UNIT VI-OPTICS
CH10: WAVE OPTICS

GIST OF THE CHAPTER:

1. Wave Nature of Light: Huygen's Theory

There are some phenomena like interference, diffraction and polarisation which could not be explained by Newton's corpuscular theory. These were explained by wave theory first proposed by Huygen.

The assumptions of Huygen's wave theory are: (*i*) A source sends waves in all possible directions.The locus of particles of a medium vibrating in the same phase is called a **wavefront**. For a point source, the wavefront is spherical; while for a line source the wavefront is cylindrical. A distant wavefront is plane. (*ii*) Each point of a wavefront acts as a source of secondary wavelets. The envelope of all wavelets at a given instant gives the position of a new wavefront.

2. Wavefront

A wavefront is defined as the locus of all the particles which are vibrating in the same phase. The perpendicular line drawn at any point on the wavefront represents the direction of propagation of the wave at that point and is called the '**ray**'.

Types of Wavefronts: The wavefronts can be of different shapes. In general, we experience three types of wavefronts.

(*i*) Spherical Wavefront: If the waves in a medium are originating from a point source, then they propagate in all directions. If we draw a spherical surface centred at point-source, then all the particles of the medium lying on that spherical surface will be in the same phase, because the disturbance starting from the source will reach all these points simultaneously. Hence in this case, the wavefront will be spherical and the rays will be the radial lines.

(ii) Cylindrical Wavefront: If the waves in a medium are originating from a line source, then they too propagate in all directions. In this case the locus of particles vibrating in the same phase will be a cylindrical surface. Hence in this case the wavefront will be cylindrical.

(iii) Plane Wavefront: At large distance from the source, the radii of spherical or cylindrical wavefront will be too large and a small part of the wavefront will appear to be plane. At infinite distance from the source, the wavefronts are always plane and the rays are parallel straight lines.

3. Coherent and Incoherent Sources of Light The sources of light emitting waves of same frequency having zero or constant initial phase difference are called coherent sources.The sources of light emitting waves with a random phase difference are called incoherent sources.For interference phenomenon, the sources must be coherent.

Methods of Producing Coherent Sources: Two independent sources can never be coherent sources. There are two broad ways of producing coherent sources for the same source.

(*i*) By division of wavefront: In this method the wavefront (which is the locus of points of same phase) is divided into two parts. The examples are Young's double slit and Fresnel's biprism.

(*ii*) By division of amplitude: In this method the amplitude of a wave is divided into two parts by successive reflections, *e.g*., Lloyd's single mirror method.

4. Interference of Light

Interference is the phenomenon of superposition of two light waves of same frequency and constantphase different travelling in same direction. The positions of maximum intensity are called maxima, while those of minimum intensity are called minima.

$\boldsymbol{x_{maxima}} = \frac{nD\lambda}{d}$ $\qquad$ $\boldsymbol{x_{minima}} = \left(n - \frac{1}{2}\right)\frac{D\lambda}{d}$

Linear Fringe width= β = $\frac{\lambda D}{d}$ $\qquad$ angular fringe width=$\frac{\beta}{D} = \frac{\lambda}{d}$

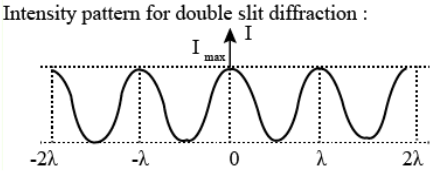
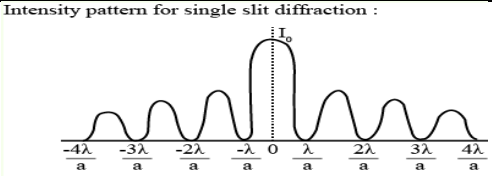
<u>Condition for sustained interference</u>

(i) The two sources of light must be coherent which means the two light waves emitted by them must have a constant phase difference or in the same phase.
(ii) The two sources must emit light of the same wavelength but the amplitudes between them should differ as little as possible. The emitted waves should be preferably of the same amplitude to get completely dark fringes.
(iii) The two sources should be very narrow. Otherwise with the increase of slit width, the coherence property will be lost. Hence, no interference pattern will be obtained.
(iv) The two sources must lie very close to each other. Otherwise overlapping of bright and dark points will hinder interference.

