PHYSICS

VIKASAN PROGRAMME
PHYSICAL OPTICS

SANGAMESH.K.BADIGER M.SC,M.PHIL.B.Ed, PGDCA

LECTURER

Govt . P.U. College for Boys, Bijapur

Mob:9880165749

1. Two waves A and B with Amplitude 4 units and 1 unit respectively interfere if the phase difference δ at a point is 60^0 the intensity at this point is

1) 25 units
2) 17 units
3) 21 units
4) 5 units

The intensity at a point at which phase difference between two coherent waves of amplitudes a_1 and a_2 is

$$I = a_1^2 + a_2^2 + 2a_1a_2 \cos\theta$$

$$I = (4)^2+(1)^2+2.4.1 \times \cos 60^0$$

$$= 16+1+8x1/2$$

$$= 21 \text{ units}$$

Ans : 3) 21 units

2. Wavelength of light can be determined by using

1) Polaroid
2) Diffraction grating
3) Prism
4) Convex lens

Ans : 2) Diffraction grating

3. In a Grating spectrum

1) Violet is the least deviated colour
2) Yellow is the least deviated colour
3) Red is the least deviated colour
4) All colours are equally deviated

Ans : 1) Violet is the least deviated colour

4. When a light wave travels from one medium to another the charecterstic parameter remains invariant is

1) Wavelength
2) Velocity
3) Frequency
4) Intensity

Ans : 3) Frequency

5. The condition of observing Fraunhoffer diffraction from a single slit is that the light wave front incident on the slit must be

1) Spherical
2) Elliptical
3) Cylindrical
4) Plane

Ans : 4) Plane

6. Specific rotation depends on -

1) Thickness of the material
2) Surrounding medium
3) Nature of the material
4) None of the these

Ans : 1) Thickness of the material

7. Glancing angle 30^0 it is found that reflected beam is completely plane polarized the R.I of glass is

1) $\sqrt{3}$
2) 1.5
3) 2
4) 3

Soln : $\theta_p + r = 90^0$

$$\emptyset_p = 90^0 - r \Rightarrow 90^0 - 30^0 = 60^0$$

$$n = Tan\emptyset_p = Tan60^0$$

$$n = \sqrt{3}$$

Ans : 1) $\sqrt{3}$

8. “Birefringence” in calcite was first observed by

1) Grimaldi 2) Malus

3) Bartholinus 4) Huygen

Ans : 3) Bartholinus

9. In the young's double slit experiment the distance of the p^{th} dark fringe from the central maximum is

1) $(2p+1)\frac{\lambda D}{d}$

2) $(2p-1)\frac{\lambda D}{d}$

3) $(2p+1)\frac{d\lambda}{d}$

4) $(2p+1)\frac{\lambda D}{2d}$

Ans : 4) (2p+1) $\frac{\lambda D}{2d}$

10. In young's double slit experiment with monochromatic light the central fringe will be

1) Coloured
2) White
3) Bright
4) Black

Ans : 3) Bright

11. Which of the following is conserved when light wave interfere?

1) Amplitude
2) Intensity
3) Phase
4) None of the these

Ans : 2) Intensity

12. In which of the following the interference not produced by the division of wave front?

1) Young's double slit experiment
2) Fresnel's biprism
3) Lloyd's mirror
4) Colours of thin film

Ans : 4) Colours of thin film

13. If young's double slit experiment is performed with white light the fringes are

1) Coloured
2) White
3) White spot surrounded by coloured fringes
4) Coloured fringes surrounded by white rings

Ans : 3) White spot surrounded by coloured fringes

14. If yellow light is replaced by blue light in young's double slit experiment the fringes will be

1) Wider
2) Narrower
3) Brighter
4) fainter

Ans : 2) Narrower

15. The fringe width β of the diffraction pattern and the slit width ‘d’ are related as

1) $\beta \propto d$ 2) $\beta \propto \frac{1}{d}$

3) $\beta \propto \sqrt{d}$ 4) None of these

Ans : 2) $\beta \alpha \frac{1}{d}$

16. Which of the following cannot produce colours with white light?

1) Dispersion
2) Interference
3) Diffraction
4) Polarization

Ans : 4) Polarisation

17. In young's double slit experiment a minimum is obtained when the phase difference of the superimposing waves is

1) Zero
2) mπ
3) (m+1) π
4) (2m+1) π

Ans : 4) $(2m+1)\pi$

18. The width of the diffraction fringe varies

1) Directly as the distance between the slit and the screen
2) Inversly as the wave length
3) Directly as the width of the slit
4) Inversly as the size of the source from which the slit is illuminated

