IIT-JEE-2012-P2-Model

Time:2:00 PM to 5:00 PM **IMPORTANT INSTRUCTIONS** **Max Marks: 198**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Single Correct Choice	3	-1	8	24
Sec – II(Q.N : 9 – 14)	Questions with Comprehension Type (3 Comprehensions : 2+2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 15 – 20)	Questions with Multiple Correct Choice	4	0	6	24
Total				**20**	**66**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 28)	Questions with Single Correct Choice	3	-1	8	24
Sec – II(Q.N : 29 – 34)	Questions with Comprehension Type (2 Comprehensions : 3+3 = 6Q)	3	-1	6	18
Sec – III(Q.N : 35 – 40)	Questions with Multiple Correct Choice	4	0	6	24
Total				**20**	**66**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : (41 – 48)	Questions with Single Correct Choice	3	-1	8	24
Sec – II(Q.N : (49 – 54)	Questions with Comprehension Type (3 Comprehensions : 2+2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 55 – 60)	Questions with Multiple Correct Choice	4	0	6	24
Total				**20**	**66**

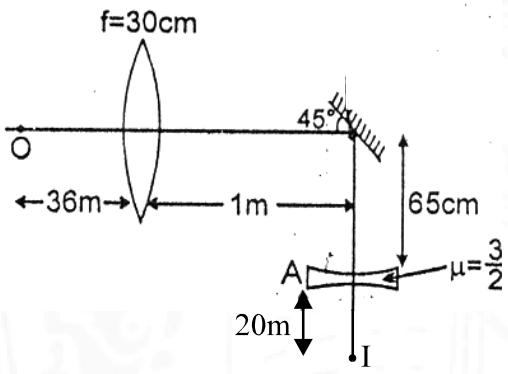
PHYSICS: **Max. Marks : 66**

SECTION – I

(SINGLE CORRECT CHOICE TYPE)

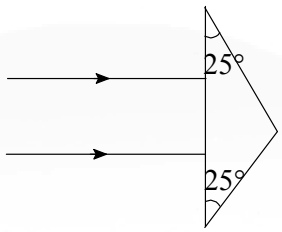
This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE is correct**

1. The final image I of the object O shown in the figure is formed at point 20 cm below a thin equal-concave lens, which is at a depth of 65 cm from principal axis. From the given geometry, calculate the radius of curvature in cm of lens kept at "A".



A) 50cm B) 60cm C) 70cm D) 65cm

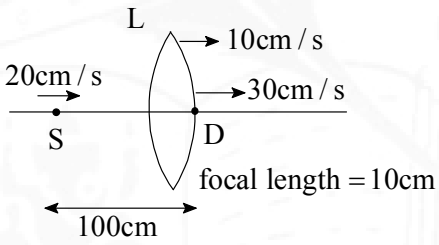
2. A beam is incident – parallel on the prism as shown in the figure below :



Find the angle between the emerging rays. (Given $\mu = 1.66, \sin 25^\circ = 3/5\sqrt{2}$)

A) 180° B) 140° C) 40° D) 320°

3. The figure shows the initial position of a point source of light S, a detector D and a lens L. Now at t = 0, all the three start moving towards right with different velocities as shown.

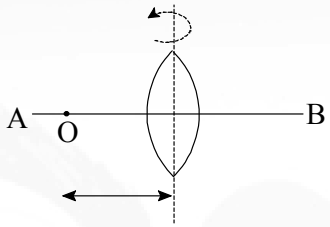


The time(s) at which the detector receives the maximum light is

A) 0.56s and 8.94s B) 3.8 s

C) 8.94 s and 19.62 s D) 0.56 s

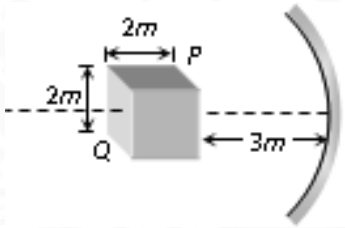
4. A point object O is placed at a distance 2f from a thin convex lens of focal length f as shown is figure. The lens then starts rotating about an axis perpendicular to the plane of paper, (object remains fixed and OA remains in the same plane), the speed of image when object is rotated by 2° is



