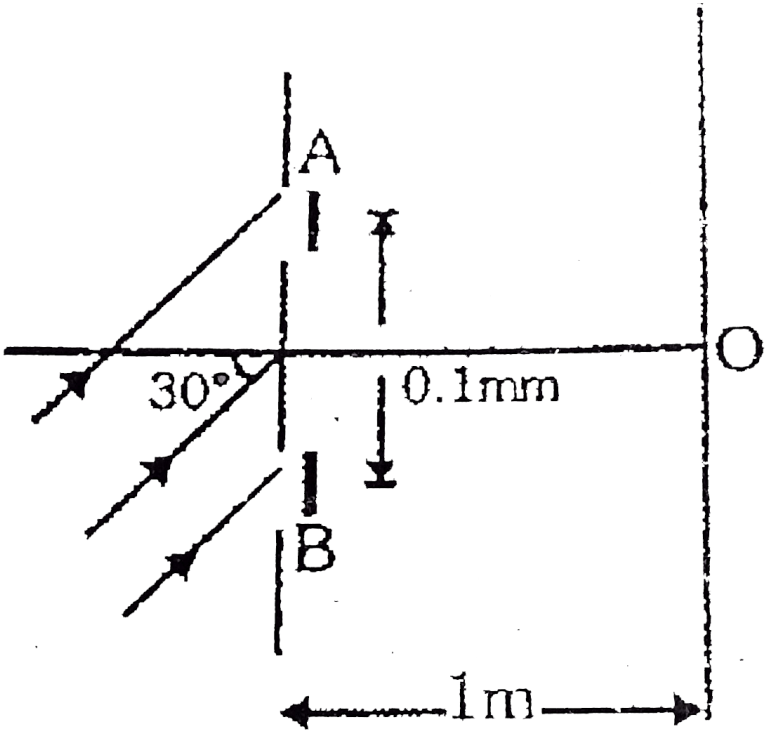

15.

In a YDSE a parallel beam of light of wavelength 6000Å is incident on slits at angle of incidence 30°. A and B are two thin transparent films each of refractive index 1.5. thickness of A is $20.4\mu m$. Light coming through A and

B have intensities I and 4I resepctively on the screen. Intensity at point O which is symmetric relative to the slits is 3I. The central maxima is above O.

(i). what is the maximum thickness of B to do so. Assuming thickness of B to be that found in part (i) answer the following parts.

(ii). Find fringe width, maximum intensity and minimum intensity on screen.

(iii). Dinstance of nearest minima from O

(iv) intensity at 5 cm on either side of O.

A. What is the maximum thickness of B to do so ? Assuming thickness of B to be that found in part (a) answer the followimg parts :

B. Find fringe width, maximum intensity & minimum intensity on screen.

C. Distance of nearest minima from O.

D. Intensity at 5 cm on either side of O.

Answer:

$[(a)t_B = 120\mu m; (b)\beta = 6mm; I_{\max} = 9I, I_{\min} = I; (c)\beta/6 = 1mm(d)I(a$

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16. A plastic film with index of refraction 1.80 is put on the surface of a car window to increase the reflectivity and thereby to keep the interior of the car cooler. The widow glass gas index of refraction 1.60.

What minimum thickness is required, if light of wavelength 600 nm in air reflected from the two sides of the film is to interfere constructively?

(b) It is found to be difficult to manufacture and install coatings as thin as calculated in part (a). What is the next greatest thickness for which there will also be constructive interference?

