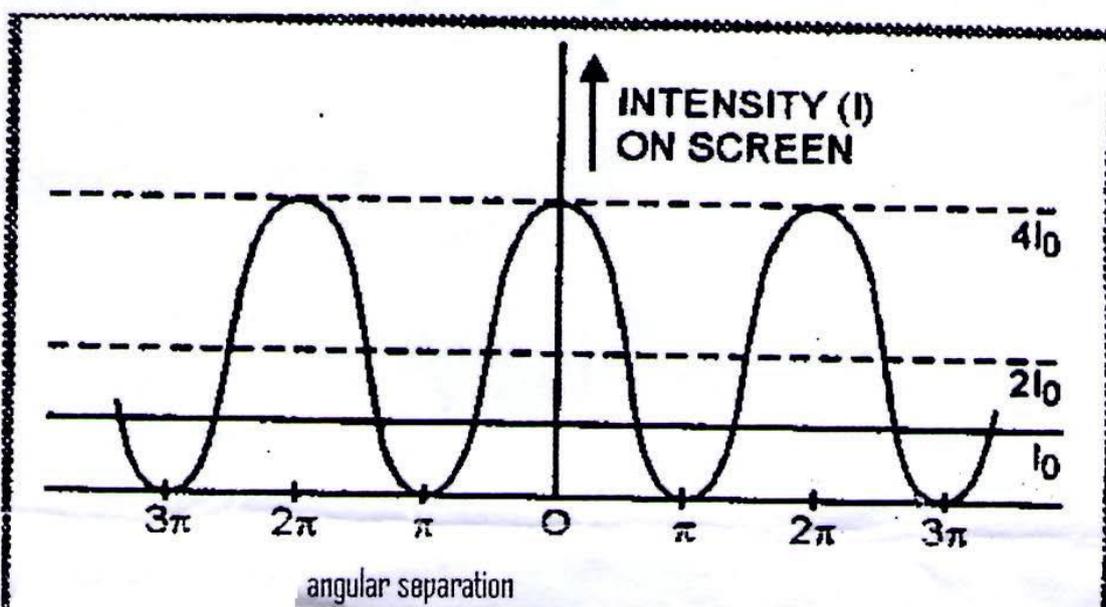


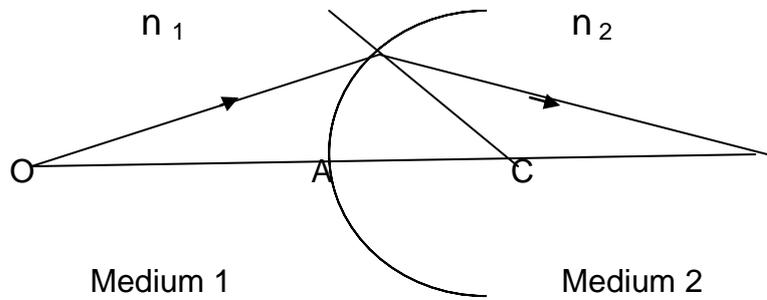
## OPTICS

1. What is the effect on the interference fringes in a young's double slit experiment due to each of the following operation:
  - (a) The screen is moved away from the plane of the slits.
  - (b) Separation between the two slit is increased.
  - (c) The monochromatic source is replaced by a source of white light. 3scores
2. (a) . Write Lens maker's formula? 1 scores  
 (b) A convex lens of refractive index  $n_2$  is immersed in a medium of ref. index  $n_1$ . In the lense convergent or divergent if  
 I)  $n_2$  greater than  $n_1$  ii)  $n_2$  less than  $n_1$  iii)  $n_2 = n_1$  3scores
3. a) Which out of blue or red light will be deviated more by a prism and why?  
 b) Obtain Lens makers formula (2)  
 c) Light passing from air in to a liquid and is deviated  $19^\circ$ , when the angle of incidents is  $52^\circ$ . Under what condition will total internal refecton occur at this interface (3)  
 d)



**What phenomenon is associated with the graph? This phenomenon is observed in one experiment. Name the experiment. If one of the slits is closed in that experiment, draw the variation in the above graph. Write any two differences between the above two phenomenon. ( $\frac{1}{2} + 1\frac{1}{2} + 2$ )**

