Optics JEST & TIFR

https://snboseplc.com/optics-jest-tifr/

Q.No: 1 JEST-2012

When unpolarised light is incident on a glass plate at a particular angle, it is observed that the reflected beam is linearly polarised. What is the angle of the refracted beam with respect to the surface normal? Refractive index of glass is 1.52.

1. 56.7°
2. 33.4°
3. 23.3°
4. The light is completely reflected and there is no refracted beam.

Q.No: 2 JEST-2014

For an optical fiber with core and cladding index of $n_1 = 1.45$ and $n_2 = 1.44$, respectively, what is the approximate cut-off angle of incidence? Cut-off angle of incidence is defined as the incidence angle below which light will be guided.

1. 7°
2. 22°
3. 5°
4. 0°

Q.No: 3 JEST-2014

A spherical air bubble is embedded in a glass slab. It will behave like a

1. Cylindrical lens
2. Achromatic lens
3. Converging lens
4. Diverging lens

Q.No: 4 JEST-2014

The resolving power of a grating spectrograph can be improved by

1. recording the spectrum in the lowest order
2. using a grating with longer grating period
3. masking a part of the grating surface
4. illuminating the grating to the maximum possible extent

Q.No: 5 JEST-2014

Three sinusoidal waves have the same frequency with amplitude $A, A/2$ and $A/3$ while their phase angles are $0, \pi/2$ and π respectively. The amplitude of the resultant wave is

1. $\frac{11A}{6}$
2. $\frac{2A}{3}$
3. $\frac{5A}{6}$
4. $\frac{7A}{6}$

Q.No: 6 JEST-2015

The wavelength of red helium-neon laser in air is 6328 Angstroms. What happens to its frequency in glass that has a refractive index of 1.50?

1. Increases by a factor of 3
2. Decreases by a factor of 1.5
3. Remains the same
4. Decreases by a factor of 0.5

Q.No: 7 JEST-2015

Let λ be the wavelength of incident light. The diffraction pattern of a circular aperture of dimension r_0 will transform from Fresnel to Fraunhofer regime if the screen distance z is,

1. $z \gg \frac{r_0^2}{\lambda}$
2. $z \gg \frac{\lambda^2}{r_0}$

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3. $z \ll \frac{\lambda^2}{r_0}$
4. $z \gg \frac{r_0^2}{\lambda}$

Q.No: 8 JEST-2016

The electric field $\vec{E} = E_0 \sin(\omega t - kz)\hat{x} + 2E_0 \sin(\omega t - kz + \pi/2)\hat{y}$ represents:

1. a linearly polarized wave
2. a right-hand circularly polarized wave
3. a left-hand circularly polarized wave
4. an elliptically polarized wave

Q.No: 9 JEST-2016

Circular fringes are obtained with a Michelson interferometer using 600 nm laser light. What minimum displacement of one mirror will make the central fringe from bright to dark?

1. 600 nm
2. 300 nm
3. 150 nm
4. 120 Angstroms

Q.No: 10 JEST-2017

A thin air film of thickness d is formed in a glass medium. For normal incidence, the condition for constructive interference in the reflected beam is (in terms of wavelength λ and integer $m = 0, 1, 2...$)

1. $2d = (m - 1/2)\lambda$
2. $2d = m\lambda$
3. $2d = (m - 1)\lambda$
4. $2\lambda = (m - 1/2)d$

Q.No: 11 JEST-2019

The refractive index (n) of the entire environment around a double slit interference setup is changed from $n = 1$ to $n = 2$. Which one of the following statements is correct about the change in the interference pattern?

1. The fringe pattern disappears
2. The central bright maximum turns dark, i.e. becomes a minimum
3. Fringe width of the pattern increases by a factor 2
4. Fringe width of the pattern decreases by a factor 2

Q.No: 12 JEST-2019

A collimated white light source illuminates the slits of a double slit interference setup and forms the interference pattern on a screen. If one slit is covered with a blue filter, which one of the following statements is correct?

1. No interference pattern is observed after the slit is covered with the blue filter
2. Interference pattern remains unchanged with and without the blue filter
3. A blue interference pattern is observed
4. The central maximum is blue with coloured higher order maxima

Q.No: 13 JEST-2019

White light of intensity I_0 is incident normally on a filter plate of thickness d. The plate has a wavelength (λ) dependent absorption coefficient $\alpha(\lambda) = \alpha_0 \left(1 - \frac{\lambda}{\lambda_0}\right)^2$ per unit length. The band pass edge of the filter is defined as the wavelength at which the intensity, after passing through the filter, is $I = \frac{I_0}{\rho}$. α_0, λ_0 and ρ are constants. The reflection coefficient of the plate may be assumed to be independent of λ. Which one of the following statements is true about the bandwidth of the filter?