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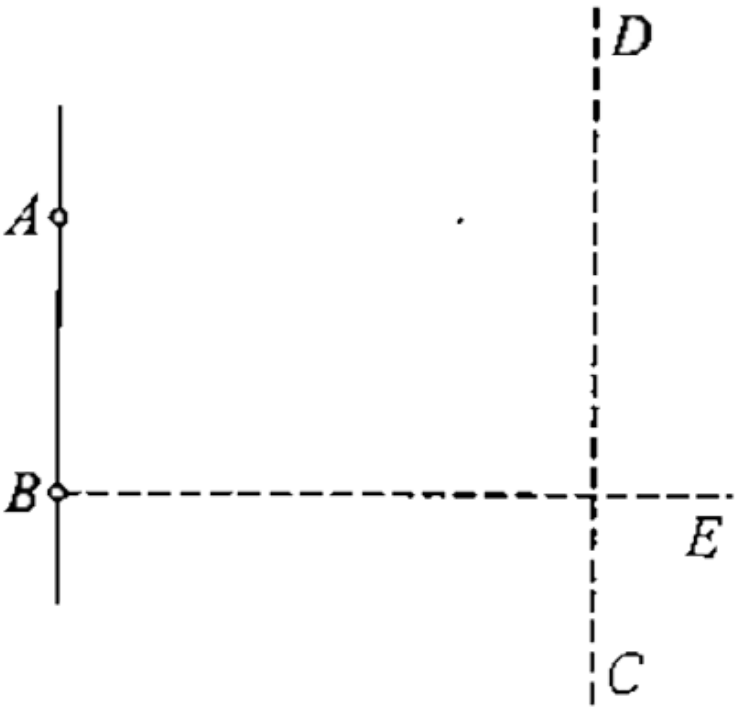
17. Two coherent monochromatic sources A and B emit light of wavelength λ. The distance beween A and B is $d = 4\lambda$.



(a) If a light detector is moved along a line CD parallel to AB, what is the maximum number of minima observed ?

(b) If the detector is moved along a line BE perpendicular to AB and passing through B, what is the number of maxima observed ?

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18. A beam of light consisting of two wavelength, 6500Å and 5200Å is used to obtain interference fringes in a Young's double slit experiment. Find the distance of the third fringe on the screen from the central

maximum for the wavelength 6500Å. What is the least distance from the central maximum at whixh the bright fringes due to both wavelengths coincide? The distance between the slits is 2 mm and the distance between the plane of the slits and the screen is 120 cm.

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19. In an experiment using Fresnel biprism, fringes of width $0.185 \times 10^{-3} m$ are observed at a distance of 1 m from the slit. Images are of the coherent sources are then produced at the same distane from the slit by placing a convex lens at a distance of 0.3 m form the slit. The images are found to be separated by $0.7 \times 10^{-2} m$. Calculate the wavelength of the light used.

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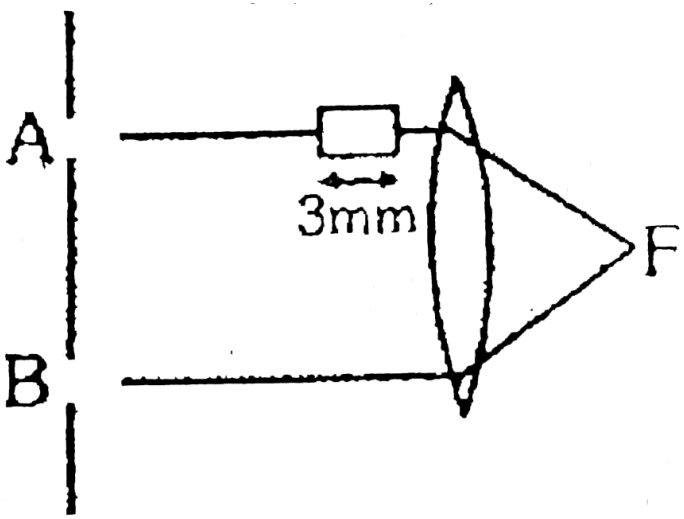
20. Two identical monochromaticlight sources A & B intensity $10^{-15} W/m^2$ produce wavelength of light $4000\sqrt{3}\text{Å}$ A glass of thickness 3mm is placed in the path of the ray as shown in figure the glass has a

varible refractive index $n = 1 + \sqrt{x}$ where x (in mm) is distance of plate from left to right calculate total intensity at focal points F of the lens.



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21. Two fine slits are placed very close to each other and they are illuminated by a strong beam of light of wavelength 5900Å. Fringes are obtained at a distance of 0.3 m from the slits. The fringe width is found to be $5.9 \times 10^{-5} m$. Calculate the distance between the slits.