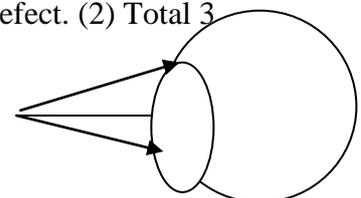
4. Simple microscope has a limited maximum magnification. For much larger magnification two lenses are used.
  - (a). Name the arrangement
  - (b). Draw the ray diagram which shows the image formation at the least distance of distinct vision.
  - (c). Using the above diagram, arrive at an expression for total magnification. (Score-1+2+2)
5. Just before sunrise the profile of a mountain becomes luminous
  - (a). Which effect is responsible for the above fact.
  - (b). What should be the order of size of obstacle to observe the above phenomenon.
  - (c) Explain diffraction at a single slit. (Score- $\frac{1}{2} + 1. \frac{1}{2} + 3$ )
6. Refraction of a ray of light at a spherical surface separating two media having refractive indices  $n_1$  and  $n_2$  is shown in the figure



- a) Which of the two medium is more denser.  
 b) In the figure show that  $n_1 / OA + n_2 / AI = n_2 - n_1 / AC$   
 c) Using the above relation arrive at the thin lens formula  
 d) An Object is placed on the principal axis of a convex lens at the distance 8cm  
 From it .Find the magnification of the image, if the focal length of the lens is 4cm (1+2+2+1)
7. In the classroom while studying optics you might have seen the pattern formed on a screen, when the narrow gap between two razor blades is illuminated by a monochromatic light. The pattern consists of a central maximum and a few secondary maxima and minima on either sides.  
 a. Name the phenomenon due to which the pattern is formed  
 b. Derive an equation for the width of central maximum of above pattern  
 c. What happens to the width of central maximum if the frequency of the light used is increased  
 d. What happens to the width of central maximum when the distance between the blade and the screen is increased ? Justify your answer(1+2+1+1)
8. The focal length of a lens is given by ,  $1/f = ( n_2 / n_1 - 1 ) ( 1/R_1 - 1/R_2 )$   
 a. Write down the factors on which focal length of a lens depends. (1 mark)  
 b. Arrive at the above expression for a thin lens. (2 marks)  
 c. With the help of above formula show that the focal length of a lens changes when it is dipped in a liquid. (2)
9. a. Sketch the pattern of diffraction produced by a single slit and explain. (2 marks)  
 b. Explain the effect of increasing and decreasing the width of slit. (2marks)  
 c. Give the suggestions for improving the resolving power of a microscope. (1mark)
10. . According to Hygen's wave theory the locus of points oscillating in phase are at same distance from the source.  
 (a) Name such a surface (1/2)  
 (b) Explain Snell's law on the basis of wave theory. (2 1/2)  
 (c) When a wave gets refracted into a denser medium which of the given below remains the same.  
 (i) wavelength (ii) speed (iii) frequency (1) Total score: 4
11. Refraction of a convex lense obeys the equation

$$n_2/v - n_1/u = \frac{n_2 - n_1}{R}$$

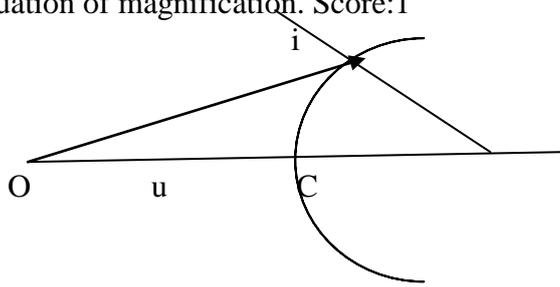
- (a) Draw the ray diagram of the above refraction (1 1/2)  
 (b) Then arrive the expression of lense maker's formula (2 1/2) Total score: 4  
 OR  
 When light fall on a prism refraction occurs.  
 (a) Obtain an expression for deviation produced in prism refraction. (2)  
 (b) How is the deviation affected in the above arrangement is immersed in a liquid of refractive index less than that of the device? (1) Total score: 4
12. Ramu is not able to read clearly the writing on the black board while he sitting in classroom.  
 (a) Name the type of defect. (1)  
 (b) How it can be corrected? Complete the diagram after correcting the defect. (2) Total 3