1. The bandwidth is linearly dependent on λ_0
2. The bandwidth is independent of the plate thickness d
3. The bandwidth is linearly dependent on α_0
4. The bandwidth is dependent on the ratio α_0/d

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Q.No: 14 JEST-2019

In the Young's double slit experiment (screen distance $D = 50$ cm and slit separation $d = 0.1$ cm), a thin mica sheet of refractive index $n = 1.5$ is introduced in the path of one of the beams. If the central fringe gets shifted by 0.2 cm, what is the thickness (in micrometer) of the mica sheet?

Q.No: 15 JEST-2020

Three polarizers are stacked, normal to a central axis, along which is incident a beam of unpolarized light of intensity I_0. The first and the third polarizers are perpendicular to each other and the middle polarizer is rotated at an angular frequency ω about the central axis (light beam). The time dependent intensity of light emerging after the third polarizer will be given by

1. $I(t) = (I_0/16)\{1 - \cos(4\omega t)\}$
2. $I(t) = (I_0/8)\{1 - \cos(2\omega t)\}$
3. $I(t) = (I_0/4)\{1 - 2\cos\omega t\}$
4. $I(t) = (I_0/2)\cos^2\omega t$

Q.No: 16 JEST-2020

A thin film of water having refractive index $n = 1.333$ floats on the surface of a beaker of silicone oil having refractive index $n_s = 1.40$. The arrangement is illuminated by 600 nm light incident normally from top and a large region of the film appears bright red. What is the minimum possible thickness of the film (in nm)?

Q.No: 17 JEST-2021

A monochromatic linearly polarized light with electromagnetic field $\vec{E} = E_0 \sin(\omega t - kz)(\hat{\mathbf{x}} + \hat{\mathbf{y}})$ is incident normally on a birefringent calcite crystal. The wavelength of the wave is 590 nm and the refractive indices of the crystal along the x- and y-directions are 1.66 and 1.49, respectively. If the thickness of the crystal is 434 nm, what will be the polarization of the light that emerges from the crystal?

1. Linearly polarized along the same axis as the incident light
2. Linearly polarized but along a different axis than the incident light
3. Circularly polarized
4. Neither linearly nor circularly polarized but elliptically polarized

Q.No: 18 JEST-2021

A glass sphere of radius R and refractive index n acts like a lens with focal length

1. $-\frac{nR}{2(n-1)}$
2. $+\frac{nR}{2(n-1)}$
3. $-\frac{nR}{2(n-1)^2}$
4. $+\frac{nR}{2(n-1)^2}$

Q.No: 19 JEST-2021

A flat soap film has a uniform thickness of 510 nm. White light (having wavelengths in the range of about 390–700 nm) is incident normally on the film. If the refractive index of the soap is 1.33, what will be the dominant colour of the reflected light?

1. Violet
2. Green
3. Red
4. White

Q.No: 20 JEST-2021

An ideal polariser is placed in between two crossed polarisers in a coaxial geometry as shown. The middle polariser is rotated at the angular speed of ω about the common axis. If unpolarised light of intensity I_0 is incident on this system, the emergent intensity of the light would be

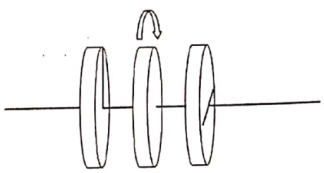


Figure 1: Setup for Q.No: 20

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1. $\frac{I_0}{8}[1-\cos 4\omega t]$
2. $\frac{I_0}{16}[1-\cos 4\omega t]$
3. $\frac{I_0}{16}[1-\cos \omega t]$
4. $\frac{I_0}{16}[1-\frac{1}{2}\cos \omega t]$

Q.No: 21 JEST-2022

A pair of crossed ideal linear polarizers allow no light to pass through. To produce some output one can insert optical elements between the crossed polarizers. For given light beam of input intensity I_0, Nirmalya inserts a quarter-wave plate between the crossed polarizers and records an output intensity αI_0. On the other hand, Ayan inserts two linear polarizers having orientations 30° and 60° w.r.t. the first polarizer of the crossed pair, and records an output intensity of βI_0. What is the ratio $\frac{\alpha}{\beta}$?

