12-12-15_Sr.IPLCO_Jee-Main_RPTM-14_ Syllabus

MATHS:

Complete Properties of Triangles and Inverse Trigonometric Functions

PHYSICS

Geometrical & Wave Optics

Experiments:

1. Focal length of (i) Convex mirror

(ii) Concave mirror, and (iii) convex lens using parallax method.

2. Plot of angle of deviation vs angle of incidence for a triangular prism.

3. Refractive index of a glass slab using a travelling microscope.

CHEMISTRY

States of Matter, Solid State, Chemical Kinetics

PHYSICS

1. In an experiment, with the position of the object fixed, a student varies the position of a convex lens and for each position, the screen is adjusted to get a clear image of the object. A graph between the object distance u and the image distance v, from the lens, is plotted using the same scale for the axes. A straight line passing through the origin and making an angle of 45^0 with the x-axis meets the experimental curve at P. The coordinates of P will be

1) $\left(\frac{f}{2},\frac{f}{2}\right)$ 2) (f,f) 3) (4f, 4f) 4) (2f,2f)

2. A thin prism p_1 with angle 4^0 made of glass of refractive index 1.54 is combined with another thin prism p_2 made of glass of refractive index 1.72 to produce no deviation. The angle of prism p_2 is

1) 3^0 2) 2.6^0 3) 4^0 4) 5.33^0

3. The power of lens having refractive index 1.25 is +3 diopters. when placed in a liquid its power is -2 diopters. The refractive index of the liquid is:

1) 1.2 2) 1.4 3) 1.5 4) 1.6

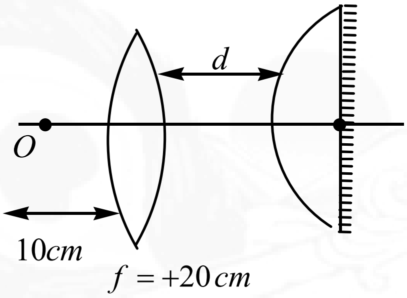
4. A tank is filled with water to a height of 12.5 cm. The apparent depth of a needle lying at the bottom of the tank is measured by a microscope to be 9.4 cm. What is the refractive index of water? If water is replaced by a liquid of refractive index 1.63 up to the same height, by what distance would the microscope have to be moved to focus on the needle again?

1) 1.73 m, 1.33 2) 1.33, 1.73 m 3) 1.33, 1.73 cm 4) 1.73 cm, 1.33

5. An object 2.4m in front of a lens forms a sharp image on a film 12cm behind the lens. A glass plate 1cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object be shifted to be in sharp focus on film?

1) 7.2m 2) 2.4 m 3) 3.2 cm 4) 5.6m

6. A convex lens of focal length 20cm and another plano-convex lens of focal length 40cm are placed coaxially (see figure). The plano convex lens is slivered on plane surface. What should be the distance d (in cm) so that final image of the object 'O' is formed on 'O' itself



1) 10 2) 15 3) 20 4) 25

7. An object is placed at a distance of 12cm from a converging lens on its principal axis. A virtual image of certain size is formed. Now the lens is moved 4cm away from the object and a real image of the same size as that of the virtual image is formed. The focal length in cm of the lens is:

1) 14 2) 16 3) 18 4) 20

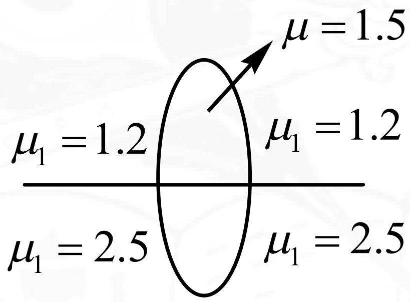
8. The two surfaces of a biconvex lens has same radii of curvatures. This lens is made of glass of refractive index 1.5 and has a focal length 10cm in air. The lens is cut into two equal halves along a plane perpendicular to its principal axis to yield two plano-convex lenses. The two pieces are glued such that the convex surfaces touch each other. If this combination lens is immersed in water of refractive index 4/3 its focal length (in cm) is

1) 5 2) 10 3) 20 4) 40

9. A screen is placed 90 cm from an object. The image of the object on the screen is formed by a convex lens at two different locations separated by 20 cm. Determine the focal length of the lens.

