SHIKSHA CLASSES,BHANDARA

Subject : Physics **Topic : Wave Optics** **M.M. : 180**

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Two coherent light beams of intensity I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are :
(1) 5I and 3I (2) 5I and I
(3) 9I and 3I (4) 9I and I

Q.2 Young's double slit experiment is performed with light of wavelength 550 nm. The separation between the slits is 1.10 mm and screen is placed at distance of 1m.What is the distance between the consecutive bright or dark fringes.
(1) 1.5 mm (2) 1.0 mm
(3) 0.5 mm (4) None of these

Q.3 Two wave are represented by the equations $y_1 = a \sin \omega t$ and $y_2 = a \cos \omega t$. The first wave :
(1) Leads the second by π
(2) Lags the seconds by π
(3) Leads the second by $\pi/2$
(4) Lags the seconds by $\pi/2$

Q.4 The resultant amplitude of a vibrating particle by the superposition of the two waves
$y_1 = a \sin\left(\omega t + \frac{\pi}{3}\right)$ and $y_2 = a \sin \omega t$ is :-
(1) a (2) $\sqrt{2}$ a
(3) 2a (4) $\sqrt{3}$ a

Q.5 Two coherent sources of different intensities send waves which interfere. If the ratio of maximum and minimum intensity in the interference pattern is 25 then find ratio of intensity of source :
(1) 25 : 1 (2) 5 : 1
(3) 9 : 4 (4) 25 : 16

Q.6 In a Young's double slit experiment with sodium light, slits are 0.589 m apart. The angular separation of the third maximum from the central maximum will be
(Given λ = 589 nm) :
(1) $\sin^{-1} (0.33 \times 10^{8})$ (2) $\sin^{-1} (0.33 \times 10^{-6})$
(3) $\sin^{-1} (3 \times 10^{-8})$ (4) $\sin^{-1} (3 \times 10^{-6})$

Q.7 If an interference pattern have maximum and minimum intensities in 36 :1 ratio then what will be the ratio of amplitudes :
(1) 5 : 7 (2) 7 : 4
(3) 4 : 7 (4) 7 : 5

Q.8 If intensity ratio of two interfering waves is 9 : 1 then ratio of maximum to minimum amplitude of resultant wave is :
(1) 2 : 1 (2) 3 : 2
(3) 1 : 3 (4) 5 : 2

Q.9 A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2μm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will :
(1) Remain unshifted
(2) Shift downward by nearly two fringes
(3) Shift upward by nearly two fringes
(4) Shift downward by 10 fringes

Q.10 In YDSE experiment, when two light rays make third minima, then they have:-
(1) Phase difference of 3π
(2) Phase difference of $5\pi/2$
(3) Path difference of 3λ
(4) Path difference of $5\lambda/2$

Q.11 Two waves $Y_1 = a\sin \omega t$ and $Y_2 = a \sin (\omega t + \delta)$ are producing interference, then resultant intensity is –
(1) $a^2\cos^2 \delta/2$ (2) $2a^2\cos^2 \delta/2$
(3) $3a^2\cos^2 \delta/2$ (4) $4a^2\cos^2 \delta/2$

Q.12 If in a Young's double slit experiment, width between the slits is 3 cm, the separation between slits and screen is 7 cm and wavelength of light is 1000 Å, then fringe width will be
(1) 2×10^{-5} m. (2) 2×10^{-9} m
(3) 0.2×10^{-6} m (4) 2.3×10^{-7} m

Q.13 In an interference experiment, third bright fringe is obtained at a point on the screen with a light of 700 nm. What should be the wavelength of the light in order to obtain 5^{th} bright fringe at the same point?
(1) 500 nm (2) 630 nm
(3) 750 nm (4) 420 nm

Q.14 Abeam of unpolarised light of intensity I_0 is passed through a polaroidAand then through another polaroid B which is oriented so that its principal plane makes an angle of 45° relative to that of A. Intensity of the emergent light is –

(1) I_0 (2) $I_0/2$
(3) $I_0/4$ (4) $I_0/8$

Q.15 In a double slit experiment if light of wavelength 5000Å is used then fringe width of 1 mm is obtained. If now light of wavelength 6000 Å is used without altering the system then new fringe width will be :