Q.No: 22 JEST-2023

Two linear polarizers are placed coaxially with the transmission axis of the first polarizer in the vertical orientation and the second polarizer in the horizontal orientation. A half waveplate placed coaxially between these crossed polarizers is rotating about its axis at an angular frequency ω. At $t = 0$, the fast axis of the half waveplate was oriented vertically. A beam of unpolarized light of intensity I_0 is incident along the axis of this optical system. The output intensity measured by a detector after the beam passes through this optical system is

1. $\frac{I_0}{4}[1+\cos(\omega t)]$
2. $\frac{I_0}{4}[1-\cos(2\omega t)]$
3. $\frac{I_0}{4}[1-\cos(4\omega t)]$
4. $\frac{I_0}{2}[1-\cos(\omega t)]$

Q.No: 23 JEST-2023

If linearly polarized light is sent through two polarizers, the first at 45° to the original axis of polarization and the second at 90° to the original axis of polarization, what fraction of the original intensity passes through the last polarizer?

1. $\frac{1}{2}$
2. $\frac{1}{4}$
3. 0
4. $\frac{1}{8}$

Q.No: 24 JEST-2023

A right-angled prism is placed in air (the refractive index of air is 1) and a light beam is incident perpendicular to the base of the prism as shown in the figure. In order to get the light beam totally reflected, the minimum value of the refractive index of the prism should be

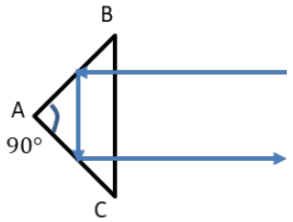


Figure 2: Setup for Q.No: 24

1. 1
2. $\frac{\sqrt{3}}{2}$
3. $\frac{\pi}{2}$
4. $\sqrt{2}$

Q.No: 25 JEST-2024

A step index optical fiber has refractive indices $n_1 = 1.474$ for core region and $n_2 = 1.470$ for the cladding region. A ray of light is incident from air into the core through the cross section of the fiber at an angle θ with the normal. What is the limiting value of θ below which the light ray will be totally internally reflected? Refractive index of air is taken as 1.

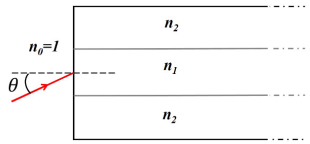


Figure 3: Setup for Q.No: 25

1. 6.229°
2. 58.194°
3. 2.862°

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4. 4.222°

Q.No: 26 JEST-2024

What is the right sequence of optical components to convert unpolarized light into circularly polarized light?

1. Light source → linear polarizer → quarter wave plate
2. Light source → quarter wave plate → half wave plate
3. Light source → linear polarizer → half wave plate
4. Light source → half wave plate → quarter wave plate

Q.No: 27 JEST-2024

An object of height 10 mm is located 150 mm to the left of a thin lens of focal length +50 mm. A second thin lens of focal length −100 mm is to be placed to the right of the first lens such that the real image of the object is located 100 mm to the right of the second lens. What should be the separation in mm between the two lenses?

Q.No: 28 JEST-2025

A wire of length 0.01 mm is placed perpendicular to the axis of a thin convex lens, 30 cm from its center. If the focal length of the lens is 20 cm, what is the length of the image of the wire?

1. 0.02 mm
2. 0.03 mm
3. 0.01 mm
4. 1 mm

Q.No: 29 JEST-2025

The Fraunhofer diffraction pattern formed by an elliptical aperture will be

1. elliptical with the semi-major axis parallel to that of the aperture.
2. circular.
3. elliptical with the semi-major axis perpendicular to that of the aperture.
4. hyperbolic.

Q.No: 30 JEST-2025

A ray of light is incident on a glass cube of refractive index 1.414 as shown in the figure. Find the angle of incidence θ_i, such that the ray grazes down the side of the glass cube.

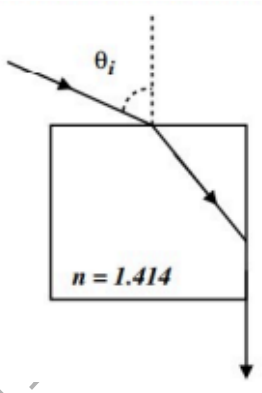


Figure 4: Setup for Q.No: 30

1. $\pi/4$
2. $\pi/3$
3. 0
4. $\pi/2$

Q.No: 31 JEST-2025

The Fraunhofer diffraction intensity pattern for light of wavelength λ by a single slit of width a is given by

$$I = A_0^2 \left(\frac{\sin \beta}{\beta} \right)^2$$

where A_0 is the intensity of the central maximum and

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

θ being the angle with the incident beam. What is the angular separation, in milli-radians, between the two first minima on two sides of the central beam, if $a = 1$ mm and $\lambda = 5000$ Å?

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Q.No: 32 JEST-2026

In Young's double slit set-up, the screen is placed at a distance $D = 150$ cm from the slits. At a point P on the screen, the second maximum is being observed. What is the minimum amount by which D should be increased so that P becomes a minimum?