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22. Biprism fringes are produced with the help of sodium light $(\lambda = 5893\text{Å})$. The angle of the biprism is 179.5^(@)` and tis refractive index 1.5. If the distance between the slit and the biprism is 0.4m and the distance between the biprism and the screen is 0.6 m, find the distance between successive bright fringes. Also calculate the maximum width of the slit for which the fringes will still be sharp.

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23. A glass plate $1.2 \times 10^{-6} m$ thick is placed in the path of one of the interfering beams in a biprism arrangement using monochromatic light of wavelength `6000Å. If the central band shifts by a distance equal to the width of the bands, find the refractive index of glass.

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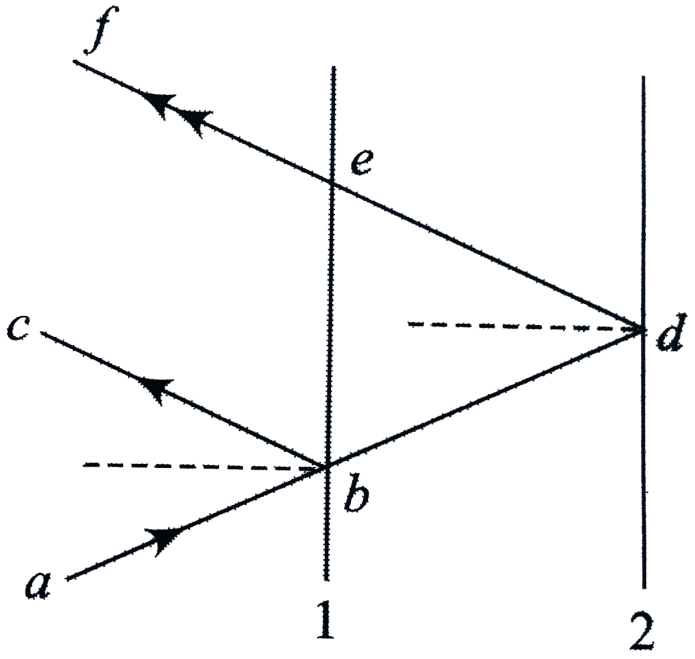
24. A narrow monochromatic beam of light of intensity 1 is incident on a glass plate as shown in figure Another identical glass plate is kept close

to the first one and parallel to it. Each glass plate reflects $25\,\%$ of the light incident on it and transmits intensities in the interference pattern formed by two beams obtained after one reflection at each plate.