A) $\frac{4f\pi\omega}{90}$ m/s along AB B) $\frac{4f\pi\omega}{90}$ m/s along BA

C) $\frac{2f\pi\omega}{90}$ m/s along AB D) $\frac{2f\pi\omega}{90}$ m/s along BA

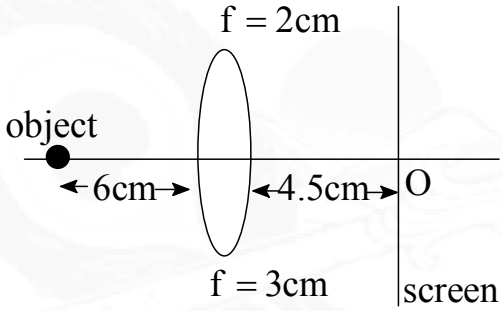
5. A cube of side 2 *m* is placed in front of a concave mirror focal length 1*m* with its face *P* at a distance of 3 *m* and face *Q* at a distance of 5 *m* from the mirror. The distance between the images of face *P* and *Q* and height of images of *P* and *Q* are



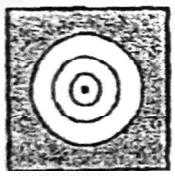
A) 1 *m,* 0.5 *m,* 0.25 *m* B) 0.5 *m,* 1 *m,* 0.25 *m*

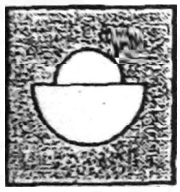
C) 0.5 *m,* 0.25 *m,* 1*m* D) 0.25 *m,* 1*m,* 0.5 *m*

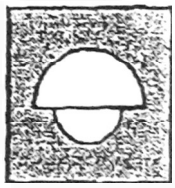
6. Two glass convex lens of focal length 2cm & 3 cm respectively both have a aperture diameter of 4cm. They are cut into 2 halves and joined to form a single lens of aperture 4cm. A point source of monochromatic light is placed on the common axis at 6cm from the combination. A screen is kept at 4.5cm from the lens on the other side. Screen is perpendicular to principal axis.

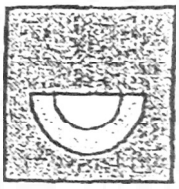


What do we see on the screen?

A) 

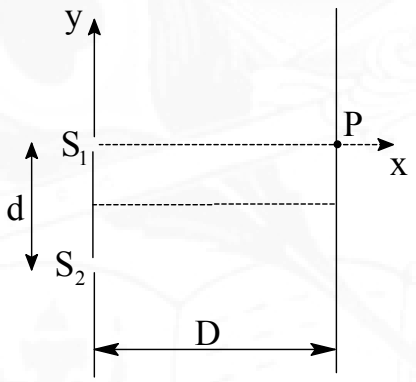
B) 

C) 

D) 

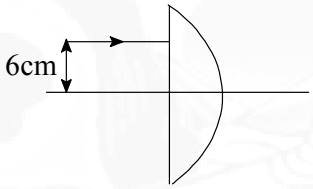
7. A thin large film having refractive index $\left(\mu = \frac{3}{2}\right)$ is placed in front of slits S_1 and S_2 of Y.D.S.E. such that its thickness varies according to the equation: $t = t_0 \cos^2 \frac{5\pi y}{4d}$

Where y = 0 is taken at S_1. Find the value of t_0 such that there is central maxima at P.



