

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.OPTM/SEM-1/BO-101/2012-13  
2012**

**GEOMETRICAL OPTICS – ( OPTICS-I )**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

10 × 1 = 10

i) The refractive index of water with respect to air is

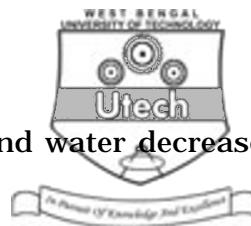
- |         |          |
|---------|----------|
| a) 1.30 | b) 1.31  |
| c) 1.33 | d) 1.32. |

ii) The wave theory of light was proposed by

- |            |              |
|------------|--------------|
| a) Newton  | b) Planck    |
| c) Huygens | d) Brewster. |

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[ Turn over



- iii) Velocities of light in diamond, glass and water decrease in which of the following orders ?
- a) Water > Glass > Diamond
  - b) Diamond > Glass > Water
  - c) Diamond > Water > Glass
  - d) Water > Diamond > Glass.
- iv) When the focal length is infinite, the power will be
- a) zero
  - b) infinite
  - c) 100
  - d) 10.
- v) Convex lens acts like a reading glass, when object is kept
- a) at focus
  - b) at  $2F$
  - c) in between  $2F$  and  $F$
  - d) in between  $F$  and optical centre.
- vi) Geometrical Optics is also known as
- a) Geometry optics
  - b) Co-ordinate optics
  - c) Ray optics
  - d) Photon optics.
- vii) Convex lens is used as slide projector when object is kept
- a) at  $2F$
  - b) in between  $F$  and  $2F$
  - c) at  $F$
  - d) none of these.
- viii) Optical fibre works on the principle of
- a) refraction
  - b) total internal reflection
  - c) reflection
  - d) none of these.
- ix) If two thin lenses of powers  $P_1$  and  $P_2$  are kept in contact then equivalent power is
- a)  $P_1 \times P_2$
  - b)  $P_1 - P_2$
  - c)  $P_1 + P_2$
  - d) none of these.



- x) Total internal reflection occurs when light travels from
- a) rarer to denser medium
  - b) denser to rarer medium
  - c) both (a) and (b)
  - d) none of these.

**GROUP - B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

- 2. Define optical fibre. State the uses of optical fibre.
- 3. Write a short note on cardinal points of thick lens system.
- 4. What is total internal reflection ? Mention condition of total internal reflection.  $2 + 3$
- 5. Write a short note on astigmatism.

**GROUP - C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

- 6. What is a lens ? Obtain lens makers' formula. Deduce the formula to find out the equivalent focal length and power when two convex lenses are mounted coaxially to form a combination.  $2 + 5 + 8$
- 7. a) Derive vergence equation for refraction at a curved surface.  
b) Obtain lens makers' formula for a thin lens.  $7 + 8$



8. a) For a thin prism prove that  $\delta = (\mu - 1) A$ , where the symbols have their usual meaning.
- b) An image of size  $d_1$  is formed on a screen by a convex lens. By moving the lens an image of size  $d_2$  is formed when the object and the screen are fixed. Show that the size  $d$  of the object is given by

$$d = (d_1 d_2)^{1/2} .$$

- c) A convex lens of glass ( $n = 1.5$ ) has radii of curvature 15 cm and 30 cm. Find its focal length in air. What will be its focal length in water of refractive index  $4/3$  ?

5 + 5 + 5

9. a) Write the statement of the Fermat's principle.
- b) Prove Snell's law of refraction in the light of Fermat's principle for a plane surface.
- c) For a concave spherical surface find out the vergence equation.

2 + 7 + 6

10. a) Why is matrix method useful in optics ?
- b) Differentiate between the following :
- i) Step index and graded index fibre
- ii) Single mode and multimode fibre.
- c) With sketch define
- i) Critical angle
- ii) Angle of acceptance.
- d) A fibre cable has an acceptance angle of  $30^\circ$  and a core index of refraction of 1.4. Calculate the refractive index of the cladding.

3 + (3 + 3) + 3 + 3

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