Ans : 1) Directly as the distance between the slit and the screen

19. The transverse nature of light waves is confirmed by

1) Interference
2) Diffraction
3) Polarisation
4) None of the these

Ans : 3) Polarisation

20. The material used for manufacturing polaroids is

1) Calcite
2) Quartz
3) Tourmaline
4) Quinine idosulphate

Ans : 4) Quinine idosulphate

21. From the Brewster's law it follows that the angle of polarisation depends on

1) Wavelength
2) Frequency
3) Plane of polarisation
4) Plane of vibration

Ans : 1) Wavelength

22. In double refraction we get two refracted rays called O-ray and E–ray then

1) Only the O-ray is polorised
2) Only the E-ray is polorised
3) Both O ray and E-rays are polorised
4) Neither O-ray nor E-ray is polorised

Ans : 3) Both O ray and E-rays are polorised

23. We prefer polaroid sun glasses because they

1) Reduce the intensity of light
2) Have soothing colours
3) Are cheaper
4) Can change colours

Ans : 1) Reduce the intensity of light

24. What is the phase difference between electric and magnetic field vectors in the electromagnetic waves?

1) Zero
2) π /4
3) π /2
4) π

Both electric and magnetic field vectors are in the same phase but they are oriented perpendicular to each other

Ans : 1) Zero

25. Given planck's constant h = $6.6X10^{-34}$ js the momentum of each photon in a given radiation is $3.3X10^{-29}kgms^{-1}$ the frequency of the radiation is

1) $3X10^{3}$ HZ
2) $6X10^{10}$ HZ
3) $7.5X10^{12}$ HZ
4) $1.5X10^{13}$ HZ

$$Soln : \lambda = \frac{h}{p} = \frac{6.625X10^{-34}}{3.3X10^{-29}}$$

$$\lambda = 2X10^{-5}m$$

$$f = \frac{C}{\lambda} = \frac{3X10^{8}}{2X10^{-5}}$$

$$f = 1.5X10^{13}\ HZ$$

Ans : 4) $1.5X10^{13}$ HZ

26. For a given telescope D=200 mm $\lambda = 6 \times 10^{-7}$ m the value of the angle subtended by two stars that could be resolved approximately

1) 0.4×10^{-6} rad
2) 0.8×10^{-6} rad
3) 4×10^{-6} rad
4) 8×10^{-6} rad

$$Soln: \frac{1.22\lambda}{D} = \frac{1.22X6X10^{-7}}{200X10^{-3}}$$

$$\frac{1.22X6X10^{-7}}{2X10^{-1}} = 3.66X10^{-6}\ rad$$

$$d\theta = 3.66 \times 10^{-6} \approx 4 \times 10^{-6} \text{ rad}$$

Ans : 3) $4x10^{-6}$ rad

27. The resolving power of telescope is highest for

1) Blue light
2) Green light
3) Yellow light
4) Red light

Soln : Resolving power is inversely proportional to wavelength

$$R.P \propto \frac{D}{1.22\lambda}$$

Ans : 1) Blue light

28. The energy of a photon of light of wavelength 450 nm is

1) $4.4X10^{-19}$ J

2) $2.5X10^{-19}$ J

3) $1.25X10^{-17}$ J

4) $2.5X10^{-17}$ J

Soln :

$$E = hr = \frac{hC}{\lambda} = \frac{6.625X10^{-34}X3X10^{8}}{4.5X10^{-7}}$$

$$E = 4.4X10^{-19}\ J$$

Ans : 1) $4.4X10^{-19}$ J

29. In the young's experiment with sodium light the slits are 0.589 m apart what is the angular width of third maximum? Given that λ= 589nm

1) $Sin^{-1}(3X10^{-6})$
2) $Sin^{-1}\ 3X10^{-8}$
3) $Sin^{-1}(0.33X10^{-6})$
4) $Sin^{-1}(0.33X10^{-8})$