13. The watch makers make use of a lens to have a magnified view of the small parts of the watch.

- Which type lens is used for this. Score:½
- Name the instrument. Score:½
- Draw the ray diagram of its image formation. Score:1
- Write the equation of magnification. Score:1

OR

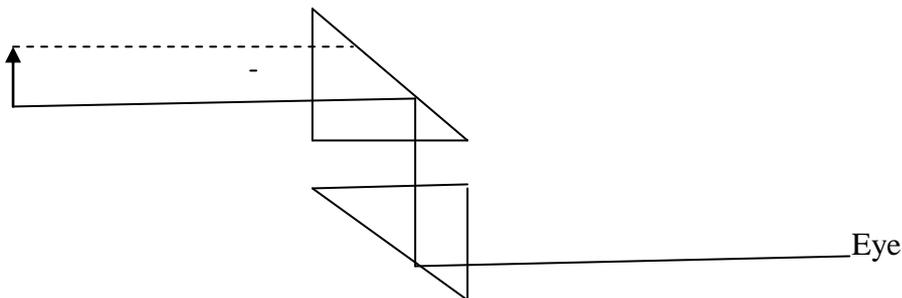


- Complete the ray diagram to locate the position of the image. Score:1
- Obtain the expression  $n_2/v - n_1/u = n_2 - n_1/R$  Score:2

14. In Young's double slit experiment with monochromatic light sources

- If one of the slit is closed what will be the observation. Score:1
- What happens to the bandwidth, if the experimental arrangement is immersed in water, explain. Score:1
- What happens to the bandwidth, if the distance between the slits is halved? Explain. Score:1
- Arrive at an expression for bandwidth. Score:2

15. A boy is trying to observe a candle-using prism.



Is the image erect or inverted? Mention the principle behind it. Score:1

16. Interference of light is observable if the light from two coherent sources overlap over a region

- What are coherent source?
- How do you produce two coherent sources?
- Two independent sources are not coherent why? [ 1 +1 +2]

17 A coin is kept at the bottom of a tank filled with water.

- Show by a diagram the refraction of light coming from the coin.-2
- How can you calculate the refractive index of water using the diagram? -2
- On the basis of the above answer, explain why a fisherman aims at the tail of a fish during spear fishing. 2

18. A man who wears glasses of power 3D must hold a news paper at least 25cm away to see the print clearly. How far away would the news paper have to be if he took off the glasses and still wanted clear vision 2scores

19. When a monochromatic light incident on a prism, Write the relation between refractive index, angle of the prism and angle of minimum deviation . prove it . Draw the I – d curve. 5 scores

20. Calculate the magnifying power of a lens of power 20 D. Draw the Ray diagram of the image formation in compound microscope 3scores.

21. Consider the refraction in a glass prism.

- Obtain a relation for the deviation of a ray of light. (2)
- Obtain a relation for the refraction angle of the prism (1)

(c) Prove the relation  $n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$  (2)

