



Name :

Roll No. :

Invigilator's Signature :

CS/B.Optm/SEM-1/BO-101/2011-12

2011

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 : $10 \times 1 = 10$
 - i) Number of images formed by two plane mirrors inclined at 60° is
 - a) 3
 - b) 6
 - c) 5
 - d) 7.
 - ii) If a thin prism of refractive index 1.5 and having an angle of 6° is made to deviate light then deviation produced by it is approximately
 - a) 1°
 - b) 3°
 - c) 2°
 - d) 4° .
 - iii) Vergence V is defined as
 - a) $V = 2R$
 - b) $V = R$
 - c) $V = 3R$
 - d) none of these.



- iv) When thin convex lens is put in contact with a thin concave lens of same focal length, the resultant combination has a focal length equal to
- a) $f/2$
 - b) $2f$
 - c) 0
 - d) none of these.
- v) A well cut diamond appears bright because
- a) it emits light
 - b) it is radioactive
 - c) scattering of light
 - d) total internal reflection of light.
- vi) During refraction of light which of the following remains unchanged ?
- a) Frequency
 - b) Speed
 - c) Wavelength
 - d) Intensity.
- vii) Total internal reflection occurs when light travels from
- a) rarer to denser medium
 - b) denser to rarer medium
 - c) both (a) & (b)
 - d) none of these.
- viii) If f_1 and f_2 represent the first and second focal lengths of a single spherical refracting surface, then
- a) $f_2 = -f_1$
 - b) $f_2 = -\mu f_1$
 - c) $f_1 = -\mu f_2$
 - d) $f_1 f_2 = -1$.
- ix) Optical fibre works on the principle of
- a) refraction
 - b) total internal reflection
 - c) reflection
 - d) none of these.



- x) 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.

GROUP – B

(Short Answer Type Questions)

Write short notes on any *three* of the following.

3 × 5 = 15

2. Vergence.
3. Astigmatism.
4. Dispersion of light.
5. Critical angle and total internal reflection.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

6. a) State the factors affecting the angle of deviation of a prism.
- b) Prove that for a small angle prism $\delta = A (\mu - 1)$, when angle of incidence is very small.
- c) Establish the relationship between dispersive power, angular dispersion and mean deviation of a prism.
- d) The minimum deviation produced by a hollow prism filled with a certain liquid is found to be 30° . The refractive angle of the prism is 60° . Calculate the RI of the liquid.

4 + 4 + 4 + 3

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7. a) Two thin lenses of focal lengths f_1 and f_2 are kept in contact. Find the focal length and power of the combination.
- b) What is aberration ? What is spherical aberration ? How can we minimize spherical aberration ?
- c) A biconvex lens with both faces of the same radius of curvature to be manufactured from a glass of refractive index 1.55. What should be the radius of curvature for the focal length of the lens to be 20 cm ? 5 + 6 + 4
8. a) Find the lateral shift by a plane parallel glass plate of thickness t and refractive index μ .
- b) What is dispersion of light ?
- c) A ray of light falling at an angle of 45° with the surface of a clean slab of ice of thickness 1 m is refracted into it an angle of 30° . Calculate the time taken by the light rays to cross the slab. Speed of light in vacuum = $3 \times 10^8 \text{ ms}^{-1}$. 8 + 2 + 5
9. a) What is optical fibre ? Describe the different types of optical fibre and state its uses.
- b) An optical fibre is placed in air of which the refractive indices of core and cladding are 1.5 and 1.47. Find acceptance angle and numerical aperture.
- c) Explain cardinal points for thick lens system with ray diagram. 5 + 5 + 5