(1) 1 mm (2) 0·5 mm
(3) 1·2 mm (4) 1·5 mm

Q.16 Two beams, A and B, of plane polarized light with mutually perpendicular planes of polarization are seen through a Polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of Polaroid through 30° makes the two beams appear equally bright. If the initial intensities of the two beams are I_A and I_B respectively, then I_A/I_B equals :

(1) 1 (2) 1/3
(3) 3 (4) 3/2

Q.17 Monochromatic green light has wavelength 5×10^{-7} m. The separation between slits is 1 mm. The fringe width of interference pattern obtained on screen at a distance of 2 meter is :

(1) 1 mm (2) 0.5 mm
(3) 2 mm (4) 0.1 mm

Q.18 Assuming human pupil to have a radius of 0.25 cm and a comfortable viewing distance of 25 cm, the minimum separation between two objects that human eye can resolve at 500 nm wavelength is

(1) 30 μm (2) 100 μm
(3) 300 μm (4) 1 μm

Q.19 The phase difference corresponding to path difference of x is :

(1) $\frac{2\pi x}{\lambda}$ (2) $\frac{2\pi\lambda}{x}$
(3) $\frac{\pi x}{\lambda}$ (4) $\frac{\pi\lambda}{x}$

Q.20 Which of following is a true statement, if in Young's experiment, separation between the slits is gradually increased :

(1) fringe width increases and fringes disappear
(2) fringe width decreases and fringes disappear
(3) fringes become blurred
(4)fringe width remains constant and fringes are more bright

Q.21 In an interference of light derived from two slit apertures, if at some point on the screen, yellow light has a path difference of $\frac{3\lambda}{2}$, then the fringe at that point will be :

(1) yellow in colour (2) white in colour
(3) dark (4) bright

Q.22 Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beam is $\pi/2$ at point A and 2π at point B. Then find out the difference between the resultant intensities at A and B.

(1) 2I (2) 5I
(3) I (4) 4I

Q.23 In Young's experiment, if X_{mr} and X_{mv} denotes the distances of m^{th} red and violet fringe from the central fringe. Then :

(1) $X_{mr} > X_{mv}$ (2) $X_{mr} < X_{mv}$
(3) $X_{mr} = X_{mv}$ (4) $X_{mr} + X_{mv} = 0$

Q.24 In an interference pattern of two waves fringe width is β. If the frequency of source is doubled then fringe width will become :

(1) (1/2) β (2) β
(3) 2β (4) (3/2) β

Q.25 On a hot summer night, the refractive index of air is smallest near the ground and increases with height form the ground. When a light beam is directed horizontally, the Huygen's principle leads us to conclude that as it travels, the light beam

(1) Goes horizontally without any deflection
(2) Bends downwards
(3) Bends upwards
(4) Becomes narrower

Q.26 In an interference pattern the $(n+4)^{th}$ blue bright fringe and n^{th} red bright fringe are formed at the same spot. If red and blue light have the wavelength of 7800 Å and 5200 Å then value of n should be :

(1) 2 (2) 4
(3) 6 (4) 8

Q.27 If intensity of each wave in the observed interference pattern in Young's double slit experiment is I_0. then for some point P where the phase difference is ϕ, intensity I will be :

(1) $I = I_0 \cos\phi$ (2) $I = I_0 \cos^2 \phi$
(3) $I = I_0 (1+\cos\phi)$ (4) $I = 2I_0(1+\cos\phi)$

Q.28 Amplitude of waves observed by two light sources of same wave length are a and 2a and have a phase difference of π between them. Then minimum intensity of light will be :

(1) 0 (2) $5a^2$
(3) a^2 (4) $9a^2$

Q.29 The box of a pin hole camera, of length L, has a hole of radius a, It is assumed that when the hole is illuminated by a parallel beam of light of wavelength λ the spread of the spot (obtained on the opposite wall of the camera) is the sum of its geometrical spread and the spread due to diffraction. The spot would then have its minimum size (say b_{min}) when

(1) $a = \sqrt{\lambda L}$ and $b_{min} = \frac{2\lambda^2}{L}$

(2) $a = \sqrt{\lambda L}$ and $b_{min} = \sqrt{4\lambda L}$

(3) $a = \frac{\lambda^2}{L}$ and $b_{min} = \sqrt{4\lambda L}$

(4) None of these

Q.30 If intensity of each of the two waves is I and they are having phase difference of 120^0, when the waves are superposed, then the resultant intensity will be :

