Name :	
Roll No. :	Contraction of Contractor and Contract
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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- iv) When thin convex lens is put in contact with a thin concave lens of the same focal length, the resultant combination has a focal length equal to
  - a) f/2 b) 2f
  - c) 0 d) none of these.
- v) Equivalent power of two thin lenses in contact having power + 5 D and 2 D is
  - a) 7D b) 7D
  - c) 3D d) none of these.
- vi) 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.
- vii) The corpuscular theory of light was proposed by
  - a) Einstein b) Newton
  - c) Maxwell d) Huygens.
- viii) If for a particular optical system object and image point can be replaced with respect to each other, then they are called
  - a) afocal points b) confocal points
  - c) conjugate points d) none of these.
- ix) Critical angle for light passing from glass to air is minimum for
  - a) red light b) green light
  - c) yellow light d) violet light.
- x) A converging lens is that which
  - a) collects rays b) spreads rays
  - c) forms real image d) forms virtual image.

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- 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

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