Wave Optics Assignment - II

1. Two waves are known to be coherent if they have
(a) Same amplitude (b) Same wavelength
(c) Same amplitude and wavelength (d) Constant phase difference and same wavelength

2. An oil flowing on water seems coloured due to interference. For observing this effect, the approximate thickness of the oil film should be
(a) 100 *Å* (b) 10000 *Å* (c) 1 *mm* (d) 1 *cm*

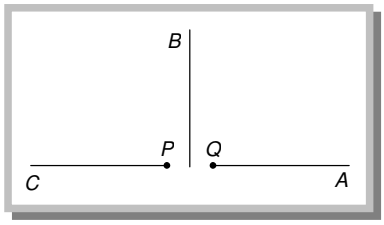
3. If *L* is the coherence length and *c* the velocity of light, the coherent time is
(a) *cL* (b) $\frac{L}{c}$ (c) $\frac{c}{L}$ (d) $\frac{1}{Lc}$

4. By a monochromatic wave, we mean
(a) A single ray (b) A single ray of a single colour
(c) Wave having a single wavelength (d) Many rays of a single colour

5. Two coherent sources of light produce destructive interference when phase difference between them is
(a) 2π (b) π (c) $\pi/2$ (d) 0

6. Which one of the following statements is correct
(a) In vacuum, the speed of light depends upon frequency
(b) In vacuum, the speed of light does not depend upon frequency
(c) In vacuum, the speed of light is independent of frequency and wavelength
(d) In vacuum, the speed of light depends upon wavelength

7. Figure here shows *P* and *Q* as two equally intense coherent sources emitting radiations of wavelength 20 *m*. The separation *PQ* is 5.0 *m* and phase of *P* is ahead of the phase of *Q* by 90°. *A*, *B* and *C* are three distant points of observation equidistant from the mid-point of *PQ*. The intensity of radiations at *A*, *B*, *C* will bear the ratio
(a) 0 : 1 : 4
(b) 4 : 1 : 0
(c) 0 : 1 : 2
(d) 2 : 1 : 0



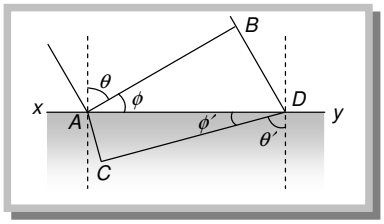
8. In Huygen's wave theory, the locus of all points in the same state of vibration is called
(a) A half period zone (b) Vibrator (c) A wavefront (d) A ray

9. The idea of the quantum nature of light has emerged in an attempt to explain
(a) Interference (b) Diffraction
(c) Radiation spectrum of a black body (d) Polarisation

10. The necessary condition for an interference by two source of light is that the
(a) Two monochromatic sources should be of same amplitude but with a constant phase
(b) Two sources should be of same amplitude
(c) Two point sources should have phase difference varying with time
(d) Two sources should be of same wavelength

11. If the intensity of the waves observed by two coherent sources is *I*. Then the intensity of resultant waves in constructive interference will be
(a) 2*I* (b) 4*I* (c) *I* (d) None of these

12. In figure, a wavefront *AB* moving in air is incident on a plane glass surface *xy*. Its position *CD* after refraction through a glass slab is shown also along with normals drawn at *A* and *D*. the refractive index of glass with respect to air will be equal to
(a) $\frac{\sin\theta}{\sin\theta'}$
(b) $\frac{\sin\theta}{\sin\phi'}$
(c) (*BD*/*AC*)
(d) (*AB*/*CD*)



13. Four independent waves are expressed as
(i) $y_1 = a_1 \sin \omega t$ (ii) $y_2 = a_2 \sin 2\omega t$ (iii) $y_3 = a_3 \cos \omega t$ (iv) $y_4 = a_4 \sin(\omega t + \pi/3)$
The interference is possible between

(a) (i) and (ii) (b) (i) and (iv) (c) (iii) and (iv) (d) Not possible at all

14. Colour of light is known by its

(a) Velocity (b) Amplitude (c) Frequency (d) Polarisation

15. Laser light is considered to be coherent because it consists of

(a) Many wavelengths (b) Uncoordinated wavelengths

(c) Coordinated waves of exactly the same wavelength (d) Divergent beams

16. A laser beam may be used to measure very large distances because

(a) It is unidirectional (b) It is coherent (c) It is monochromatic (d) It is not absorbed