1. 80 cm
2. 20 cm
3. 50 cm
4. 30 cm

Q.No: 33 JEST-2026

Consider a Newton's rings experiment with a biconvex lens of diameter 20 cm and maximum thickness 60 μm placed on a flat reflecting surface, illuminated by normal incident light of wavelength 600 nm. When we change the medium of the experiment from air to a liquid medium, the fringe separation reduces by 20%. What is the refractive index of the liquid medium?

Q.No: 1 TIFR-2012

Unpolarised light of intensity I_0 passes successively through two identical linear polarisers A and B, placed such that their polarisation axes are at an angle of 45° (see figure) with respect to one another.

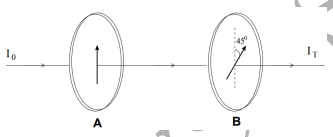


Figure 5: Setup for TIFR-2012 Q.No: 1

Assuming A and B to be perfect polarisers (i.e. no absorption losses), the intensity of the transmitted light will be $I_T =$

1. $I_0/4$
2. $I_0/2\sqrt{2}$
3. $I_0/2$
4. $I_0/\sqrt{2}$

Q.No: 2 TIFR-2013

A ray of light is incident on the surface of a thin prism at a small angle θ_1 with the normal, as shown in the figure on the right. The material of the prism has refractive index n and you may assume the outside refractive index to be unity. If the (small) apex angle of the prism is α, the deviation angle δ (angle between the incident and exited ray; see figure) is given by

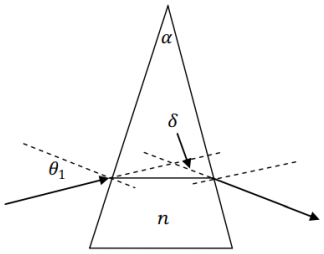


Figure 6: Setup for TIFR-2013 Q.No: 2

1. α
2. αn
3. $\alpha(n+1)$
4. $\alpha(n-1)$

Q.No: 3 TIFR-2013

A parallel beam of light of wavelength λ is incident on a transmission grating with groove spacing d, at an angle θ_i, as shown in the figure on the left. The plane of incidence is normal to the grooves. After diffraction, the transmitted beam is seen to be at an angle α relative to the normal. Which of the following conditions must be satisfied for this to happen?

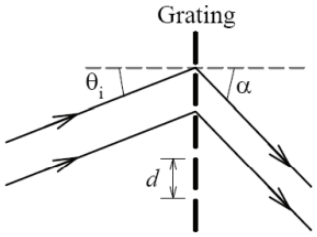


Figure 7: Setup for TIFR-2013 Q.No: 3

1. $d(\sin\theta_i - \sin\alpha) = n\lambda$
2. $d(\sin\theta_i + \sin\alpha) = n\lambda$
3. $2d\sin(\theta_i - \alpha) = n\lambda$

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4. $2d\sin(\alpha+\theta_i)=n\lambda$

Q.No: 4 TIFR-2013

A cross-shaped opening is illuminated by a parallel beam of white light. A thin plano-convex cylindrical glass lens is placed 20 cm in front of it, as shown in the figure below.

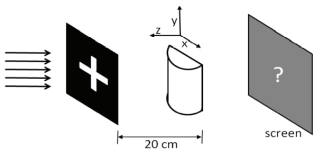


Figure 8: Setup for TIFR-2013 Q.No: 4

The radius of curvature of the curved surface of the lens is 5 cm and 1.5 is the refractive index of glass. On a screen placed as shown at the plane where a real image forms on the other side of the lens, the image of the opening will appear as

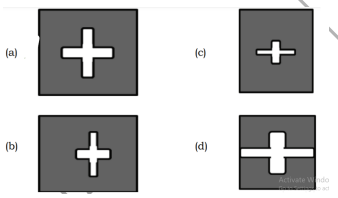


Figure 9: Options for TIFR-2013 Q.No: 4

Q.No: 5 TIFR-2013

The rate of deposition of a dielectric thin film on a thick dielectric substrate was monitored by the following experiment: a laser beam of wavelength $\lambda = 633$ nm, at near-normal incidence θ_i, was reflected from the thin film (see inset figure on the right), and the reflection coefficient R was measured. As the film thickness increased R varied with time as shown on the right. The refractive index of the film is 3.07 and is less than that of the substrate. Using the graph, the approximate thickness of the film at the end of 25 seconds can be estimated to be