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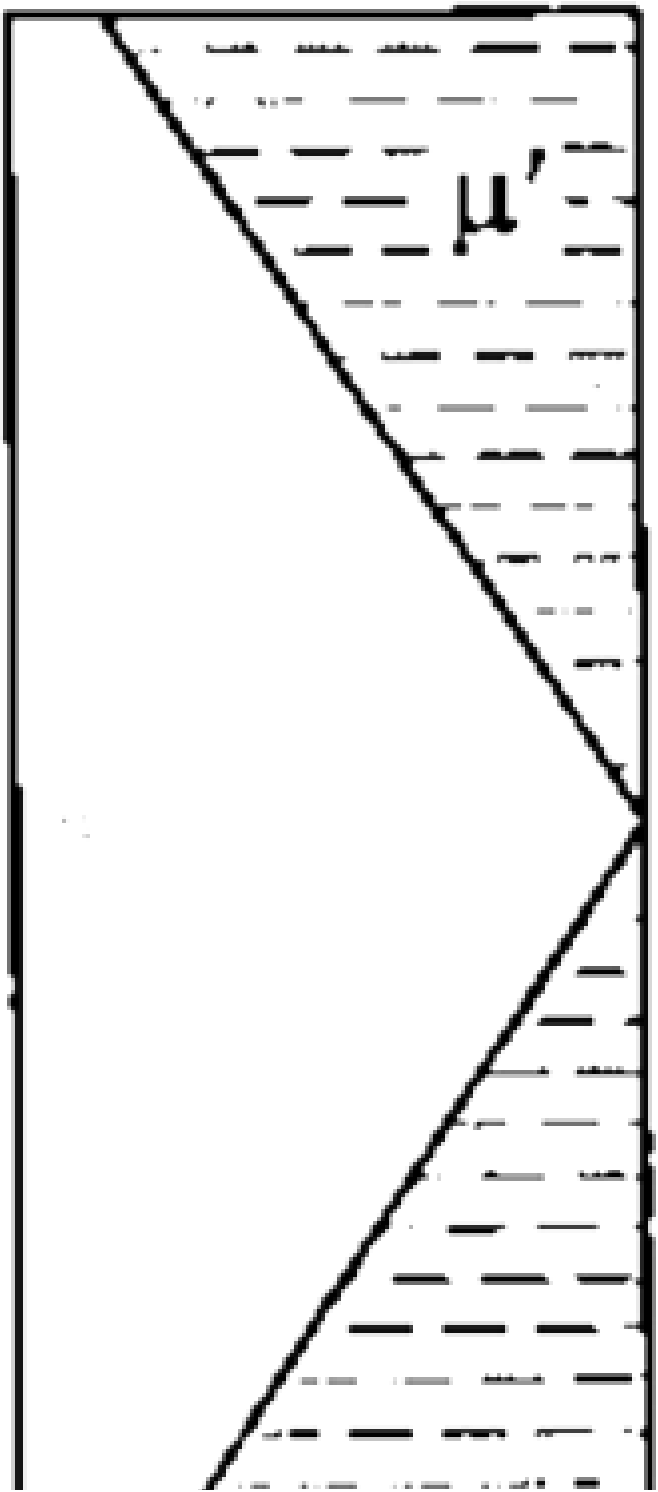
25. A plane light wave of wavelength $\lambda = 700nm$ falls normally on the base of a biprism made of glass $(\mu = 1.560)$ width refracting angle $\theta = 5^{\circ}$. A plate is placed behind the biprism and the space between them is filled with a liquid of refractive index $(\mu' = 1.500)$. Find the fringe

width on a screen behind the biprism.



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26. In a biprism experiment, the angular width of fringes was $\theta = 2'$. Calculate the separation between the slits if the wavelength of the incident light was $\lambda = 700nm$.

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27. In a biprism experiment, calculate the intensity of lights on the screen at a point $5\beta/6$ away from the central fringe in terms of the intensity of the central fringe, which is I_0. Here β is the fringe width.

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28. Two parallel beams of light P and Q are incident normally on a prism and the transmitted rays are brought to focus with the help of a convergent lens as shown in Fig. 2.23. If the intensities of the upper and lower beams immediately after transmission from face AC are 4I and I, respectively, find the resultant intensity at the focus.

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Others

1. In a Young's double slits set up, the wavelength of light used is 546nm. The distance of screen from slits is 1m. The slits separation is 0.3 mm.

(a) Compare the intensity at a point P distant 10mm from the central fringe where the intensity is I_0.

(b) Find the number of bright fringes between P and the central fringe.

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2. 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.

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3. A glass plate (n=1.53) that is 0.485 μ m thick and surrounded by air is illuminated by a beam of white light normal to the plate.

(a) What wavelengths (in air) within the limits of the visible spectrum $(\lambda = 400\text{to}700nm)$ are intensified in the reflected beam ?

(b) What wavelengths within the visible spectrum are intensified in the transmitted light?

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4. An oil film covers the surface of a small pond. The refractive index of the oil is greater than that of water. At one point on the film, the film has the smallest non-zero thickness for which there will be destructive interference in the reflected light when infrared radiation with wavelength 800 nm is incident normal to the film. When this film is viewed at normal incidence at this same point, for what visible wavelengths, if any, will there be constructive interference? (Visible light has wavelengths between 400nm and 700 nm)