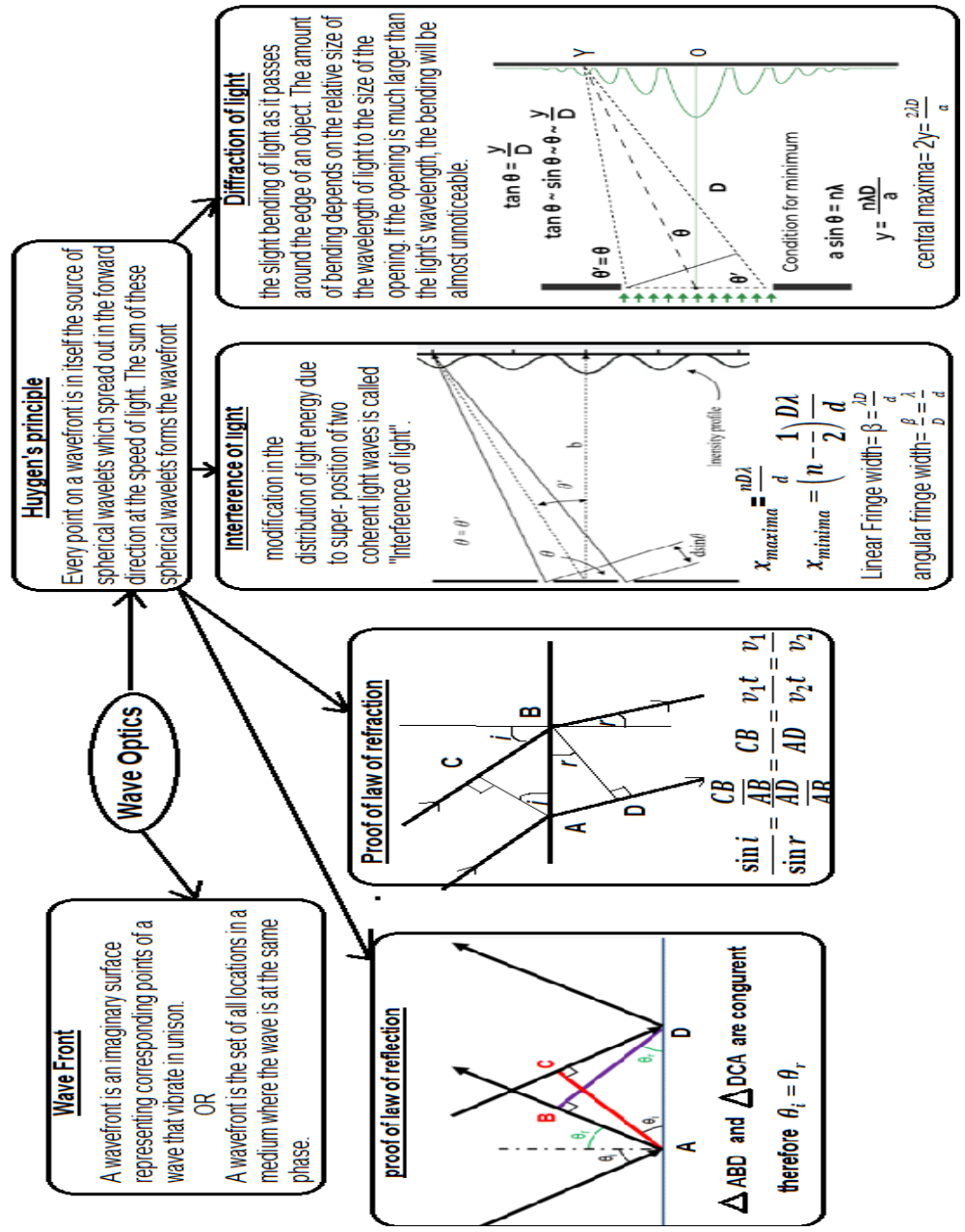
5. Diffraction of Light

The bending of light from the corner of small obstacles or apertures is called diffraction of light.