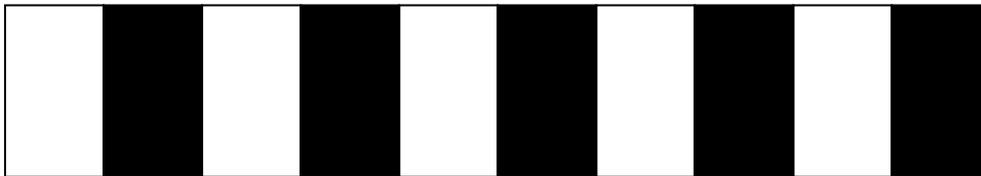
OR

- (a) Name the telescope used for viewing distant objects on the surface of the earth. (½)  
 (b) How many lenses are used in the telescope? (½)  
 (c) Draw a ray diagram and obtain an equation for the magnifying power of this telescope. (3)  
 (d) What is the total length of the telescope? (1)
21. (a) Assuming the formula for refraction at a spherical surface deduce the lens making formula. (3)  
 (b) An illuminated wire gauze is kept at a distance of 10 cm from a convex lens. A magnified image is obtained on a screen kept at a distance of 30 cm from the lens. Find the focal length of the convex lens. (2)
22. a. State Brewster's Law (1)  
 b. Using Young's Double slit experiment derive an expression for bandwidth. (3)  
 c. What happens to the Bandwidth of interferences pattern when the whole arrangement is immersed in water? Why? (2)
23. Show that focal length of a lens depends on radii of curvature and refractive indices. (3)
24. To a fish under water viewing oblique, does a person standing on the bank appear taller or shorter than his actual height? Illustrate it using a ray diagram.
25. Young's double slit experiment demonstrates the interference of light.  
 (a) Give the conditions to be satisfied for getting sustained interference pattern. (1)  
 (b) Obtain the conditions for maxima and minima. (2)  
 (c) What change would you expect in the fringe width if whole of the apparatus of Young's double slit experiment is immersed in water? Justify. (2)

OR

Diffraction at a single slit is an example of Fraunhofer diffraction.

- (a) State the difference between Fresnel's diffraction and Fraunhofer diffraction. (1)  
 (b) Obtain the conditions for maxima and minima. (2)  
 (c) Among the following which one undergo maximum diffraction radio waves, gamma rays, visible light. Justify your answer. (2)
26. The photograph given below is obtained by passing a LASER beam on a plain of closely spaced slits.



- (a) Identify this pattern. (1)  
 (b) In the double slit experiment using wavelength 5461 Å, the fringe width measured is 0.15 mm. By keeping the same arrangement the fringe width measured for an unknown wave length is 0.12 mm. Find the unknown wavelength.
27. Light travels from one medium to another, which one of the following

remains constant.

(1)

- a. Frequency b) Velocity c) wavelength d) None of the above.  
 b. Monochromatic light of wave length 589nm is incident from air on a water surface. What is the speed of refracted light? ( $n = 1.33$ ) (2)

28.

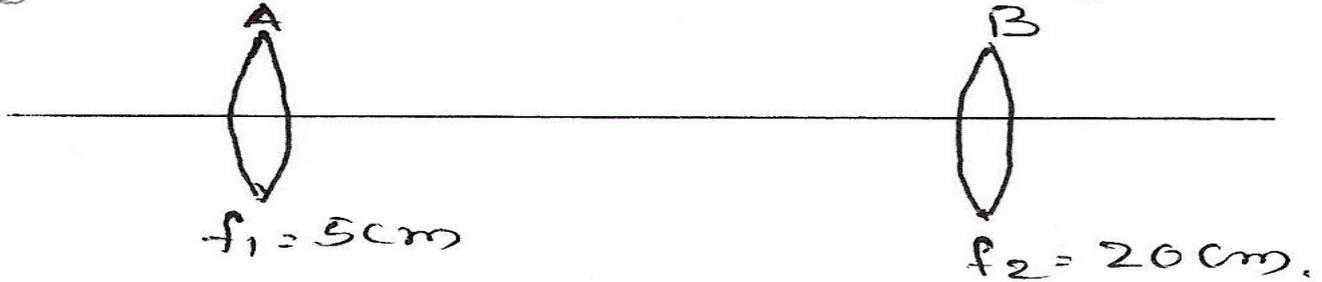
for a convex spherical refracting surface when the object is in rarer medium, the formula for refraction is  $\frac{n_1}{u} + \frac{n_2}{v} = \frac{n_2 - n_1}{R}$

a. Name the law which satisfies during refraction

b. Draw the ray diagram and deduce relation between object distance (u) image distance (v) and focal length (f) for a thin convex lens. (1)

29.

Figure shows two lenses used in Telescope.

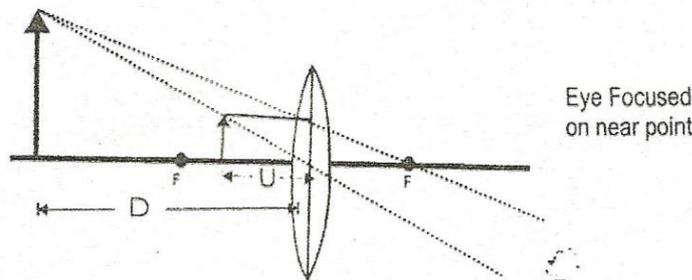


a. Which one of the two lenses you will select to use the objective lens on astronomical telescope. (1)

b. Draw a ray diagram for a refracting telescope and obtain an expression for magnifying power when it is used in Near point adjustment. (3)

30.