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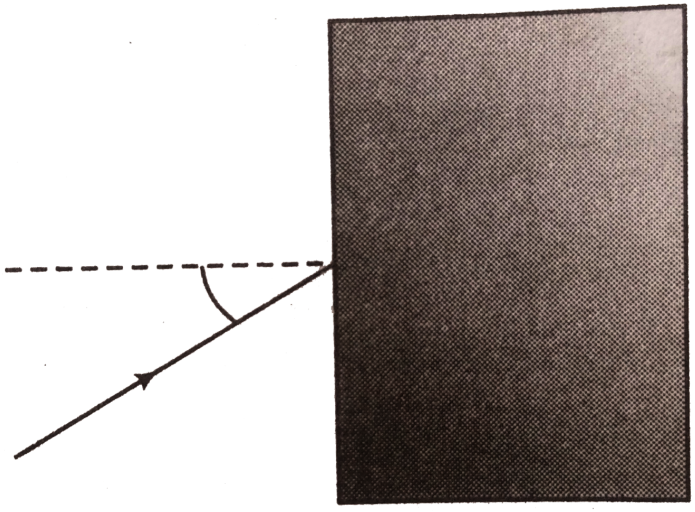
5. A ray of light is incident on the left vertical face of the glass slab. If the incident light has an intensity I and on each reflection the intensity decreases by 90% and on each refraction the intensity decreases by 10%,

find the ratio of the intensities of maximum to minimum in reflected



pattern.

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6. A convergent lens with a focal length of f = 10 cm is cut into two halves that are then moved apart to a distance of d =0.5 mm (a double lens). Find the fringe width on screen at a distance of 60 cm behind the lens if a pont source of monochromatic light $(\lambda = 5000\text{Å})$ is placed in front of the lens at a distance of a = 15 cm from it.

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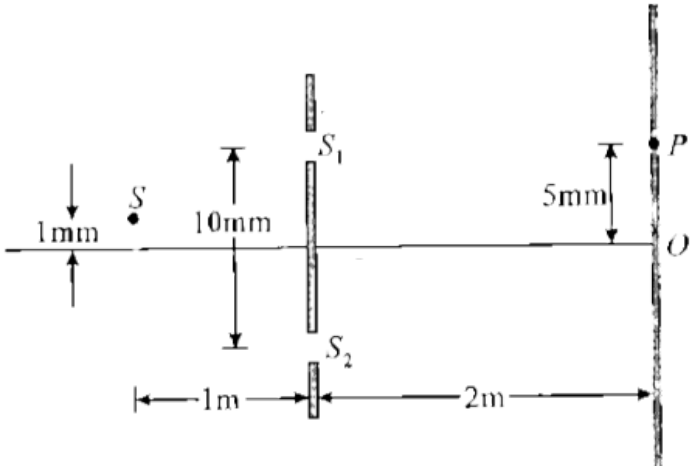
7. In the Young's double slit experiment a point source of $\lambda = 5000\text{Å}$ is placed slightly off the central axis as shown in the figure-6.127.



(a) Find the nature and order of the interference at the point P.

(b) Find the nature and other of the interference at O.

(c) Where should we place a film of refractive index $\mu = 1.5$ and what should be its thickness so that maxima of zero order is obtained at O.

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8. A lens of diameter $5.0cm$ and focal length $f = 25.0cm$ was cut along the diameter into two identical halves. In the process, the layer of the lens $\alpha = 1.00mm$ in thieckness was lost. Then the halves were put

together to form a composite lens. In this focal plane a narrow slit was placed, emitting monochromatic light with wavelength $\lambda = 0.60\mu m$. Behind the lens a screen was located at a distance $b = 50cm$ from it. Find:

(a) the which of a fringe on the screen and the number of possible maxima,

(b) the maximum width of the slit $\partial_{\max}$ at which the fringes on the screen will be still observed sufficiently sharp.