Linear central maxima= 2y= $\frac{2\lambda D}{a}$ $\qquad$ angular central maxima= $\frac{2\lambda}{a}$

Difference between Diffraction and Interference	
Interference	**Diffraction**
Interference may be defined as waves emerging from two different sources, producing different wavefronts.	Diffraction, on the other hand, can be termed as secondary waves that emerge from the different parts of the same wave.
The contrast between maxima and minima is very good.	The contrast between maxima and minima is poor.
The width of the fringes in interference is equal.	The width of the fringes is not equal in diffraction.
	

CONCEPT MAP/MIND MAP:



LEVEL 1 MCQ

1 Idea of secondary wavelets for the. propagation of a wave was first given by
(a) Newton(b) Huygens(c) Maxwell(d) Fresnel

2 Light propagates rectilinearly, due to
(a) wave nature (b) wavelengths
(c) velocity (d) frequency

3 Which of the following is correct for light diverging from a point source?
(a) The intensity decreases in proportion with the distance squared.
(b) The wavefront is parabolic.
(c) The intensity at the wavelength does not depend on the distance.
(d) None of these.

4 The refractive index of glass is 1.5 for light waves of $\lambda = 6000$ Å in vacuum. Its wavelength in glass is
(a) 2000 Å(b) 4000 Å(c) 1000 Å(d) 3000 Å

5 The phenomena which is not explained by Huygen's construction of wavefront
(a) reflection(b) diffraction(c) refraction(d) origin of spectra

LEVEL 2 MCQ

6 A laser beam is used for locating distant objects because
(a) it is monochromatic(b) it is not chromatic
(c) it is not observed(d) it has small angular spread

7 Two slits in Young's double slit experiment have widths in the ratio 81:1. The ratio of the amplitudes of light waves is
(a) 3 :1(b) 3 : 2(c) 9 :1(d) 6:1

8 When interference of light takes place
(a) energy is created in the region of maximum intensity
(b) energy is destroyed in the region of maximum intensity
(c) conservation of energy holds good and energy is redistributed
(d) conservation of energy does not hold good

9 To observe diffraction, the size of the obstacle
(a) should beX/2, where X is the wavelength.
(b) should be of the order of wavelength.
(c) has no relation to wavelength.
(d) should be much larger than the wavelength

10 What is the geometric shape of the wavefront that originates when a plane wave passes through a convex lens?
a) Converging spherical b) Diverging spherical
c) Plane d) None of the above

LEVEL 3 MCQ

11 How can the fringe width increase in Young's double-slit experiment?
a. By decreasing the width of the slit
b. By reducing the separation of slits
c. By reducing the wavelength of the slits
d. By decreasing the distance between slits and the screen

12 What is the locus of all particles in a medium vibrating in the same phase called?
a. Fringe b.Wavelet c.Wavefront d.None of the above

13 Which of the following factors does the intensity of light depend on?
a. Frequency b.Wavelength c.Amplitude d.Velocity

14 Two light sources are said to be coherent when both the sources of light emit light of
a. The same amplitude and phase
b. The same intensity and wavelength
c. The same speed
d. The same wavelength and constant phase difference

15 Which of the following is conserved when light waves interfere?
a. Intensity b. Amplitude c. Phase d. None of the above

ASSERTION AND REASON TYPE

Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

16 **Assertion :** According to Huygen's principle, no backward wave-front is possible.
Reason : Amplitude of secondary wavelet is proportional to $(1 + \cos\theta)$ where θ is the angle between the ray at the point of consideration and the direction of secondary wavelet.

17 **Assertion :** No interference pattern is detected when two coherent sources are infinitely close to each other.
Reason : The fringe width is inversely proportional to the distance between the two sources.

18 **Assertion :** It is necessary to have two waves of equal intensity to study interference pattern.

Reason : There will be an effect on clarity if the waves are of unequal intensity.

19 **Assertion :** In YDSE, if a thin film is introduced in front of the upper slit, then the fringe pattern shifts in the downward direction.
Reason : In YDSE if the slit widths are unequal, the minima will be completely dark.

20 **Assertion :** Diffraction takes place for all types of waves mechanical or non-mechanical, transverse or longitudinal.
Reason : Diffraction's effect are perceptible only if wavelength of wave is comparable to dimensions of diffracting device.

LEVEL 1 (2M QUESTIONS)

1 Write the important characteristic features by which the Interference can be distinguished from the observed diffraction pattern.