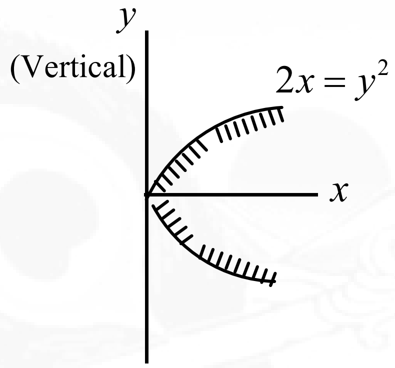
1) 21.4 cm 2) 21.4 m 3) 20 m 4) 2m

10. A thin lens of material having refractive index $\mu = 1.5$ and focal length of 20cm when placed in air is taken and two mediums of different refractive indices $\mu_1 = 1.2$ and $\mu_2 = 2.5$ are there covering upper and lower halves of the lens, respectively as shown in figure. If an object is placed on the principal axis, then its two images will form one after refraction from upper part and other after refraction from lower part . Consider the object to be at ∞, the separation between two images formed would be



1) 15cm 2) 40cm 3) 25cm 4) 65cm

11. The reflecting surface represented by the equation $2x = y^2$ as shown in the figure. A ray travelling horizontal becomes vertical after reflection. The co-ordinates of the point of the incidences can be



1) $(1/2,1)$ 2) $(1,1/2)$ 3) $(1/2,1/2)$ 4) $(1/2,\pm 1)$

12. A 2cm diameter coin rests flat on the bottom of a bowl in which the water is 20cm deep $\left(\mu_w = \frac{4}{3}\right)$. If the coin is viewed directly from above what is the apparent diameter

1) 2cm 2) 1.5cm 3) 2.67cm 4) 1.69cm

13. A ray incident at a point at an angle of incidences of 60^0 enters a glass sphere of $\mu = \sqrt{3}$ and is reflected and refracted at the farther surface of the sphere. the angle between the reflected and refracted rays at this surface is:

1) 50^0 2) 90^0 3) 60^0 4) 40^0

14. A driver looking up through the water in a lake sees the outside world contained in a circular horizon. If the refractive index of water is (4/3) and the eye of the diver is situated 12cm below the surface, then what is the radius of the horizontal circle (In cm)?

1) $12\times3\times\sqrt{5}$ 2) $12\times(4/3)$ 3) $12\times(3/\sqrt{7})$ 4) $12\times\sqrt{7}\times3$

15. If the source of light used in a Young's double slit experiment is changed from red to blue, then which of the following statement is correct.

1) the fringes will become brighter

2) consecutive fringes will be closer

3) the number of maximas formed on the screen decreases

4) the central bright fringe will become a dark fringe

16. Two coherent monochromatic light beams of intensities I and $4I$ are superposed. The maximum and minimum possible intensities in the resulting beam are:

1) $5I$ and I 2) $5I$ and $3I$ 3) $9I$ and I 4) $9I$ and $3I$

17. A thin sheet of a transparent material $(\mu = 1.6)$ is placed in the path of one of the interfering beams in a YDSE using sodium light $\lambda = 5890\,A^0$. The central fringe shifts to a position originally occupied by the 12^{th} bright fringe. The thickness of the sheet is

1) $0.98\,\mu m$ 2) $11.78\,\mu m$ 3) $20\,\mu m$ 4) $15.68\,\mu m$

18. In Young's double slit experiment $\frac{d}{D} = 10^{-4}$ (d = distance between slits, D = distance of screen from the slits). At a point P on the screen resulting intensity is equal to the intensity due to individual slit I_0. Then minimum distance of point P from the central maximum is: $\left(\lambda = 6000\,\overset{0}{A}\right)$

1) 2 mm 2) 1 mm 3) 0.5 mm 4) 4 mm

19. In Young's double slit experiment, the light rays from the two coherent sources S_1 & S_2 having an initial phase difference of $\frac{\pi}{6}$ reach a point P on the screen. If $S_1P - S_2P = \lambda / 4$, then the intensity at the point P may be (I is the maximum intensity on the screen)

1) 0 2) 3I/4 3) I/8 4) I/2

20. Two identical coherent sources placed on a diameter of a circle of radius R at separation $x = 5\lambda (<< R)$ symmetrically about the centre of the circle. The sources emit identical wavelength λ each. The number of points on the circle with maximum intensity is :

1) 20 2) 22 3) 24 4) 26

21. 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:

1) the intensities of both the maxima and the minima increase

2) the intensity of the maxima increases and the minima has zero intensity

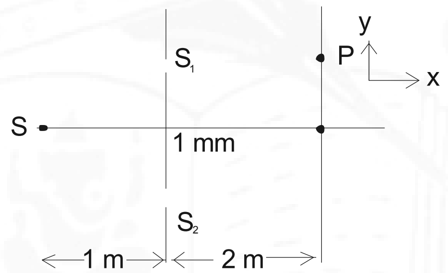
3) the intensity of maxima decreases and that of minima increase

4) the intensity of maxima decreases and the minima has zero intensity

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

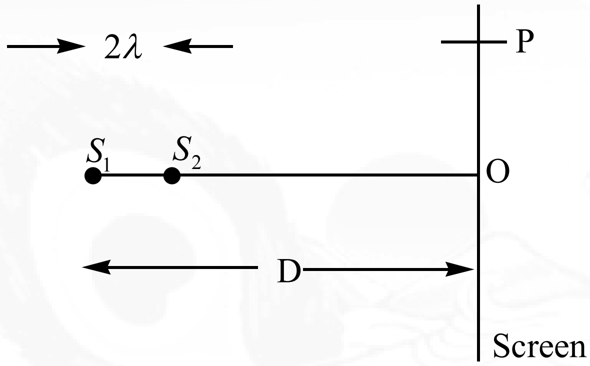
1) $2I$ 2) $4I$ 3) $5I$ 4) $7I$

23. In a Young's double slit experiment set up, source S of wavelength 500 nm illuminates two slits S_1 and S_2 which act as two coherent sources. The source S oscillates about its own position according to the equation $y = 0.5\sin\pi t$ where y is in mm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exactly in front of the upper slit becomes minimum is



1) 1s 2) 2s 3) 3s 4) 1.5s

24. Two sources S_1 *and* S_2 emitting coherent light waves of wavelength λ in the same phase are situated as shown. The minimum distance OP, so that the light intensity detected at P is equal to that at O is(D>>λ)

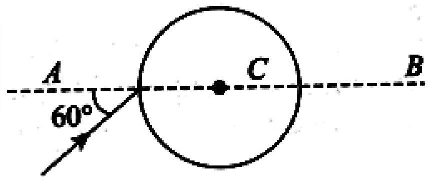


1) $D\sqrt{2}$ 2) $D/2$ 3) $D\sqrt{3}$ 4) $D/\sqrt{3}$

25. In Young's double slit experiment, the screen is at a distance D from the plane of the slits which are illuminated by plane monochromatic light of wavelength λ. P is a point on the screen at a distance y from the central maximum. If, by some special arrangement, the slits be moved symmetrically apart with a relative velocity v with in their plane and perpendicular to their lengths, the number of fringes crossing the point P per unit time is

1) $\frac{2yv}{\lambda D}$ 2) $\frac{y\lambda}{vD}$ 3) $\frac{yv}{2\lambda D}$ 4) $\frac{yv}{\lambda D}$

26. A ray of light falls on a transparent sphere with centre at C as shown in Fig. The ray emerges from the sphere parallel to line AB. The refractive index of the sphere is



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

27. A mark on the surface of a glass sphere $(\mu = 1.5)$ is viewed from a diametrically opposite position. If appears to be at a distance 10 cm from its actual position. The radius of the sphere is

1) 5 cm 2) 10 cm 3) 15 cm 4) 25 cm

28. A small candles 2.5 cm in size is placed at 27 cm in front of a concave mirror of radius of curvature 36 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image, and the nature and size of image is

1) 54 cm, erect magnified 5cm 2) 54 cm, real inverted magnified 5cm

3) 5 cm erect magnified 54 cm 4) 54 cm, real inverted diminished 4 cm

29. In the visible region, the dispersive powers and the mean angular deviations for crown and flint glass prisms are ω and ω^1 and d and d^1 respectively. When the two prism are combined, the condition of zero angular dispersion by the combination is

1) $\sqrt{\omega d} + \sqrt{\omega' d'} = 0$ 2) $\omega' d + \omega d' = 0$

3) $\omega d + \omega' d' = 0$ 4) $(\omega d)^2 + (\omega' d')^2 = 0$

30. A double convex lens forms a real image of an object on a screen which is fixed. Now the lens is given a constant velocity 1 m/s along its axis and away from the screen. For the purpose of forming a sharp image always on the screen, the object is also required to be given an appropriate velocity. The speed of the object at the instant the size of the image is half the size of the object.

1) 1 m/s 2) 2 m/s 3) 3 m/s 4) 4 m/s