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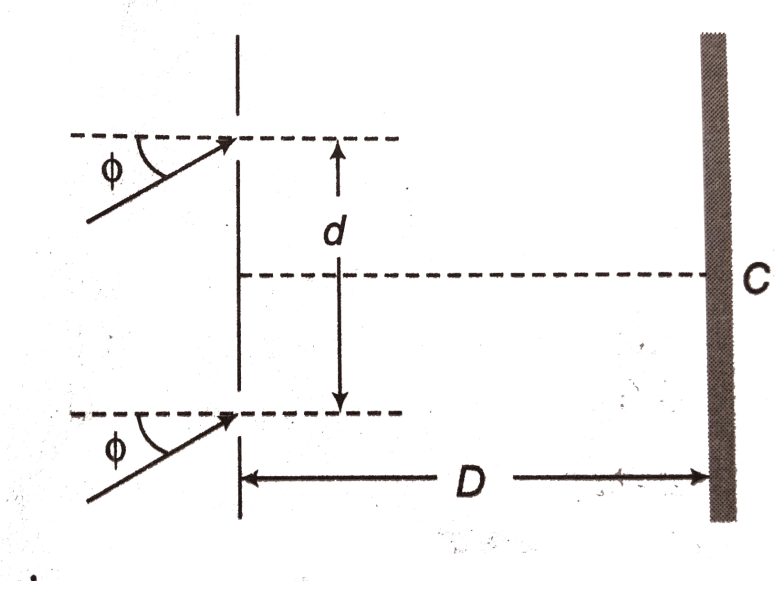
9. Light of wavelength$\lambda = 500nm$ falls on two narrow slits placed a distance d = 50×10^{-4} cm

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?

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10. A double slit arrangement produces fringes for light $\lambda = 5890\text{Å}$ which are 0.2° apart. If the whole arrangement is fully dipped in a liquid of $\mu = \frac{4}{3}$, the angular fringes separation is

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11. In a double-slit pattern $(\lambda = 6000\text{Å})$, the zero-order and tenth-order maxima fall at 12.34 mm and 1473mm from a particular reference point. If λ is changed to 5000Å, find the position of the zero order and tenth order fringes, other arrangements remaining the same.

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12. The distance between a slit and a biprism of acute angle 2° is 10cm. Find the fringe width and the width of the entire band when observation is made on a screen at a distance of 90 cm from the biprism. The refractive index of the material of the biprism is 1.5 and $\lambda = 5890\text{Å}$.

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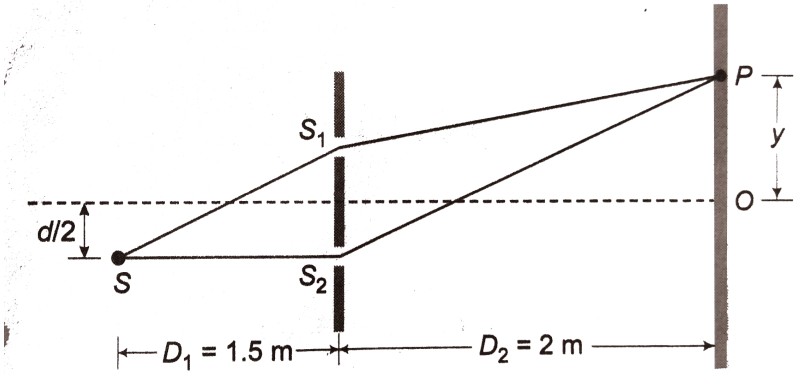
13. In the YDSE, the monochromatic source of wavelength λ is placed at a distance $\frac{d}{2}$ from the central axis (as shown in the figure), where d is the separation between the two slits S_1 and S_2.



(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 $\lambda = 6000\text{Å}, d = 6mm.$)

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14. Fringes are produced by a Fresnel's biprism in focal plane of a reading microscope which is 100cm from the slit. A lens inserted between the biprism and the eyepiece gives two images of the slit in two positions of the lens. In one case the two images of the slit are 0.45 mm apart in the

other case 2.90 mm apart. If sodium light of wavelength 5893Å used, find the width of the interference fringes. If the distance between the slit and biprism is 10cm and refractive index of the material of the biprism is 1.5, calculate the angle in degrees which the inclined faces of the biprism makes with its base.

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15. In a biprism experiment with sodium light $(\lambda = 5893\text{Å})$, the micrometer reading is 2.32mm when the eyepiece is placed at a distance of 100 cm from the source. If the distance between two virtual sources is 2 cm, find the new reading of micrometer when the eyepiece is moved such that 20 fringes cross the field of veiw.