2 One of the slits of Young's double-slit experiment is covered with a semi-transparent paper so that it transmits lesser light. What will be the effect on the interference pattern?

3 A parallel beam of light of wavelength 600 nm is incident normally on a slit of width 'a'. If the distance between the slits and the screen is 0.8 m and the distance of 2nd order maximum from the centre of the screen is. 15 mm, calculate the width of the slit.

LEVEL 2 (2M QUESTIONS)

4 (i) State the principle on which the working of an optical fibre is based.
(ii) What are the necessary conditions for this phenomenon to occur?

5 Why are coherent sources necessary to produce a sustained interference pattern?

6 Write the distinguishing features between a diffraction pattern due to a single slit and the interference fringes produced in Young's double-slit experiment?

7 In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?

LEVEL 3 (2M QUESTIONS)

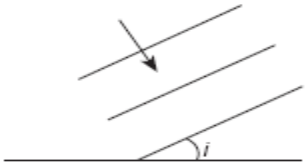
8 When a tiny circular obstacle is placed in the path of light from a distance source, a bright spot is seen at the centre of the shadow of the obstacle. Explain, why?

9 Write the conditions under which light sources can be said to be coherent.

10 Why is it necessary to have coherent sources in order to produce an interference pattern?

LEVEL-1 (3M QUESTIONS)

1 A plane wavefront propagating in a medium of refractive index μ_1 is incident on a plane surface making the angle of incidence ***i*** as shown in the figure. It enters into a medium of refractive index μ_2 ($\mu_2 > \mu_1$). Use Huygens' construction of secondary



wavelets to trace the propagation of the refracted wavefront. Hence verify Snell's law of refraction.

2 How is a wavefront defined? Using Huygen's construction draw a figure showing the propagation of a plane wave reflecting at the interface of the two media. Show that the angle of incidence is equal to the angle of reflection.

3 Why cannot two independent monochromatic sources produce sustained interference patterns? Deduce, with the help of Young's arrangement to produce interference pattern, an expression for the fringe width.

4 The intensity at the central maxima (O) in a Young's double slit experiment is I_o. If the distance OP equals one-third of the fringe width of the pattern, show that the intensity at point P would be $\frac{I_0}{4}$.

LEVEL 2 (3M QUESTIONS)

5 How is Huygen's principle used to obtain the diffraction pattern due to a single slit? Show the plot of variation of intensity with angle and state the reason for the reduction in intensity of secondary maxima compared to central maximum.

6 In a double slit interference experiment, the two coherent beams have slightly different intensities I and $I + \delta I$ ($\delta I << I$). Show that the resultant intensity at the maxima is nearly $4I$ while that at the minima is nearly $\frac{|\delta I|^2}{4I}$.

7 In a single slit diffraction pattern, how does the angular width of central maximum change , when (i) width of slit is decreased (ii)distance between Slit and screen is increased (iii) light of smaller visible wavelength is used?

8 Light of wavelength 550 nm is incident as parallel beam on a slit of width 0.1 mm. Find the angular width and the linear width of the principal maxima in the resulting diffraction pattern on a screen kept at a distance of 1.1 m from the slit, which of these width would not change if the screen were moved to a distance of 2.2 m from the slit?

LEVEL 3 (3M QUESTIONS)

9 Yellow light (λ=6000 Å) illuminates a single slit of width $1X10^{-4}$m. Calculate the distance between two dark lines on either side of central maximum when the diffraction pattern is viewed on a screen kept 1.5 m away from the slit.

10 A parallel beam of light of wavelength 600nm is incident normally on a slit of width 'a'. If the distance between the slit and the screen is 0.8m and the distance of second order maximum from the centre of the screen is15mm, calculate the width of the slit.

1. A beam of light consisting of two wavelengths 6500 Ao and 5200 Ao is used to obtain interference fringes. The distance between the slits is 2.0 mm and the distance between the plane of the slits and the screen is 120 cm.

2. Monochromatic light from a narrow slit illuminates two narrow slits 0.3 mm apart producing an interference pattern with bright fringes 1.5 mm apart on a screen 75 cm away. Find the wavelength of the light. How will the fringe width be altered if-
   i) the distance of the screen is doubled
   ii) the separation between the slits is doubled ?

