

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 :

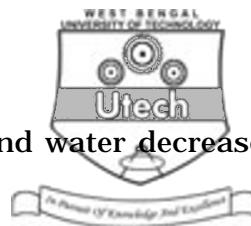
10 × 1 = 10

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.



- 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
- rarer to denser medium
 - denser to rarer medium
 - both (a) and (b)
 - none of these.

GROUP - B

(Short Answer Type Questions)

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

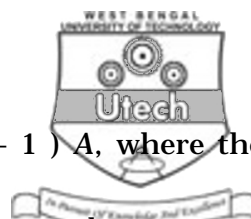
- Define optical fibre. State the uses of optical fibre.
- Write a short note on cardinal points of thick lens system.
- What is total internal reflection ? Mention condition of total internal reflection. $2 + 3$
- Write a short note on astigmatism.

GROUP - C

(Long Answer Type Questions)

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

- 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. $2 + 5 + 8$
- Derive vergence equation for refraction at a curved surface.
 - 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° and a core index of refraction of 1.4. Calculate the refractive index of the cladding.

3 + (3 + 3) + 3 + 3