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16. In a two slit experiment with monochromatic light fringes are obtained on a screen placed at some distance from the sits. If the screen is moved by m $5 \times 10^{-2} m$ towards the slits, the change in fringe width is

m $3 \times 10^{-5} m$. If separation between the slits is $10^{-3} m$, the wavelength of light used is

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17. In a YDSE, the separation between slits is $2mm$ where as the distance of screen from the plane of slits is $2.5m$. Light of wavelengths in the range $200 - 800nm$ is allowed to fall on the slits. Find the wavelengths in the visible region that will be present on the screen at $1mm$ from central maximum. Also find the wavelength that will be present at that point of screen in the infrared as well as in the ultraviolet region.

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18. A double slit apparatus is immersed in a liquid of refractive index 1.33. It has slit and the screen 1 mm. The slits are illuminated by a parallel beam of light whose wavelength in air is $6300Å$

a. calculate the fringe width.

b. One of the slits of the apparatus is covered by a thin glass sheet of

refractive index 1.53. Find the smallest thickness of the sheet to bring athe adjacent minima on the axis.

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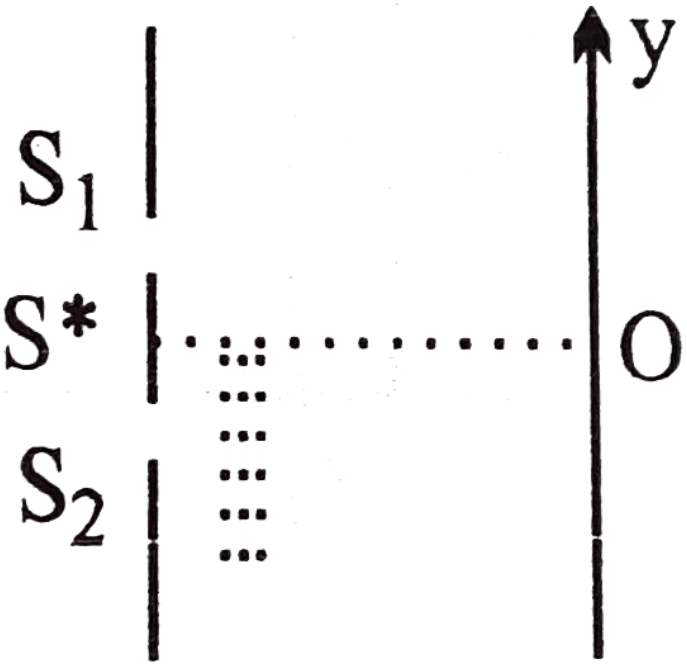
19. The young's double slit experiment is done in a medium of refractive index $4/3$.A light of $600nm$wavelength is falling on the slits having 0.45 mm separation .The lower slit S_2 is covered by a thin glass sheet of thickness $10.4\mu m$ and refractive index1.5.the intereference pattern is observed ona screen placed $1.5m$ from the slits are shown



(a) Find the location of the central maximum (bright fringe with zero path difference)on the y-axis.

(b) Find the light intensity at point Orelative to the maximum fringe intensity.

(c)Now,if $600nm$light is replaced by white light of range 400 to700 nm find the wavelength of the light that from maxima exactly point O.[All wavelengths in this problem are for the given medium of refractive index $4/3$ .Ignore dispersion]

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20. A screen is at distance $D = 80$ cm form a diaphragm having two narrow slits S_1 and S_2 which are $d = 2$ mm apart.