11 A beam of light consisting of two wavelengths 6500 Ao and 5200 Ao is used to obtain interference fringes. The distance between the slits is 2.0 mm and the distance between the plane of the slits and the screen is 120 cm.
   a) Find position of third maxima for first wavelength.
   b) Find the minimum distance at which maxima of the two wavelength coincide.

12 Monochromatic light from a narrow slit illuminates two narrow slits 0.3 mm apart producing an interference pattern with bright fringes 1.5 mm apart on a screen 75 cm away. Find the wavelength of the light. How will the fringe width be altered if-
i) the distance of the screen is doubled
ii) the separation between the slits is doubled ?

LEVEL-1 (5M QUESTIONS)

1 (a) State Huygen's principle. Using this principle draw a diagram to show how a plane wavefront incident at the interface of the two media gets refracted when it propagates from rarer to a denser medium. Hence verify Snell's law of refraction.
(b) When monochromatic light travels from a rarer to a denser medium, explain the following, giving reasons:
(i) Is the frequency of reflected and refracted light same as the frequency of incident light?
(ii) Does the decrease in speed imply a reduction in the energy carried by light wave ?

2 (a) (i) 'Two independent monochromatic sources of light cannot produce a sustained interference pattern'. Give reason.
(ii) Light waves each of amplitude a and frequency *n*, emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by $y_1 = a \cos t$ and $y_2 = a \cos(\omega t + \phi)$, what is the phase difference between the two, obtain the expression for the resultant intensity at the point.
(b) In Young's double slit experiment, using monochromatic light of wavelength, the intensity of light at a point on the screen where path difference is, is *K* units. Find out the intensity of light at a point where path difference is $\frac{\lambda}{3}$.

3 (a) In Young's double slit experiment, describe briefly how bright and dark fringes are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width.
(b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9 : 25. Find the ratio of the widths of the two slits.

LEVEL 2 (5M QUESTIONS)

4 (a) In Young's double slit experiment, deduce the conditions for obtaining constructive and destructive interference fringes. Hence deduce the expression for the fringe width.

(b) Show that the fringe pattern on the screen is actually a superposition of single slit diffraction from each slit.

(c) What should be the width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern, for green light of wavelength 500 nm, if the separation between two slits is 1 mm?

5 (a) Using Huygen's construction of secondary wavelets explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a monochromatic beam of light is incident normally.

(b) Show that the angular width of the first diffraction fringe is half that of the central fringe.

(c) Explain why the maxima at $\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}$ become weaker and weaker with increasing *n*.

6 (a) Write three characteristic features to distinguish between the interference fringes in Young's double slit experiment and the diffraction pattern obtained due to a narrow single slit.

(b) A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. Find the width of the slit.

LEVEL 3 (5M QUESTIONS)

7 State the essential condition for diffraction of light to take place. Use Huygen's principle to explain diffraction of light due to a narrow single slit and the formation of a pattern of fringes obtained on the screen. Sketch the pattern of fringes formed due to diffraction at a single slit showing variation of intensity with angle θ.

8 Red colour of light of wavelength λ is passed from two narrow slits which are distance *d* apart and interference pattern is obtained on the screen distance *D*apart from the plane of two slits. Then find the answer to following parts assuming that slit widths are equal to produce intensity I0 from each slit.

(a) Intensity at a point on the screen, situated at a distance 1/4 th of fringe separation from centre.

(b) Intensity in the screen, if the sources become incoherent by using two different lamps behind lamps S_1 and S_2.

(c) Angular position of 10th maxima, and the angular width of that fringe.

(d) Find the distance between 5th maxima and 3rd minima, at same side of central maxima.

(e) If the phase difference between the two waves reaching two slits from the source slit is (i) 5π and (ii) 2π, then what will be the colour of central fringe?

9 A slit of width 'a' is illuminated by white light.

(a) For what value of a will the first minimum for red light of λ = 650 nm be at θ = 15°?

(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?

LEVEL -1 (NUMERICALS)

1 Two plane monochromatic waves propagating in the same direction with amplitudes A and 2A and differing in phase by $\pi/3$ superimpose. Calculate the amplitude of resulting wave.

2 Two slits are made 1mm apart and the screen is placed 1m away. What is the fringe separation when blue green light of wavelength 500nm is used?