17. Interference patterns are not observed in thick films, because

(a) Most of the incident light intensity is observed within the film

(b) A thick film has a high coefficient of reflection

(c) The maxima of interference patterns are far from the minima

(d) There is too much overlapping of colours washing out the interference pattern

18. Phenomenon of interference is not observed by two sodium lamps of same power. It is because both waves have

(a) Not constant phase difference (b) Zero phase difference

(c) Different intensity (d) Different frequencies

19. In a Young's double slit experiment, the separation between the two slits is 0.9 *mm* and the fringes are observed one *metre* away. If it produces the second dark fringe at a distance of 1 *mm* from the central fringe, the wavelength of monochromatic source of light used is

(a) 500 *nm* (b) 600 *nm* (c) 450 *nm* (d) 400 *nm*

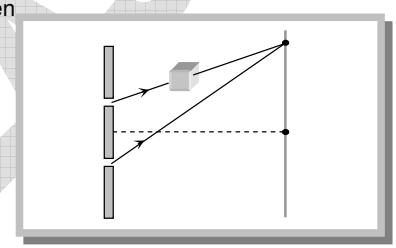
20. A monochromatic beams of light is used for the formation of fringes on the screen by illuminating the two slits in the Young's double slit mica is interposed in the path of one of the interfering beams then

(a) The fringe width increases

(b) The fringe width decreases

(c) The fringe width remains the same but the pattern shifts

(d) The fringe pattern disappears



21. In a Young's double-slit experiment the fringe width is 0.2 *mm*. If the wavelength of light used is increased by 10% and the separation between the slits is also increased by 10%, the fringe width will be

(a) 0.20 *mm* (b) 0.401 *mm* (c) 0.242 *mm* (d) 0.165 *mm*

22. In Young's experiment, the distance between the slits is reduced to half and the distance between the slit and screen is doubled, then the fringe width

(a) Will not change (b) Will become half (c) Will be doubled (d) Will become four times

23. 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 source in order obtain 5th bright fringe at the same point

(a) 500 *nm* (b) 630 *nm* (c) 750 *nm* (d) 420 *nm*

24. In Young's double-slit experiment the fringe width is β. If entire arrangement is placed in a liquid of refractive index n, the fringe width becomes

(a) $\frac{\beta}{n+1}$ (b) $n\beta$ (c) β / n (d) $\beta / n-1$

25. If the separation between slits in Young's double slit experiment is reduced to $\frac{1}{3}rd$, the fringe width becomes n times. The value of n is

(a) 3 (b) $\frac{1}{3}$ (c) 9 (d) $\frac{1}{9}$

26. When a thin transparent plate of thickness t and refractive index μ is placed in the path of one of the two interfering waves of light, then the path difference changes by

(a) $(\mu + 1)t$ (b) $(\mu - 1)t$ (c) $\frac{(\mu+1)}{t}$ (d) $\frac{(\mu-1)}{t}$

27. In a Young's double slit experiment, the source illuminating the slits is changed from blue to violet. The width of the fringes

(a) Increases (b) Decreases (c) Becomes unequal (d) Remains constant

28. In Young's double slit experiment, the intensity of light coming from the first slit is double the intensity from the second slit. The ratio of the maximum intensity to the minimum intensity on the interference fringe pattern observed is

(a) 34 (b) 40 (c) 25 (d) 38

29. A flake of glass (refractive index 1.5) is placed over one of the openings of a double slit apparatus. The interference pattern displaces itself through seven successive maxima towards the side where the flake is placed. if wavelength of the diffracted light is $\lambda = 600\,nm$, then the thickness of the flake is

(a) 2100 *nm* (b) 4200 *nm* (c) 8400 *nm* (d) None of these

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

(a) The intensitites of both the maxima and the minima increase

(b) The intensity of the maxima increases and minima has zero intensity

(c) The intensity of the maxima decreases and that of minima increases

(d) The intensity of the maxima decreases and the minima has zero intensity

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

(a) 4 (b) 3 (c) 2 (d) 1

32. In a double slit experiment if 5^{th} dark fringe is formed opposite to one of the slits, the wavelength of light is

(a) $\frac{d^2}{6D}$ (b) $\frac{d^2}{5D}$ (c) $\frac{d^2}{15D}$ (d) $\frac{d^2}{9D}$