A) $\frac{d^2}{D}$ B) $\frac{2d^2}{D}$ C) $\frac{d^2}{2D}$ D) $\frac{d^2}{4D}$

8. A light ray parallel to the principal axis is incident (as shown in the figure) on a thin planoconvex lens with radius of curvature of its curved part equal to 10cm. Assuming that the refractive index of the material of the lens is 4/3 and medium on both sides of the lens is air, find the distance of the point from the lens where this ray meets the principal axis in cm. [Note:- Use snell's law and consider the incidenting ray is not paraxial)



A) $\frac{130}{7}$ B) $\frac{150}{7}$ C) $\frac{120}{7}$ D) $\frac{170}{7}$

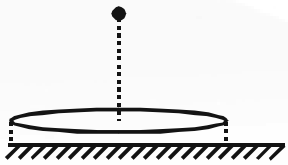
SECTION - II
(COMPREHENSION TYPE)

This section contains **6 multiple choice questions** relating to three paragraphs with two questions on each paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONLY ONE is correct.**

Paragraph for Questions 9 and 10

A thin equiconvex lens of refractive index $\frac{3}{2}$ is placed on a horizontal plane mirror as shown in the figure. The space between lens and the mirror is then filled with water of refractive index $\frac{4}{3}$. It is found that when a point object is

placed 15 cm above the lens on the principal axis the object coincides with its own image.



9. At what distance object should be placed before water is filled so that image coincides with object if R is radius of curvature of lens

A) 1.5 R B) R C) 2R D) $\frac{R}{2}$

10. In the above experiment when water is present, and parallel rays are incident then it will converge at a distance

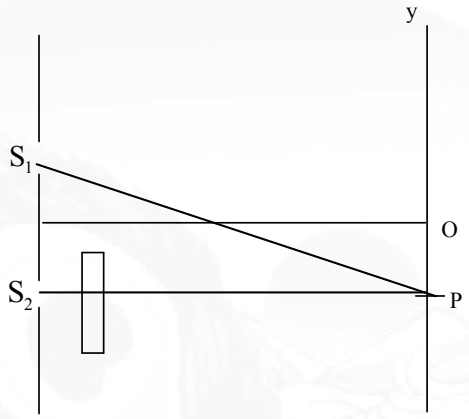
A) 2.25 cm B) 15 cm

C) 10 cm D) 7.5 cm

Paragraph for Questions 11 and 12

The YDSE is done in a medium of refraction index 4/3. A light of 600 nm wavelength is falling on the slits having 0.45 mm separation. The lower slit S_2 is covered by a thin glass sheet of thickness $10.4\mu m$ and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown.

All wavelengths in this passage are for given refractive index 4/3, [ignore dispersion]



11. If P is location of zeroth order maxima. Then OP is

A) 1.33 mm B) 4.33 mm C) 3.30 mm D) 1.50 mm

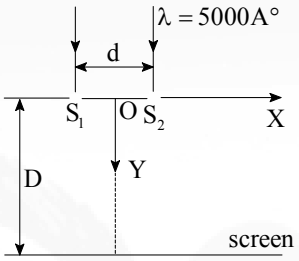
12. If 600 nm light is replaced by white light of range 500 to 700 nm. Find the wave length of the light that form maxima exactly at point O.

A) 650 nm B) 500 nm C) 550 nm D) 700 nm

Paragraph for Questions 13 and 14

In the figure shown alongside, light of wavelength $\lambda = 5000A^\circ$ is incident on the slits (in a horizontally fixed place). Here, d = 1mm, D = 1m. Take origin at O

and X Y plane as shown in the figure. The screen is released from rest from the initial position as shown. (Take $g = 10 m/s^2$)



13. The velocity of central maxima at t = 5s, is

A) 50 m/s along Y-axis B) 50m/s along –ve Y-axis

C) 25m/s along Y-axis D) 3×10^8 m/s along Y-axis

14. Velocity of 2nd maxima wrt central maxima at t = 2s, is

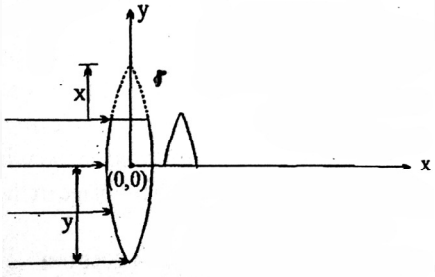
A) $(8cm/s)\hat{i} + 20m/s\,\hat{j}$ B) $(8cm/s)\hat{i}$

C) 2cm/s $\hat{i}$ D) 86 m/s$\hat{i}$

SECTION – III
(MULTIPLE CORRECT CHOICE TYPE)

