



Name :

Roll No. :

Invigilator's Signature :

CS/B.OPTM/SEM-1/BO-101/2009-10

2009

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) During refraction of light which of the following remains unchanged ?
 - a) Frequency
 - b) Speed
 - c) Wavelength
 - d) Intensity.
 - ii) 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.
 - iii) 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) $f_1 f_2 = -1$.

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GROUP – B
(Short Answer Type Questions)

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

2. a) Define first and second principal focus for spherical refracting surfaces.
b) Write down different cardinal points of a lens system.
3. For a thin prism prove that $\delta = (\mu - 1) A$, where the symbols have their usual meaning.
4. Write a short note on chromatic aberration.
5. What is total internal reflection ? Mention the conditions of total internal reflection. $2 + 3$
6. Explain the difference between the geometrical path length and optical path length of a light ray travelling in a medium.

GROUP – C
(Long Answer Type Questions)

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

7. a) State and explain Fermat's principle.
b) Derive laws of refraction using Fermat's principle.
c) A thin lens of focal length f and refractive index 1.5 is placed under a liquid of refractive index 1.333. Find the geometrical focus of a pencil of parallel rays directly incident upon the lens. $2 + 8 + 5$

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8. a) Derive vergence equation for refraction at a curved surface.
- b) Obtain lens makers formula for a thin lens. 7 + 8
9. 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) Briefly explain the structure of an optical fibre. 8 + 2 + 5
10. 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 chromatic aberration ?
- c) Three lenses of focal lengths +3D, +5D, - 6D are kept in contact. Find out the equivalent power and the equivalent focal length of the combination. 5 + 6 + 4
11. a) Using matrix method in paraxial optics, derive Translation matrix for a thick lens.
- b) What is optical fibre ? Explain the propagation of light through it.
- c) Mention the medical application of optical fibre. 6 + (2 + 5) + 2