Figure below shows the image observed at the near point of eye by a boy through a simple microscope.



a) Draw a ray diagram which shows the image formation at infinity, so that the boy can observe it with a relaxed eye. score : 3

b) Distinguish between linear magnification and angular magnification. score : 2

31.

Can a beam of light passing through a hollow prism produce good spectrum? score : 2

32.

Two lenses of focal length 5 cm and 20 cm are given :

- a) Which of the two lenses will you select to use as the objective lens in astronomical telescope. score : 1
- b) Draw the ray diagram for a refracting telescope and obtain an expression for magnifying power when it is used in Near point adjustment. score : 3
- c) Can you convert a microscope into telescope by interchanging its objective and eyepiece. Comment . score : 1

33. (A) Consider the refraction in a glass prism

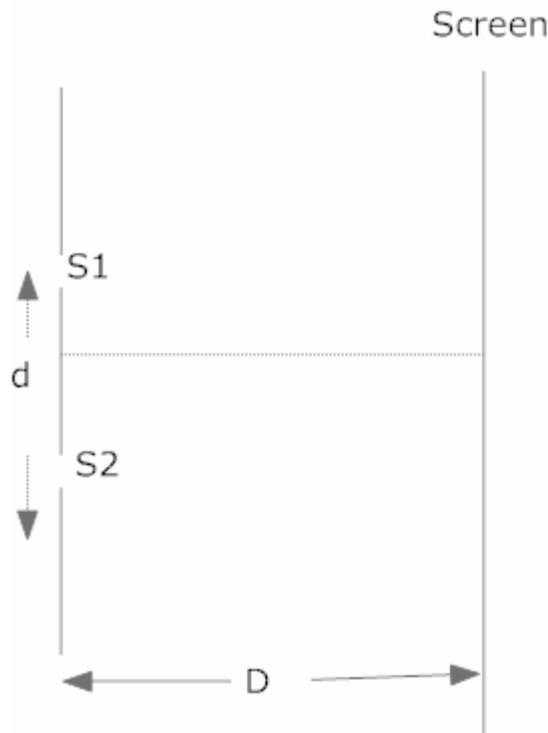
- a) Obtain a relation for the deviation of a ray of light
- b) Prove the relation  $n = \frac{\sin \left( \frac{A+D}{2} \right)}{\sin \left( \frac{A}{2} \right)}$
- c) Show that for a small angled prism  $d = (n-1) A$  (1)

**OR**

(B)

- a) Name the telescope used for viewing distant objects on the surface of the earth (1)
- b) How many lenses are used in the telescope (1)
- c) Draw the ray diagram and obtain an equation for the magnifying power of this telescope (3)
34. a) Assuming the formula for refraction at a spherical surface deduce the lens makers formula (3)
- b) An illuminated wire gauze is kept at a distance of 10cm from a convex lens. A magnified image is obtained on a screen kept at a distance of 30 cm from the lens. Find the total length of the convex lens. (2)

35.

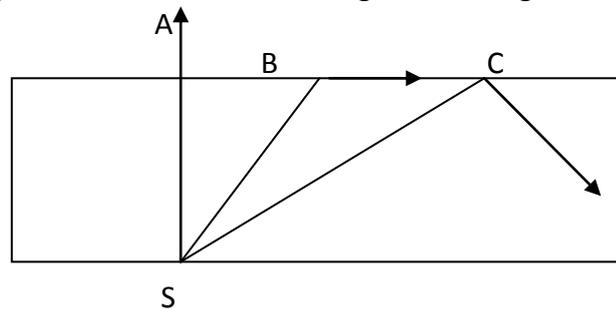


Identify the experimental arrangement .Interference pattern is obtained on the screen.

What changes will occur if we change the following parameters.