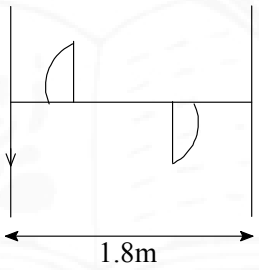
This section contains **6 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE is/ are correct**

15. The hashed part of the lens is cut and kept on the x axis as shown n the diagram. If parallel paraxial rays are falling on this system then the coordinate of image formed after refraction from both the lenses is (30, -1). If x = 2.5 then (all the distance is in cm) (Assume lens have no spherical aberration):



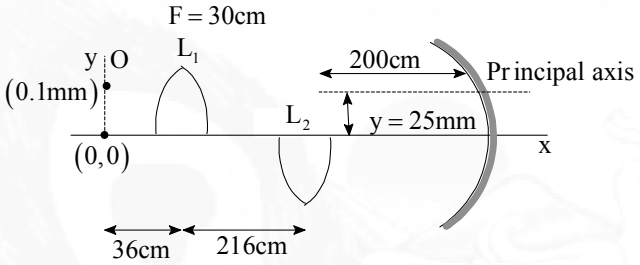
A) f = 30cm B) f = 60 cm C) y = 3cm D) y = 4.5cm

16. A thin plano-convex lens of focal length f is split into two equal halves. One of the halves is shifted along the optical axis as shown. Both halves form real image of a real object at same position. The separation between object and image planes is 1.8m and the magnification of image formed by one of the half lens is 2. The separation between two halves is d.



A) f = 0.4m B) f = 0.6m C) d = 0.6 m D) d = 0.4 m

17. A point object 'O' having coordinates (0, 1mm) is placed in front of two identical half lenses, having focal length as f = 30cm and x-axis as the optical axis as shown in the figure. A concave mirror is also placed as shown in the figure. Now answer the following question.



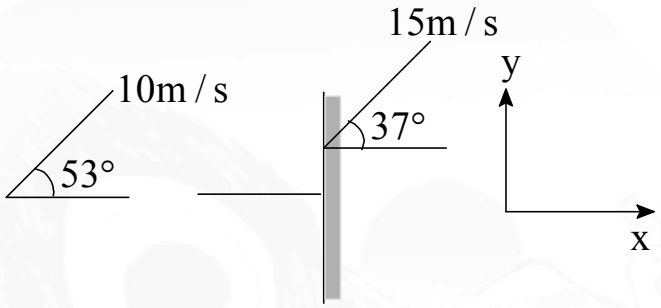
A) The y-coordinate of the image that would have been formed by L_1 will be – 5 mm

B) The x-coordinate of the second image that will be formed by L_2 will be 432 cm

C) If the second image formed by L_2 is formed at the centre of curvature of the concave mirror then the focal length of the concave mirror is 10cm

D) If the second image formed by L_2 is formed at the centre of curvature of the concave mirror then the focal length of the concave mirror is 12cm

18. For the situation shown below mark the correct option. All the velocities mentioned are wrt ground.



A) Velocity of image wrt mirror is $10\hat{i} - 4\hat{j}$.

B) Velocity of image wrt mirror is $2\hat{i} - 2\hat{j}$

C) Velocity of image wrt ground is $10\hat{i} + 8\hat{j}$

D) Velocity of image wrt object is $4\hat{i}$.

19. In displacement method, the distance between object and screen is 96cm. The ratio of magnification of two positions formed by a convex lens placed between them is 4.84. Then

A) Ratio of the length of object to the length of shorter image is 3.2

B) Distance between the two positions of the lens is 36cm

C) Focal length of the lens is 22.5 cm

D) Distance of the lens from the shorter image is 30 cm

20. A point object is moving with a velocity 0.01 m/s on principal axis towards a convex lens of focal length 0.3m when the object is at a distance of 0.4m, from the lens.

A) Distance of image from the object 1.6m.

B) Rate of change in position of image 0.09m/s

C) Rate of change in lateral magnification 1.8 s^{-1}

D) Magnification of image at this position lens than one