Soln :

$$Sin\emptyset = \frac{n\lambda}{d} = \frac{3X5.89X10^{-7}}{0.589}$$

$$\emptyset = Sin^{-1}(3X10^{-6})$$

Ans : 1) Sin^{-1} $(3X10^{-6})$

30. In young's double slit experiment if the slit widths are in the ratio of 1:9 the ratio of intensities at the maximum and minimum

1) 10:9
2) 9:1
3) 4:1
4) 3:1

Soln :

$$\frac{I_{max}}{I_{man}} = \frac{(a_1+a_2)^2}{(a_1-a_2)^2} \qquad a_1 = 1, \quad a_2 = 3$$

$$= \frac{(1+3)^2}{(1-3)^2} = \frac{16}{4} = 4:1$$

$$I_{max} : I_{min} = 4 : 1$$

Ans : 3) 4:1

31. In young's experiment the wavelength of red light is 7.5×10^{-5} cm and that of blue light is 5.0×10^{-5} cm the value of n for which $(n+1)^{th}$ the blue bright band coincides with the n^{th} red band is

1) 8
2) 4
3) 2
4) 1

Soln :

$$n\lambda_a = (n+1)\lambda_b$$

$$= \frac{n}{n+1} = \frac{\lambda_b}{\lambda_a} = \frac{5X10^{-7}}{7.5X10^{-7}}$$

$n \times 7.5\ 10^{-7} = (n + 1)\ 5 \times 10^{-7}$

$2.5 \times 10^{-7}\ n = 5 \times 10^{-7}$

$n = 5 / 2.5 = 2$

Ans : 3) 2

32. Un polarized light converts to partially or plane polarized light by many processes which of the following does not do that?

1) Reflection
2) Diffraction
3) Double refraction
4) Scattering

Ans : 2) Diffraction

33. Which of the following is correct?

1) Interference of light is evidence of transverse character of light
2) Rain bow appears because of scattering of light
3) Light and sound both are transverse wave
4) Coherent source of light passing through two slits causes interference

Ans : 4) Coherent source of light passing through two slits causes interference

34. The light waves from two coherent sources of same intensity 'I' interfere, at the minimum the intensity of light is zero. What is the intensity of light at the maximum?

1) 4I 2) I 3) 2I 4) 8I

Amplitude at the maximum is $2\sqrt{I}$.

Hence intensity at the maximum is 4I

ANS A) 4I

35. Phenomenon of diffraction of light was discovered by

1) Fresnel
2) Grimaldi
3) Huygen
4) Newton

Ans : 2) Grimaldi

36. In a Fraunhoffer diffraction experiment at a single slit using a light of wavelength 400 nm the first minimum is formed at an angle of 30^0 then the direction θ of the first second maximum given by

1) Tan^{-1} (3/4)
2) Sin^{-1} (3/4)
3) 60^0
4) Tan^{-1} (4/3)

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

$d = \lambda/\sin\theta = 400 \times 10^{-9}/0.5 = 8 \times 10^{-7}m$

$d\sin\theta = 3\lambda/2$ i.e $\sin\theta = 3\lambda/2d$

$= 3 \times 4x10^{-7}/2x8x10^{-7}$

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

Ans : 2) $\sin^{-1}(3/4)$

37. Velocity of light according to this theory is greater in a denser medium than in a rarer medium

1) Electro magnetic theory
2) Quantum theory
3) Corpuscular theory
4) Wave theory

Ans : 3) Corpuscular theory

38. Ordinary light is incident on a glass slab at the polarizing angle suffers a deviation of 22^0 the value of the angle of refraction in glass in this case is

1) 34^0
2) 22^0
3) 5^0
4) 68^0

$$\text{i.e } \theta p = 90^0 - r$$

$$d = \theta p - r = \theta p - r = 22^0$$

$$(90^0 - r) - r = 22^0$$

$$2r = 90^0 - 22^0 = 68^0$$

$$r = 34^0$$

Ans : 1) 34^0

39. Bright colours exhibited by spiders web exposed to sun light are due to

1) Interference
2) Resolution
3) Diffraction
4) Polarization

Ans : 3) Diffraction

40. Numerical aperture of an oil immersion objective using oil of R.I 1.5 is 0.75 then its numerical aperture when kept in air is