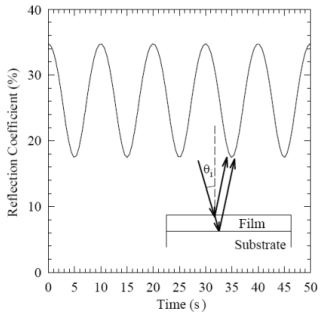


Figure 10: Setup for TIFR-2013 Q.No: 5

1. $0.017\mu m$
2. $0.26\mu m$
3. $0.51\mu m$
4. $2.2\mu m$

Q.No: 6 TIFR-2014

Two telescopes X and Y have identical objective lenses, but the single-lens eyepiece of X is converging whereas the single-lens eyepiece of Y is diverging. If the magnification M of these two telescopes for objects at infinity is the same, the lengths L_X and L_Y of the two telescopes (length of a telescope is defined as the distance between the objective lens and the eyepiece) must be in the ratio $L_X/L_Y =$

1. $\frac{2M+1}{2M-1}$
2. $\frac{2M-1}{M+1}$
3. $\frac{M+1}{M-1}$
4. $\frac{M-1}{M+1}$

Q.No: 7 TIFR-2014

A lens can be constructed using a flat circular glass plate whose refractive index n varies radially, i.e. $n = n(r)$, where r is the radial distance from the centre of the plate. In order to make a convex lens by this method $n(r)$ should vary (in terms of positive constants $n(0)$ and α) as

1. $n(0) - \alpha/r^2$
2. $n(0) - \alpha/r$
3. $n(0) - \alpha r$
4. $n(0) - \alpha r^2$

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Q.No: 8 TIFR-2014

In a laboratory, the double-slit experiment is performed with free non-relativistic electrons, each having energy E, emitted from a source S (see figure below). The screen consists of a uniform sheet of charge-sensitive pixels of size r. If the slit-screen distance is z and the spacing between slits is d, which of the following restrictions on the electron energy E should be satisfied so that the fringes can be distinctly observed?

1. $E \leq \frac{1}{2m_e}\left(\frac{hz}{rd}\right)^2$
2. $E \leq c\left(\frac{hz}{rd}\right)$
3. $E \geq \frac{1}{2m_e}\left(\frac{hz}{rd}\right)^2$
4. $E \geq c\left(\frac{hz}{rd}\right)$

Q.No: 9 TIFR-2014

A glass plate P (refractive index $n_P = 1.54$) is coated with a dielectric material C with the refractive index $n_C = 1.6$. In order to have enhanced reflection from this coated glass for near-normal incident light of wavelength λ, the thickness of the coating material C must be

1. even multiples of $\lambda/2n_C$
2. even multiples of $\lambda/4n_C$
3. odd multiples of $\lambda/4n_C$
4. integral multiples of $\lambda/4n_C$

Q.No: 10 TIFR-2015

The focal length in air of a thin lens made of glass of refractive index 1.5 is ℓ. When immersed in water (refractive index = 4/3), its focal length becomes

1. 4ℓ
2. $\ell/4$
3. $3\ell/4$
4. $4\ell/3$

Q.No: 11 TIFR-2015

In a transmission diffraction grating, there are 10^4 lines/mm. Which of the following ranges of wavelength (in nm) will produce at least one principal maximum?

1. 1–200
2. 201–500
3. 501–1000
4. 1001–5000

Q.No: 12 TIFR-2016

Consider a process in which atoms of Actinium-226 ($^{226}_{89}Ac$) get converted to atoms of Radium-226 ($^{226}_{88}Ra$) and the yield of energy is 0.64 MeV per atom. This occurs through



Figure 11: Setup for TIFR-2016 Q.No: 12

This observer will perceive the pool as

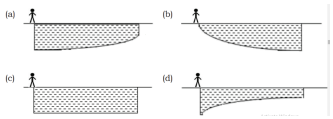


Figure 12: Options for TIFR-2016 Q.No: 12

Q.No: 13 TIFR-2017

A beam of plane microwaves of wavelength 12 cm strikes the surface of a dielectric at 45°. If the refractive index of the dielectric is 4/3, what will be the wavelength, in units of mm, of the microwaves inside the dielectric?

Q.No: 14 TIFR-2017

Light passes through a narrow slit and gives the Fraunhofer diffraction pattern shown in the adjacent figure.

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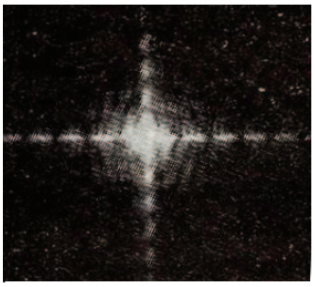


Figure 13: Setup for TIFR-2017 Q.No: 14

Which of the following could be the shape of the slit?