LEVEL -2 (NUMERICALS)

1 A slit of width 'd' is illuminated by light of wavelength 5000Å. For what value of 'd' will the first maximum fall at an angle of diffraction of 30°.

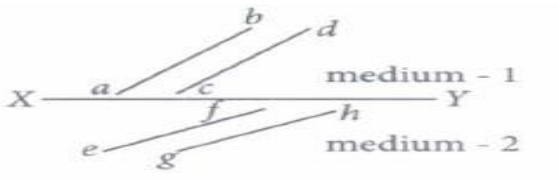
2 Two spectral lines of sodium D1 and D2 have wavelengths approximately 5890Å and 5896Å. A sodium lamp sends incident plane wave on to a slit of width 2 micrometer. A screen is located 2m from the slit. Find the spacing between the first maxima of two sodium lines as measured on the screen.

LEVEL -3 (NUMERICALS)

1 If one of the two identical slits producing interference in Young's experiment is covered with glass, so that light intensity passing through it is reduced to 50%, find the ratio of the maximum intensity of the fringes in the interference pattern.

CASE BASED QUESTIONS

1 Wavefront is a locus of points which vibrate in same phase. A ray of light is perpendicular to the wavefront. According to Huygens principle, each point of the wavefront is the source of a secondary disturbance and the wavelets connecting from these points spread out in all directions with the speed of wave. The figure shows a surface XY separating two transparent media, medium-1 and medium-2. The lines ab and cd represent wavefronts of a light wave travelling in medium- 1 and incident on XY. The lines ef and gh represent wavefronts of the light wave in medium -2 after refraction.



(i) Light travels as a

a) parallel beam in each medium
b) convergent beam in each medium
c) divergent beam in each medium

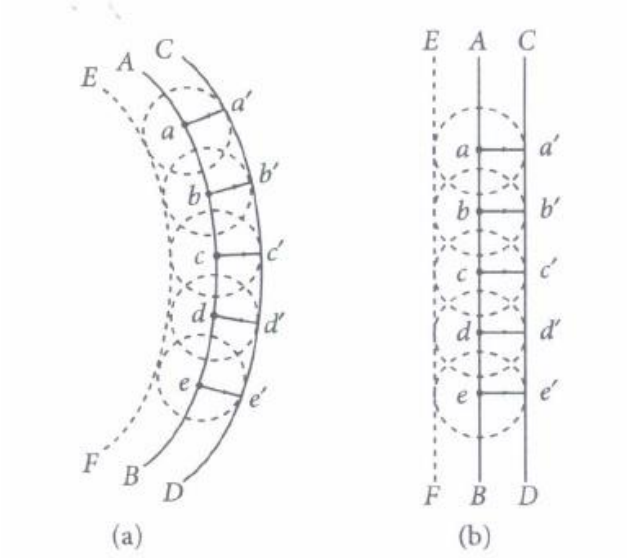
d) divergent beam in one medium and convergent beam in the other medium.

(ii) Wavefront is the locus of all points, where the particles of the medium vibrate with the same
a) phase b) amplitude c) frequency d) period

(iii) A point source that emits waves uniformly in all directions, produces wavefronts that are
a) Spherical b) elliptical c) cylindrical d) planar

(iv) What are the types of wavefronts ?
a) Spherical b) Cylinderical c) Plane d) All of these

2 Huygen's principle is the basis of wave theory of light. Each point on a wavefront acts as a fresh source of new disturbance, called secondary waves or wavelets. The secondary wavelets spread out in all directions with the speed light in the given medium.An initially parallel cylindrical beam travels in a medium of refractive index u . The intensity of the beam is decreasing with increasing radius.



(i) The initial shape of the wavefront of the beam is

(a) planar	(b) convex
(c) concave	(d) convex near the axis and concave near the periphery

(ii) According to Huygens Principle, the surface of constant phase is

(a) called an optical ray	(b) called a wave
(c) called a wavefront	(d) always linear in shape

(iii) As the beam enters the medium, it will

(a) travel as a cylindrical beam	(b) diverge
(c) converge	(d) diverge near tile axis and converge near the periphery.