1) 0.25
2) 0.5
3) 1
4) 0.3

Soln :

$$\frac{N.A}{n} = \frac{0.75}{1.5}$$

$$N.A = 0.5$$

Ans : 2) 0.5

41. Direction of the first second maximum in the fraunhoffer diffraction pattern at a single slit is given by (a is the width of the slit)

1) $a \sin \emptyset = \frac{3\lambda}{2}$

2) $a \sin \emptyset = \frac{\lambda}{2}$

3) $a \sin\theta = 3\lambda$

4) $a \sin\theta = \lambda$

Soln :

$$a \sin \emptyset = (2n+1)\frac{\lambda}{2} \quad n = 1$$

$$a \sin \emptyset = \frac{3\lambda}{2}$$

Ans : 1) $a \sin \emptyset = \frac{3\lambda}{2}$

42. Biaxial crystal among the following is

1) Mica
2) Tourmaline
3) Calcite
4) Quartz

Ans : 1) Mica

43. Diffraction effects are easier to notice in the case of sound waves than in the case of light waves because

1) Sound waves are mechanical waves
2) Sound waves of longer wave length
3) Sound waves are longitudinal
4) Sound is perceived by the ear

Ans : 2) Sound waves of longer wave length

44. Light is incident on a glass plate at an angle of 60^0 the reflected and refracted rays are mutually perpendicular to each other the refractive index of the plate is

1) 1.5
2) 1.73
3) 1.22
4) 0.5

Soln : According to Brewster's law

$$n = Tan\emptyset_p$$

$$n = Tan60^0 = \sqrt{3}$$

$$n = 1.73$$

Ans : 2) 1.73

45. When light is incident on a doubly refracting crystal two refracted rays ordinary ray (O-ray) and extra ordinary ray (E.O ray) are produced then

1) Both O-ray and E- ray are polarized in the plane of incidence
2) Both O-ray and E- ray are polarized perpendicular to the plane of incidence
3) E-ray is polarized in the plane of incidence and O-ray perpendicular to the plane of incidence
4) E-ray is polarized perpendicular to the plane of incidence and O-ray in the plane of incidence

Ans: 4) E-ray is polarized perpendicular to the plane of incidence and O-ray in the plane of incidence

46. The phenomenon of rotation of plane polarised light is called

1) Optical activity
2) Dichroism
3) Rear effect
4) Double refraction

Ans : 1) Optical activity

47. Rain bow is formed due to

1) Total internal reflection
2) Scattering
3) Refraction
4) Dispersion and total internal reflection

Ans: 4) Dispersion and total internal reflection

48. Wave theory of light in its original form was first postulated by

1) Newton
2) Huygen
3) Young
4) Fresnel

Ans : 2) Huygen

49. The width of the diffraction band varies

1. Directly as the distance between slit and screen
2. Inversely as size of source from which the slit is illuminated
3. Inversely as wavelength
4. Directly as width of slit

Ans : 1) Directly as the distance between slit and screen

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

1) 2.9 cm
2) 2.4 mm
3) 1.2 cm
4) 1.2 mm

Soln :

$$\beta = \lambda D/d$$

$$= 6 \times 10^{-7} \times 2 / 1 \times 10^{-3}$$

$$\beta = 1.2\text{mm}$$

Ans : 4) 1.2 mm

51. A diffraction pattern due to a single slit is observed using a green light when it is replaced by red light

1) No change is observed
2) Bands become narrower and crowded
3) Bands become broader
4) Bands disappear

Ans : 3) Bands become broader

52 In young's double slit experiment fringe width decreases by 25% when the apparatus is immersed in a liquid refractive index of liquid is

1) 1.5
2) 1.33
3) 1.43
4) 1.62

Soln :

$$\frac{1}{100-25} = \frac{1}{0.75}$$

$$n = 1.33$$

Ans : 2) 1.33

53 Limit of resolution of telescope is 4.88×10^{-6} rad for light of wavelength 560 nm diameter of the objective is

1) 0.14 m
2) 1.4 m
3) 0.07 m
4) 0.7 m

Soln : $d\theta = 1.22\lambda/d$

$$d = \frac{1.22\,\lambda}{do} = \frac{1.22X5.6X10^{-7}}{4.88X10^{-6}}$$

$$d = 1.4X10^{-1}$$

$$= 0.14\,\text{m}$$

Ans : 1) 0.14 m

54. The electromagnetic theory of light failed to explain

1) Diffraction
2) Interference
3) Photo electric effect
4) Polarisation

Ans : 3) Photo electric effect

55 Prism spectrum and first order grating spectrum of a given light are under study then

1. Prism spectrum will be more bright
2. Grating spectrum will be more bright
3. Both are equally bright
4. Intensities of two spectra are unpredicatable