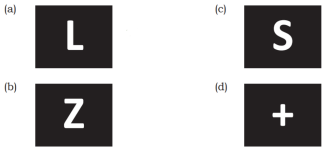


Figure 14: Options for TIFR-2017 Q.No: 14

Q.No: 15 TIFR-2020

A monochromatic laser beam is incident on a wet piece of filter paper atop a sheet of glass of thickness d. The pattern observed on the paper is

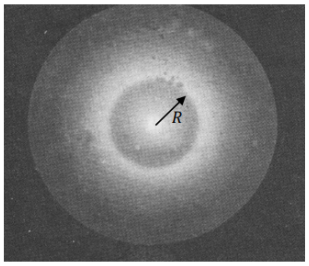


Figure 15: Setup for TIFR-2020 Q.No: 15

If the radius of the inner ring observed is R, the refractive index of the glass must be

1. $\sin\left\{\tan^{-1}\left(\frac{R}{2d}\right)\right\}$
2. $\sin\left\{\tan^{-1}\left(\frac{R}{d}\right)\right\}$
3. $\tan\left\{\sin^{-1}\left(\frac{R}{2d}\right)\right\}$
4. $\tan\left\{\sin^{-1}\left(\frac{R}{d}\right)\right\}$

Q.No: 16 TIFR-2020

A plane polarised light wave with electric field expressed as

$$\vec{E}(z,t) = E_0\hat{j}\cos(kz - \omega t)$$

is incident from the left on the apparatus as sketched below.

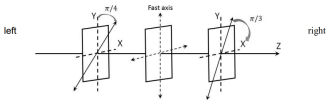


Figure 16: Setup for TIFR-2020 Q.No: 16

The apparatus consists of (from left to right) a polariser with transmission axis at $\pi/4$ w.r.t. the y-axis, followed by a quarter-wave plate with fast axis along the y-axis, and finally, a polariser with transmission axis at $\pi/3$ about the x-axis.

If the incident intensity of the wave is I_0, what will be the intensity of the light emerging out of the apparatus (on the right)?

1. $I_0/4$
2. $I_0/8$
3. $3I_0/8$
4. $I_0/16$

Q.No: 17 TIFR-2022

Since the refractive index of water is 4/3, the angular velocity (in degrees per hour) of the Sun at noon is perceived by a fish in the ocean deep below the surface as around

1. 11.3
2. 15.0
3. 13.2
4. 20.0

Q.No: 18 TIFR-2022

On a wet monsoon day at 12 noon, a thin film of oil of thickness 0.3 μm is formed on a wet road. If the refractive index of oil and water are 1.475 and 1.333, respectively, which of the following wavelengths of light will be reflected with maximum intensity?

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1. 590 nm
2. 407 nm
3. 443 nm
4. 640 nm

Q.No: 19 TIFR-2022

A satellite used to make Google Earth images carries on board a telescope which must be designed, when operating at a wavelength λ, to be able to resolve objects on the ground of length as small as δ.

If the satellite goes around the Earth in a circular orbit with uniform speed v, the minimum diameter D_{min} of the telescope mirror can be determined in terms of R, the radius of the Earth, and g, the acceleration due to gravity at the surface, to be

1. $\frac{1.22\lambda}{\delta}(\frac{gR^2}{v^2} - R)$
2. $\frac{1.22\lambda}{\delta}\frac{gR^2}{v^2}(1 + \frac{R}{\lambda})$
3. $\frac{1.22\lambda}{\delta}\frac{gR^2}{\lambda v^2}$
4. $\frac{1.22\lambda}{\delta}\sqrt{\frac{gR^3}{v^2}}$

Q.No: 20 TIFR-2022

According to a standard table, the refractive index of water at $4°C$ is 1.33 at a wavelength of 590 nm. However, a carefully performed experiment in the lab yielded a refractive index of 1.41.

Which one of the following statements could be the explanation of this discrepancy?

1. The experiment was performed at a wavelength lower than 590 nm.
2. The experiment was performed at a wavelength higher than 590 nm.
3. The water sample was at a temperature lower than $4°C$
4. The water sample was at a temperature much higher than $4°C$

Q.No: 21 TIFR-2023

In a mercury vapour lamp an electric arc passing through mercury vapour proceeds light. When the lamp is switched on, the arc is struck, and the liquid mercury starts evaporating as the temperature gradually increases.

In a certain experiment, a Michelson interferometer is set up with a mercury vapour lamp as the light source, and the lamp is switched on. Which one of the following effect will be observed?