- a)If the screen is moved away from the slits.
- b)If the slit separation (d) is increased.
- c) If the monochromatic source is replaced by white light. (1 ½)
- d)write any two difference between interference and diffraction. (2)
36. Right angled isosceles glass prisms are used as reflectors of light in optical instruments.
- a) With the help of a neat diagram show how the image is turned to 180° in a reversing prism. (2)

- b) The critical angle of glass is  $42^\circ$ . The velocity of light in glass is \_\_\_\_ (1)
37. Rainbow is a beautiful example of the production of solar spectrum in nature.
- How are rainbows formed? (2)
  - For which colour the refractive index of a prism is i) maximum ii) minimum (1)
38. A point object at a distance of 36cm from a convex lens of focal length 10cm, is moved by 10cm in 2 sec along principal axis towards the lens. Then image will also change its position.
- Write the law which relates object and image distance from the lens. (1)
  - Find the initial and final position of the image distance from the lens. (2)
  - A man argues that the image will move uniformly at the same speed as that of object. What is your opinion? Justify. (2)
39. In Young's double slit experiment two slits are illuminated by red monochromatic light source
- If one of the slits is closed what will be the observation on the screen? (1)
  - Arrive at an expression for band width of interference fringes when both the slits are open (3)
  - What happens with the bandwidth if the experimental arrangement is immersed in water (1)
40. Figure shows a source of light S placed at the bottom of a tank containing water.



- Which of the rays A, B, C undergo refraction?
  - What is the critical angle of the medium?
  - Name the phenomenon shown by C.
  - State the conditions necessary for the above phenomenon. ( $\frac{1}{2} + 1 + 1 + 2 = 4\frac{1}{2}$  scores)
41. Diffraction of light by a single slit is noticed in the lab.
- What does this phenomenon throw on the nature of light?
  - Explain the formation of bands due to diffraction.
  - Give the variation of intensity distribution of single slit diffraction pattern. ( $1 + 2\frac{1}{2} + 1\frac{1}{2} = 5$  scores)
42. a) A glass slab is placed on letters of different colours. Which colour appear more raised up. Explain  
 b) Why does smoked ball appear silvery white when dipped in water? 2+2
43. A point object at a distance of 36cm from a convex lens of focal length 10cm is moved 10cm in 2s along the principal axis towards the lens. The image will also change its position
- Write the law which relates object and image distances
  - Find the initial and final positions of the image, also calculate the average speed of the image
  - A man argues that the image will move uniformly at the same speed as that of the object. What is your opinion? Justify your answer. 1+2+2
44. (a) State and define S.I unit of power of lens? ( 1 ½)  
 (b) What are the conditions under which total internal reflections take place? (1)  
 (c) Explain with a diagram, How optical fiber transmit signals? ( 2 )
- 45 (a) State the conditions for sustained interference pattern? (1½)  
 (b) Derive an expression for fringe width using Young's double slit method for interference of light?  
 (3) (c) What is the effect on the interference pattern ? (1)
- OR**
13. (a) Draw ray diagram showing image formation in a compound microscope (2)  
 (b) Hence derive the equation for its magnifying power? (2)  
 (c) A ray of light incident at  $49^\circ$  on the face of an equilateral prism passes symmetrically. Calculate refractive index of the material of the prism. (1 ½)
46. The superposition of light waves is known as interference.
- Write the relation between path difference and phase difference. 1/2
  - Derive an expression for bandwidth(B) of interference pattern in Young's double slit experiment 2

c Write the difference between interference and diffraction 2

47. Microscope is to obtain large image of an object.

a. Draw the figure which shows the image formation in a compound microscope. 11/2