Ans : 2) Grating spectrum will be more bright

56 To increase the angular width of interference fringes

1. Wavelength should increase
2. Distance between coherent source should increase
3. Either (1) or (2)
4. Neither (1) nor (2)

Ans : 1) Wavelength should increase

57 When grating is used, zeroth order spectrum will be

1) Dark
2) Red
3) Violet
4) Bright white

Ans : 4) Bright white

58. In Newton's ring experiment monochromatic light is replaced by white light then

1. No ring pattern is observed
2. More intense bright and dark rings are observed
3. A few coloured rings with central dark spot are observed
4. A few coloured rings with central bright spot are observed

Ans : 3) A few coloured rings with central dark spot are observed

59. For constructive interference path difference between two interfering waves must be equal to

1) $(2n+1)\lambda$
2) $(2n+1)\lambda$
3) $2n\lambda$
4) $n\lambda$

Ans : 4) n λ

60. Huygen's concept of secondary waves is useful in

1. Explaining polarisation
2. Determining focal length of a lens
3. Geometrical reconstruction of wave front
4. None of the these

Ans : 3) Geometrical reconstruction of wave front

61 The fringe width of interference fringes for red colour is β the fringe width for the violet colour will be nearly

1) Same
2) Doubled
3) Four times
4) Eight times

Ans: 2) Doubled

62. Newton postulated his corpuscular theory on the basis of

1) Dispersion of white light
2) Rectillinear propagation of light
3) Colours of thin film
4) Newton's rings

Ans : 2) Rectillinear propagation of light

63. In a wave the path difference corresponding to a phase diff of Φ is

1) $\frac{\pi}{2\lambda}\phi$ 2) $\frac{\pi}{\lambda}\phi$

3) $\frac{\lambda}{2\pi}\phi$ 4) $\frac{\lambda}{\pi}\phi$

Ans : $3)\ \frac{\lambda}{2\pi}\ \emptyset$

64. The diameter of the objective of an astronomical telescope is 0.1 m and the wavelength of light used is $6000A^0$ resolving limit of the telescope will be nearly

1) $6X10^{-5}$ rad
2) $6X10^{-4}$ rad
3) $6X10^{-6}$ rad
4) $7.32X10^{-6}$ rad

$$d\theta = 1.22\lambda/d \quad = 1.22 \times 6 \times 10^{-7}/0.1$$

$$= 7.32 \times 10^{-6} \text{rad}$$

Ans : 4) $7.32X10^{-6}$ rad

65. The idea of quantum nature of radiation is used to explain

1) Interference
2) Diffraction
3) Polarisation
4) Photo electric emission

Ans : 4) Photo electric emission

66. Two sources are said to be coherent if they produce waves

1. Of equal wave length
2. Of equal speed
3. Having same shape of wave front
4. Having a constant phase difference

Ans : 4) Having a constant phase difference

67. A calcite crystal is placed over a dot on a paper sheet and the crystal is rotated on viewing through the calcite one sees

1. A single stationary dot
2. Two stationary dots
3. Two dots rotating above one another
4. One dot rotating about the other stationary dot some times coinciding with it

Ans : 4) One dot rotating about the other stationary dot some times coinciding with it

68. Diffraction of light is the

1. Change in the path of a ray of light travelling from one medium to another
2. Spreading of light around the edges of an obstacle
3. Splitting of light due to refraction
4. None of the these

Ans : 2) Spreading of light around the edges of an obstacle

69. The ability of optical instrument to show the images of two near by point objects as separate is called

1) Magnifying power
2) Dispersive power
3) Resolving power
4) None of the these

Ans : 3) Resolving power

70. Limit of resolution of the human eye is about

1) One second of arc
2) One minute of arc
3) One degree of arc
4) None of the these

Ans : 2) One minute of arc

71. Light which has acquired the property of one sidedness is called

1) Un polarized light
2) Plane polarized light
3) Polarized light
4) None of the these

Ans : 2) Plane polarised light