1. Initially, fringes will appear with high contract but low intensity, which will be reduced in contrast over the period of time as the light intensity builds up.
2. High contrast fringes will appear as soon as the lamp is switched on and will remain thus so long as the lamp is on.
3. Initially, no fringes will be observed, but the fringes will emerge with high contrast as the lamp heats up.
4. No fringes will be observed as the source is incoherent and has many frequencies.

Q.No: 22 TIFR-2023

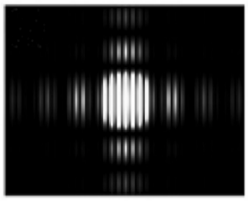


Figure 17: Fringe pattern for TIFR-2023 Q.No: 22

The aperture arrangement that would yield such a fringe pattern is



Figure 18: Option (a)

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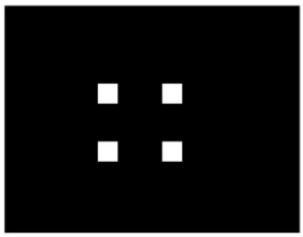


Figure 19: Option (b)



Figure 20: Option (c)



Figure 21: Option (d)

Q.No: 23 TIFR-2023

An electromagnetic wave is described by the following expression

$$\vec{E}(z,t) = E_0 \sin kz\{\hat{i}\cos\omega t + \hat{j}\cos(\omega t - \frac{\pi}{2})\}$$

Which one of the following correctly describes this waveform?

1. A left circular-polarised standing wave along the positive z-axis.
2. A right circular-polarised travelling wave along the positive z-axis.
3. A left circular-polarised travelling wave along the positive z-axis.
4. A right circular-polarised standing wave along the positive z-axis.

Q.No: 24 TIFR-2023

A diffraction grating spectrograph is used to resolve the two sodium D lines (589 and 589.6 nm) in the first order of diffraction. If the width of the grating is 2 cm and the focal length of the spectrograph camera is 20 cm, what the linear separation at the focal plane of the two D lines will be about

1. 6 μm
2. 6 mm
3. 60 μm
4. 60 nm

Q.No: 25 TIFR-2024

Unpolarised light of intensity 200 W/m^2 is incident on a set of two perfect polarisers arranged one behind the other. The first polariser has its transmission axis at $+55°$ with respect to the vertical and the second polariser has its transmission axis at $+100°$ with respect to the vertical. What is the intensity of the transmitted light?

1. 50 W/m^2
2. 100 W/m^2
3. 1.98 W/m^2
4. 3.01 W/m^2

Q.No: 26 TIFR-2024

Two small loudspeakers A and B, separated by 15 cm, were pointed toward a small microphone M at a distance 1.5 m away from the centre of the line AB, in the perpendicular direction as shown in the sketch below.



Figure 22: Setup for TIFR-2024 Q.No: 26

The following sound intensity pattern was observed as a function of the position of the microphone as it is moved parallel to AB.

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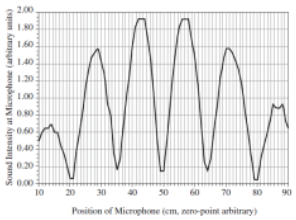


Figure 23: Intensity pattern for TIFR-2024 Q.No: 26

The dips in the signal were repeated at the interval of 14.5 cm. The speed of sound in the experiment's background condition is 343 m/s. What can we conclude from this information?

1. The two loudspeakers are vibrating at frequency 23.65 kHz and they are out of phase.
2. The two loudspeakers are vibrating at frequency 23.65 kHz and they are in phase.
3. The two loudspeakers are vibrating at frequency 47.3 kHz and they are in phase.
4. The two loudspeakers are vibrating at frequency 47.3 kHz and they are out of phase.

Q.No: 27 TIFR-2025

Laser light is incident normally on a thin film of material with a refractive index n_s larger than that of air ($n_a \approx 1$). As the wavelength of the laser light is varied, the intensity of the transmitted light through the film shows a peak at 633 nm. If the thickness of the film is 118 nm, the minimum n_s is closest to:

1. 2.68
2. 5.36
3. 1.34
4. 3.68

Q.No: 28 TIFR-2025

A stream of electrons, each having an energy of 0.5 eV, impinges on a pair of extremely thin slits separated by 10 μm. The distance between adjacent minima on a screen 20 m behind the slits would be closest to:

1. 3.48 mm
2. 1.74 mm
3. 6.96 cm
4. 5 m

Q.No: 29 TIFR-2026

A thin film of oil (refractive index, $n_{\text{oil}} = 1.40$) floats on a puddle of water (refractive index, $n_{\text{water}} = 1.33$) on a road. The film is illuminated at normal incidence from air by white light. In the light reflected vertically, green colour (with wavelength in air $\lambda_0 = 560$ nm) is enhanced. The smallest possible thickness of the oil film is approximately:

1. 100 nm
2. 2000 nm
3. 200 nm
4. 360 nm

Q.No: 30 TIFR-2026

An electron beam is accelerated over a potential V and strikes a crystal with lattice constant 5 Å. What is the minimum V needed to resolve the crystal?