b. Derive an expression for magnifying power of compound microscope 2

48. Polarisation suggests that light waves are transverse in nature

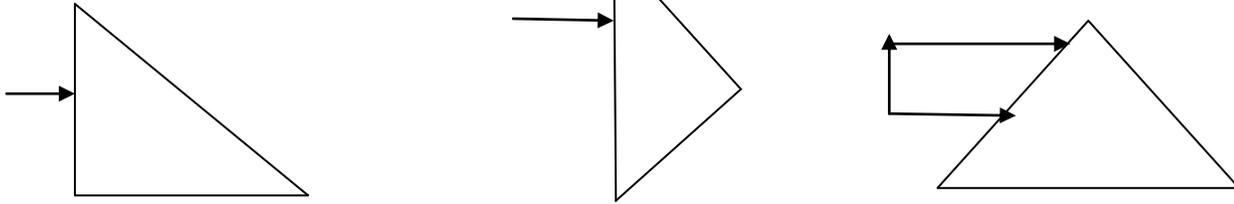
a. What is polarisation ? 1/2

b. State Brewster's law. 1/2

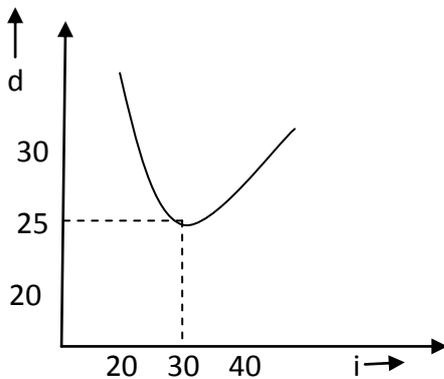
c. Show that the reflected and refracted rays are perpendicular to each other 1

49. (a) When a ray of light incident on a reflecting surface at an  $30^\circ$  what will be the angle of reflection?

(b) Complete the ray diagram



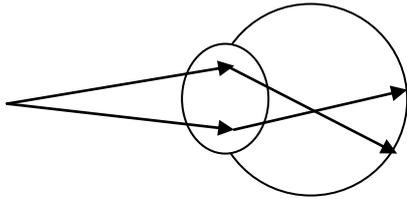
50. Find the angle of minimum deviation and angle of prism from the graph



51. Draw the intensity distribution curve for double slit experiment?

What happens to this curve if one slit is closed?

52. The ray diagram of the image formed on the retina is shown in the figure.



a.) Which defect of eye is shown in the figure? [score 1]

b.) How will you correct it ? [score 1]

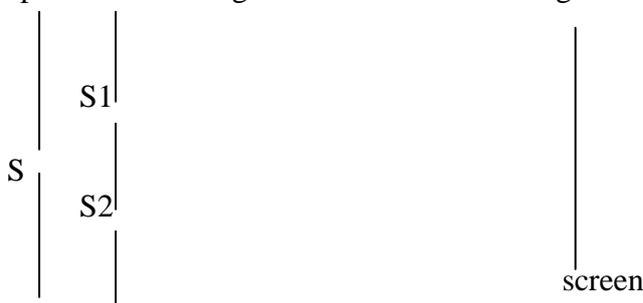
c.) Draw the ray diagram for the refraction through prism [score 1]

d.) What is the condition for minimum deviation ? [score 1/2]

e.) Arrive at the relation connecting refractive index 'n', angle of the prism 'A' and minimum deviation D [score 1 1/2]

f.) Plot the  $i - d$  curve [score 1]

53. An experimental arrangement is shown in the figure



- a.) Name the experiment [score ½]
- b.) What is the nature of S1 and S2? [Score ½]
- c.) What is the condition for bright band? [Score 1]
- d.) complete the diagram and obtain the expression  $\beta = \frac{D \lambda}{d}$  [score 2]

54. a) Derive lens makers formula. (2)

b) Write the lens makers formula for a plano convex lens. (1)

c) What is the power of a lens of focal length of -20 cm, will it a converging or diverging lens. (1)

55. You may be observed that the fish inside an aquarium appears to be raised.

a) What is the reason for this phenomenon ? ( ½ )

b) Obtain an expression for apparent shift of fish. (1 ½ )

c) What happens to the height of the object vertically stands in the aquarium when it is observed by the fish. Justify your answer. (1 ½ )

56. In interference pattern alternate dark and bright bands can be seen

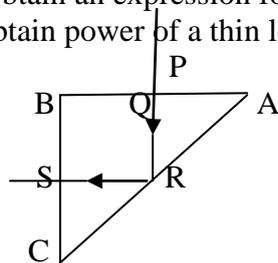
(a) Obtain an expression for band width of the interference pattern

(b) Obtain band width in terms of refractive index if the arrangement is immersed in water (3+2=5)

57. (a) Obtain an expression for U, V & R for a spherical surface.

(b) Obtain power of a thin lens (3+2=5)

58.



