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 X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 *ƒ*1 and *ƒ* 2 represent the first and second focal lengths of a single spherical refracting

surface, then

a) *ƒ*2 -*ƒ* 1 b) *ƒ*2 µ*ƒ*1

c) *ƒ*1 *µ ƒ*2 d) *ƒ*1 *ƒ*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) *ƒ*/2 b) 2 *ƒ*

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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GROUP – B

( Short Answer Type Questions )

Answer any *three* of the following. 3 X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 δ= ( µ– 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 X15 = 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 .

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