(1) I (2) 2I
(3) I/2 (4) 4I

Q.31 The intensity of two waves is 2 and 3 unit, then average intensity of light in the overlapping region will have the value :

(1) 2.5 (2) 6
(3) 5 (4) 13

Q.32 In Young's experiment, monochromatic light through a single slit S is used to illuminate the two slits S_1 and S_2. Interference fringes are obtained on a screen. The fringe width is found to be w. Now a thin sheet of mica (thickness t and refractive index μ) is placed near and in front of one of the two slits. Now the fringe width is found to be w′, then :

(1) $w' = w/\mu$ (2) $w' = w\mu$
(3) $w' = (\mu - 1)\, tw$ (4) $w' = w$

Q.33 Two coherent sources of equal intensities produce a maximum of 100 units. If the amplitude of one of the sources is reduced by 20%, then the maximum intensity produced will be :

(1) 100 (2) 81
(3) 89 (4) 60

Q.34 In Young's double slit experiment, the two slits act as coherent sources of equal amplitude A and wavelength λ. In another experiment with the same set up the two slits are sources of equal amplitude A and wavelength λ but are incoherent. The ratio of the intensity of light at the mid-point of the screen in the first case to that in the second case is :

(1) 4 : 1 (2) 2 : 1
(3) 1 : 1 (4) None of the above

Q.35 In Young's experiment, light of wavelength 6000Å is used to produce fringes of width 0.8 mm at a distance of 2.5 m. If the whole experiment is deep in a liquid of refractive index 1.6, then fringe width will be :

(1) 0.5 mm (2) 0.6 mm
(2) 0.4 mm (4) 0.2 mm

Q.36 In double slit experiment, the angular width of the fringes is 0.20° for the sodium light (λ = 5890Å). In order to increase the angular width of the fringes by 10%, the necessary change in the wavelength is

(1) Increase of 589Å (2) Decrease of 589Å
(3) Increase of 6479Å (4) Zero

Q.37 If a transparent medium of refractive index $\mu = 1.5$ and thickness $t = 2.5 \times 10^{-5}$ m is inserted in front of the slits of Young's Double slit experiment, how much will be the shift in the interference pattern?

The distance between the slits is 0.5 mm and that between slits and screen is 100 cm :

(1) 5 cm (2) 2.5 cm
(3) 0.25 cm (4) 0.1 cm

Q.38 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})

(1) 3×10^8 (2) $\left(\frac{3}{\sqrt{2}}\right) \times 10^8$
(3) $\sqrt{3} \times 10^8$ (4) 0.5×10^8

Q.39 Find the half angular width of the central bright maximum in the Fraunhofer diffraction pattern of a slit of width 12×10^{-5} cm when the slit is illuminated by monochromatic light of wavelength 6000 Å.

(1) 40° (2) 45°
(3) 30° (4) 60°

Q.40 A light source of 5000Å wave length produces a single slit diffraction. The first minima in diffraction pattern is seen, at a distance of 5mm from central maxima. The distance between screen and slit is 2 metre. The width of slit in mm will be :

(1) 0.1 (2) 0.4
(3) 0.2 (4) 2

Q.41 A plane wave front of wave length 6000 Å is incident upon a slit of 0.2mm width, which enables Fraunhofer's diffraction pattern to be obtained on a screen 2 metre away. Width of the central maxima in mm will be :

(1) 10 (2) 12
(3) 8 (4) 2

Q.42 Two polaroids as oriented with their planes perpendicular to incident light and transmission axis making an angle of 30º with each other. What fraction of incident unpolarised light is transmitted?

(1) 57.5 % (2) 17.5 %
(3) 27.5 % (4) 37.5 %

Q.43 In case of Rayleigh scattering, the amount of scattered light varies with wavelength as :–

(1) $\propto \lambda$ (2) $\propto \left[\frac{1}{\lambda^2}\right]$
(3) $\propto \left[\frac{1}{\lambda^3}\right]$ (4) $\propto \left[\frac{1}{\lambda^4}\right]$

Q.44 The red colour of sun at rising and setting is due to the phenomenon of

(1) selective absorption (2) diffraction
(3) reflection of red colour (4) scattering

Q.45 If the light is polarised by reflection, then the angle between reflected and refracted light is :

(1) π (2) $\pi/2$
(3) 2π (4) $\pi/4$


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