ABC is the section of a prism. Angle B is right angled.  $\angle A = \angle C = 45^\circ$ . A ray of light PQ is incident normally on the face AB. The refracted ray QR strikes the face AC at angle of incidence  $45^\circ$ .

a) The ray QR does not undergo refraction at the face AC but emerges through the face BC as shown. What is the phenomenon called? [1]

(b) In the above case what is the minimum value of refractive index of the material of the prism for the above phenomenon to occur? [1]

59. Thomas Young successfully conducted the double slit experiment and explained interference pattern using Huygens's theory.

(a) What are coherent sources? [1]

(b) Obtain an expression for Band width. [2]

60. There is a relation connecting refractive indices and radii of curvature of the surfaces of a lens

(a) Derive lens makers formula. [2]

(b) Name the law which related to refraction. [1]

61. (a) Draw the ray diagram of a compound microscope. [2]

(b) With the help of a diagram explain primary rainbow. [1]

62. Using Huygen's principle prove law of reflection. [2]

63.a) Calculate the impedance of the LCR circuit? (2)

b). What is the condition of resonance in an LCR Circuit. Give an expression for resonant frequency (2)

c). Calculate power of an AC circuit if it is purely resistive and purely inductive (2)

64. Derive an expression for refractive index of the material of the prism using suitable diagram. (3)

65. How is primary rainbow differ from secondary rainbow (2)

66. A magician during a show makes a glass lens with  $n = 1.47$  disappear in a trough of liquid. What is the refractive index of the liquid? Could the liquid be water? (1)

67. The condition for maximum or minimum intensity depends on path difference or phase difference. Give the conditions for brightness and darkness(constructive and destructive interference) (2)

68. What is optical path difference? Obtain an expression for it.Hence derive an expression for bandwidth (2)

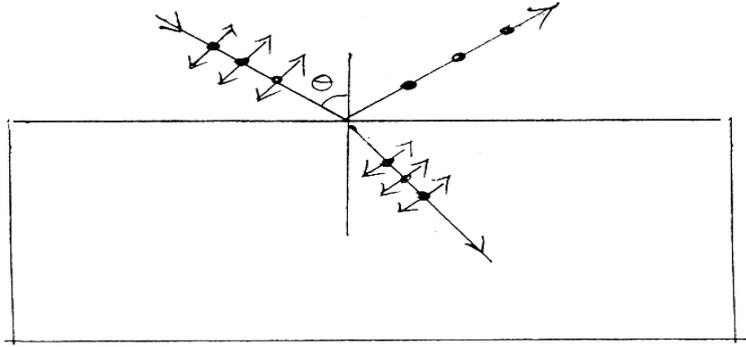
69. Draw the ray diagram of a compound microscope (2)

70. Derive lens makers formula for a thin lens? Hence derive law of distances of a lens (5)

71. What is linear magnification. Give an expression for it (1). State and explain law of malus (2)

72. The figure represents a light ray after reflection is polarized. To get maximum polarization the angle made is

$57.5^\circ$ .



a). This angle is called \_\_\_\_\_

b). Calculate  $\tan 57.5^\circ$  and compare the result with refractive index of glass.

c). State the law connecting refractive index and angle of incidence at maximum polarization (1+2+2=5)

73. (a) Name the phenomenon of light which illustrates its transverse wave nature.

(b) Which law gives the relation between polarizing angle and refractive index of a medium. Derive the relation.

(c) What is the angle between the reflected ray and refracted ray. [1+3+1]

74. Some observations are given in column A and important phenomena of light in column B. Relate them.

A	B
a. colour of rainbow	Interference of light
b. blue colour of sky	Diffraction of light
c. colour on soap film	Scattering of light
d. colour on compact disc	Dispersion of light

(score 4)

75. a) The interference pattern obtained using two monochromatic coherent sources are bright and dark bands of equal width. What will be the nature of the pattern if we use white light coherent sources?

b) In Young's double slit experiment, two slits are placed 0.1 mm away from each other. A screen is placed 1 m away from the slits. It is found that the distance between the central bright fringe and the third bright fringe is 1.2 cm. What is the wavelength of light used in the experiment?

[1 + 11/2 ]