(iv) Two plane wavefronts of light, one incident on a thin convex lens and another on the refracting face of a thin prism. After refraction at them, the emerging wavefronts respectively become

(a) plane wavefront and plane wavefront	(b) plane wavefront and spherical wavefront
(c) spherical wavefront and plane wavefront	(d) spherical wavefront and spherical wavefront

COMPETENCY BASED

1 In a double slit experiment, the two slits are 1mm apart and the screen is placed 1m away. A monochromatic light of wavelength 500nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single slit pattern.

CCT

1 In a double slit experiment , when light of wavelength 400nm was used, the angular width of first minimum formed on a screen placed 1m away, was found to be 0.2^{o}. What will be the angular width of first minimum if entire appratus is immersed in water ($\mu = 4/3$).

SELF ASSESSMENT		
Time allowed: 1 hour	**Max. marks: 25**	
Q.No.	**QUESTIONS**	**MARKS**
MCQ		
1	Two waves are said to be coherent if they have. (a) same phase and different amplitude (b) different frequency phase and amplitude (c) same frequency but different amplitude (d) same frequency, phase and amplitude	1
2	A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focallength 60 cm. The aperture is illuminated normally by a parallel beam of wavelength5 × 10^{-5} cm. The distance of the first dark band of the diffraction pattern from the centre of the screen is (a) 0.10 cm (b) 0.25 cm (c) 0.20 cm (d) 0.15 cm	1
3	For light diverging from a point source a) the wavefront is spherical b) the intensity decreases in proportion to the distance squared. c) the wavefront is parabolic. (d) the intensity at the wavefront does not depend on the distance.	1
4	In Young's double-slit experiment, the distance between the slit sources and the screen is 1 m. fringe width is (a) 3 mm (b) 0.3 mm (c) 6 mm (d) 0.6 nm	1
• **Question no. 5 and 6 are assertion and reason type questions.** • **Directions:** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses**.** (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion. (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion. (c) If the Assertion is correct but Reason is incorrect. (d) If both the Assertion and Reason are incorrect.		
5	**Assertion :** In Young's double slit experiment if wavelength of incident monochromatic light is just doubled, number of bright fringe on the screen will increase. **Reason :** Maximum number of bright fringe on the screen is inversely proportional to the wavelength of light used	1
6	**Assertion :** Thin film such as soap bubble or a thin layer of oil on water show beautiful colours when illuminated by white light. **Reason :** It happens due to the interference of light reflected from upper and lower face of the thin film	1

7	Name the phenomenon which is responsible for bending of light around sharp corners of an obstacle. Under what conditions does this phenomenon take place? Give one application of this phenomenon in everyday life	2
8	A parallel beam of light of 600 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1.2 m away. It is observed that the first minimum is at a distance of 3 mm from the centre of the screen. Calculate the width of the slit.	2
9	.(a) If one of two identical slits producing interference in Young's experiment is covered with glass, so that the light intensity passing through it is reduced to 50%, find the ratio of the maximum and minimum intensity of the fringe in the interference pattern. (b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light?	3
10	Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperture 2 × 10–4 m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.	3
11	**CASE BASED QUESTION** For constructive interference, the path difference is equal to integral multiple of wavelengths and resultant intensity will be maximum at that points. While for destructive interference, the path difference is (n + 1/2) multiple of wavelengths and where resultant intensity is zero. When light is passed around the sharp edges of an obstacle it get bended and may enters into the geometrical shadow of that obstacle such a phenomenon of light is called as diffraction of light. In interference, there are equally spaced alternate bright and dark bands are possible. While in diffraction, the there is a only one bright central Maxima and around both sides of the central Maxima the intensity of the light decreases as we go away from that central Maxima. **Q I.) For coherent sources of light the phase difference must be___** a) one b) zero c) either zero or constant d) 90° **Q II.) If the phase difference is 0, +2π, -4π then the interference should be** a)constructive interference b) destructive interference c) both a and b d) diffraction of light **Q III.) For destructive interference** a) path difference is (n +1/2) times wavelength b) phase difference is π, -3π, +5π c) path difference is integral multiple of wavelengths	4

	d) both a and b **Q IV.) The interference and diffraction of light explains which nature of light?**	
12	(a) In Young's double slit experiment, describe briefly how bright and dark fringes are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width. (b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9**:**25. Find the ratio of the widths of the two slits.	5

********For detailed answers refer part II of study material*********