Slit S_1 is covered by a transparent sheet of thickness

$t_1 = 2.5\mu m$ slit S_2 is covered by another sheet of thikness

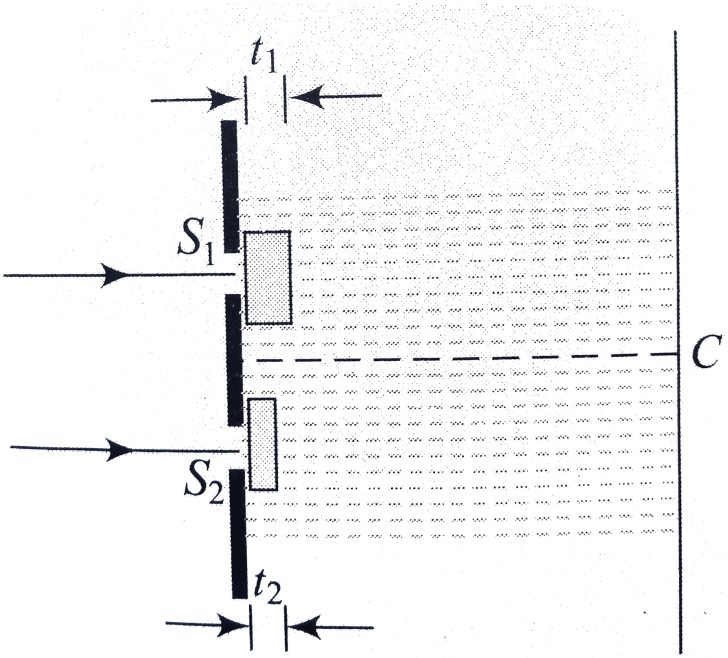
$t_2 = 1.25\mu m$ as shown if Fig. 2.52.

Both sheets are made of same material having refractive index $\mu = 1.40$

Water is filled in the space between diaphragm and screen. Amondichromatic light beam of wavelength $\lambda = 5000\text{Å}$ is incident normally on the diaphragm.

Assuming intensity of beam to be uniform, calculate ratio of intensity of C to maximum intensity of interference pattern obtained on the screen

$(\mu_w = 4/3)$



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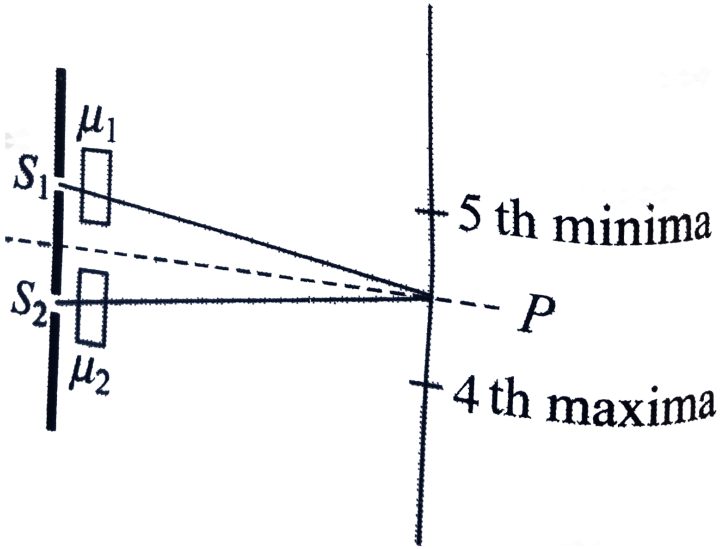
21. In Young's experiment the upper slit is covered by a thin glass plate of refractive index 1.4 while the lower slit is covered by another glass plate, having the same thickness as the first one but having refractive index 1.7 interference pattern is observed using light of wavelength 5400Å

It is found that point P on the screen where the central maximum $(n = 0)$ fell before the glass plates were inserted now has $3/4$ the

original intensity. It is further observed that what used to be the fourth maximum earlier, lies below point P while the fifth minimum lies above P. Calculate the thickness of glass plate. (Absorption of light by glass plate may be neglected.



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22. In young's experiments ,the source of red light of wavelength $7 \times 10^{-7} m$ when a thin glass plate of refrative index 1.5 at this wavelength is put in the path of one of the interfering beams,the central bright fringe shifts by 10^{-3} m to the position previously occupied by the

$5th$ bright fringe,Find the thickness of the plates. When the sources is now change to green light of wavelenght 5×10^{-7}m ,the central fringe shifts to a position initially occupied by the $6th$ bright fringe due to red light,Find the refractive index of glass for the green light .Also estimate the changes in fringe width due to the change in wavelength

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