1. 5 V
2. 30 V
3. 300 V
4. 0.5 V

Q.No: 31 TIFR-2026

An earth imaging satellite is in a near earth circular orbit (see figure) with an orbital period of 100 minutes and observes earth with a light of wavelength 550 nm. If it can resolve the ground with 0.5 m, the minimum diameter of the mirror on the satellite should be closest to:

(Assume the system is diffraction limited. The mass and radius of Earth are 5.97×10^{24} kg and 6.4×10^3 km, respectively.)

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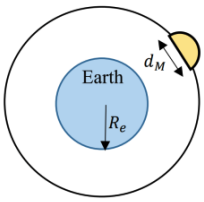


Figure 24: Setup for TIFR-2026 Q.No: 31

1. 1 m
2. 5 m
3. 0.5 m
4. 10 m

Q.No: 32 TIFR-2026

In the experimental arrangement below, a plane polarised light of intensity I and wavelength 500 nm is propagating along the z-axis. It is polarised along the y-axis and is incident on the first polarizer which has the transmission axis at an angle of $\pi/4$ with respect to the y-axis, as shown.

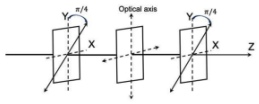


Figure 25: Setup for TIFR-2026 Q.No: 32

Subsequently, the beam passes through a flat birefringent crystal of thickness 950 μm and optical axis along the y-axis. The crystal is kept normal to the z-axis. If the refractive indices of the crystal are $n_o = 1.514$ and $n_e = 1.519$, the beam intensity measured after the second polarizer whose transmission axis is parallel to that of the first one would be:

1. 0
2. $I/4$
3. $I/2$
4. I

Question No.	Entrance with year	
1	JEST-2012	Option (b)
2	JEST-2014	Option
3	JEST-2014	Option (d)
4	JEST-2014	Option (d)
5	JEST-2014	Option (c)
6	JEST-2015	Option (c)
7	JEST-2015	Option (a)
8	JEST-2016	Option (D)
9	JEST-2016	Option (C)
10	JEST-2017	Option (A)
11	JEST-2019	Option (D)
12	JEST-2019	Option (C)
13	JEST-2019	Option (A)
14	JEST-2019	Ans: 8
15	JEST-2020	Option (A)
16	JEST-2020	Ans: 225
17	JEST-2021	Option (D)
18	JEST-2021	Option (B)
19	JEST-2021	Option (B)
20	JEST-2021	Option (B)
21	JEST-2022	Ans: 1.19
22	JEST-2023	Option (c)
23	JEST-2023	Option (b)
24	JEST-2023	Option (d)
25	JEST-2024	Option (a)
26	JEST-2024	Option (a)
27	JEST-2024	Ans: 25
28	JEST-2025	Option (a)
29	JEST-2025	Option (c)
30	JEST-2025	Option (d)
31	JEST-2025	Ans: 1
32	JEST-2026	Option (d)
33	JEST-2026	Ans: 1.5–1.6

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Question No.	Entrance with year	
1	TIFR-2012	Option (a)
2	TIFR-2013	Option (d)
3	TIFR-2013	Option (b)
4	TIFR-2013	Option (a)
5	TIFR-2013	Option (b)
6	TIFR-2014	Option (c)
7	TIFR-2014	Option (d)
8	TIFR-2014	Option (a)
9	TIFR-2014	Option (c)
10	TIFR-2015	Option (a)
11	TIFR-2015	Option (a)
12	TIFR-2016	Option (a)
13	TIFR-2017	Ans: 90
14	TIFR-2017	Option (a)
15	TIFR-2020	Option (a)
16	TIFR-2020	Option (a)
17	TIFR-2022	Option (a)
18	TIFR-2022	Option (a)
19	TIFR-2022	Option (a)
20	TIFR-2022	Option (a)
21	TIFR-2023	Option (a)
22	TIFR-2023	Option (c)
23	TIFR-2023	Option (a)
24	TIFR-2023	Option (a)
25	TIFR-2024	Option (a)
26	TIFR-2024	Option (a)
27	TIFR-2025	Option (a)
28	TIFR-2025	Option (a)
29	TIFR-2026	Option (a)
30	TIFR-2026	Option (a)
31	TIFR-2026	Option (a)
32	TIFR-2026	Option (a)

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