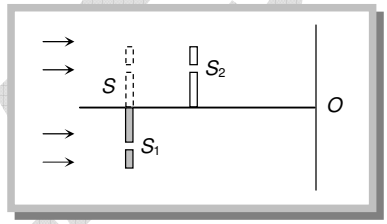
33. In a Young's double slit experiment one of the slits is advanced towards the screen by a distance $d/2$ and $d = n\lambda$ where *n* is an odd integer and *d* is the initial distance between the slits. If I_0 is the intensity of each wave from the slits, the intensity at *O* is

(a) I_0

(b) $\frac{I_0}{4}$

(c) 0

(d) $2I_0$



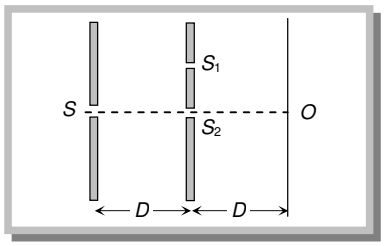
34. Two ideal slits S_1 and S_2 are at a distance *d* apart, and illuminated by light of wavelength λ passing through an ideal source slit *S* placed on the line through S_2 as shown. The distance between the planes of slits and the source slit is *D*. A screen is held at a distance *D* from the plane of the slits. The minimum value of *d* for which there is darkness at *O* is

(a) $\sqrt{\frac{3\lambda D}{2}}$

(b) $\sqrt{\lambda D}$

(c) $\sqrt{\frac{\lambda D}{2}}$

(d) $\sqrt{3\lambda D}$



35. In a double slit experiment interference is obtained from electron waves produced in an electron gun supplied with voltage *V*. if λ is the wavelength of the beam, *D* is the distance of screen, *d* is the spacing between coherent source, *h* is Planck's constant, *e* is charge on electron and *m* is mass of electron then fringe width is given as

(a) $\frac{hD}{\sqrt{2meV}\,d}$ (b) $\frac{2hD}{\sqrt{meV}\,d}$ (c) $\frac{hd}{\sqrt{2meV}\,D}$ (d) $\frac{2hd}{\sqrt{meV}\,D}$

36. In a double slit arrangement fringes are produced using light of wavelength 4800 Å. One slit is covered by a thin plate of glass of refractive index 1.4 and the other with another glass plate of same thickness but of refractive index 1.7. By doing so the central bright shifts to original fifth bright fringe from centre. Thickness of glass plate is

(a) 8 μm (b) 6 μm (c) 4 μm (d) 10 μm

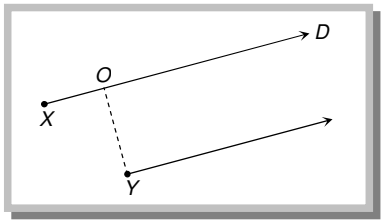
37. Two point sources *X* and *Y* emit waves of same frequency and speed but *Y* lags in phase behind *X* by $2\pi n$ radian. If there is a maximum in direction *D* the distance *XO* using *n* as an integer is given by

(a) $\frac{\lambda}{2}(n-l)$

(b) $\lambda(n+l)$

(c) $\frac{\lambda}{2}(n+l)$

(d) $\lambda(n-l)$



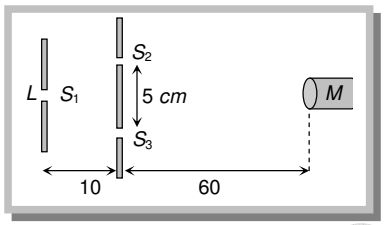
38. A student is asked to measure the wavelength of monochromatic light. He sets up the apparatus sketched below. S_1, S_2, S_3 are narrow parallel slits, *L* is a sodium lamp and *M* is a micrometer eye-piece. The student fails to observe interference fringes. You would advise him to

(a) Increase the width of S_1

(b) Decrease the distance between S_2 and S_3

(c) Replace *L* with a white light source

(d) Replace *M* with a telescope



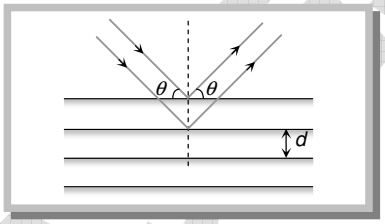
39. A beam with wavelength λ falls on a stack of partially reflecting planes with separation *d*. The angle θ that the beam should make with the planes so that the beams reflected from successive planes may interfere constructively is (where n =1, 2, ……)

(a) $\sin^{-1}\left(\frac{n\lambda}{d}\right)$

(b) $\tan^{-1}\left(\frac{n\lambda}{d}\right)$

(c) $\sin^{-1}\left(\frac{n\lambda}{2d}\right)$

(d) $\cos^{-1}\left(\frac{n\lambda}{2d}\right)$



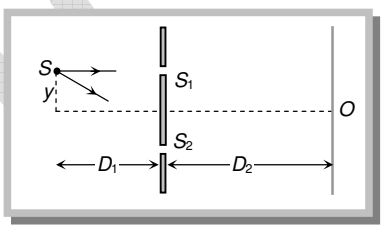
40. In a double slit experiment the source slit *S* is at a distance D_1 and the screen at a distance D_2 from the plane of ideal slit cuts S_1 and S_2 as shown. If the source slit is shifted to by parallel to S_1S_2, the central bright fringe will be shifted by

(a) y

(b) $-y$

(c) $\frac{D_2}{D_1}y$

(d) $-\frac{D_2}{D_1}y$



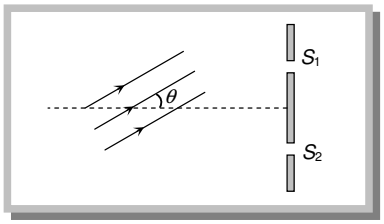
41. A parallel beam of monochromatic light is used in a Young's double slit experiment. The slits are separated by a distance *d* and the screen is placed parallel to the plane of the slits. The angle which the incident beam must make with the normal to the plane of the slits to produce darkness at the position of central brightness is

(a) $\cos^{-1}\frac{\lambda}{d}$

(b) $\cos^{-1}\frac{2\lambda}{d}$

(c) $\sin^{-1}\frac{\lambda}{d}$

(d) $\sin^{-1}\frac{\lambda}{2d}$



42. In a Young's double slit experiment, let β be the fringe width, and let I_0 be the intensity at the central bright fringe. At a distance *x* from the central bright fringe, the intensity will be

(a) $I_0\cos\left(\frac{x}{\beta}\right)$ (b) $I_0\cos^2\left(\frac{x}{\beta}\right)$ (c) $I_0\cos^2\left(\frac{\pi x}{\beta}\right)$ (d) $\left(\frac{I_0}{4}\right)\cos^2\left(\frac{\pi x}{\beta}\right)$

43. In Young's double slit experiment the distance *d* between the slits S_1 and S_2 is 1 *mm*. What should be the width of each slit be so as to obtain 10 maxima of the two slit interference pattern with in the central maximum of the single slit diffraction pattern

(a) 0.1 *mm* (b) 0.2 *mm* (c) 0.3 *mm* (d) 0.4 *mm*

44. The light of wavelength 6328 *Å* is incident on a slit of width 0.2 *mm* perpendicularly situated at a distance of 9 *m* and the central maxima between two minima, the angular is approximately

(a) 0.36° (b) 0.18° (c) 0.72° (d) 0.08°

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

(a) No change (b) diffraction bands become narrower and crowded together

(c) Bands become broader and farther apart (d) Bands disappear

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

(a) Distance between slit and source (b) Wavelength of light used

(c) Width of the slit (d) Frequency of light used

47. In order to see diffraction the thickness of the film is

(a) 100 Å (b) 10,000 Å (c) 1 *mm* (d) 1 *cm*

48. Which is incorrect with reference to polarisation by reflection

(a) The degree of polarisation varies with the angle of incidence

(b) Percentage of the polarising light in the reflected beam is the greatest at the angle of polarisation

(c) Reflected light is plane polarised in the plane of incidence

(d) Reflected light is plane polarised in the plane perpendicular to plane of incidence

49. A star emitting light of wavelength 5896 Å is moving away from the earth with a speed of 3600 *km/sec.* The wavelength of light observed on earth will ($c = 3 \times 10^8 m / \sec$ is the speed of light)

(a) Decrease by 5825.25 Å (b) Increase by 5966.75 Å (c) Decrease by 70.75 Å (d) Increase by 70.75 Å

50. The periodic time of rotation of a certain star is 22 days and its radius is $7 \times 10^8 m$. If the wavelength of light emitted by its surface be 4320 Å, the Doppler shift will be (1 day = 86400 *sec*)

(a) 0.033 *Å* (b) 0.33 *Å* (c) 3.3 *Å* (d) 33 *Å*