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Department of Allied Health Sciences
Brainware University
Barasat, Kolkata- 700125

BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – B.Optomety-2022/B.Optomety-2023/B.Optomety-
2024/B.Optomety-2025

Course Name – Physical Optics

Course Code - BOPTOC204

(Semester II)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Electromagnetic waves are interpreted as
 - a) longitudinal in nature
 - b) transverse in nature
 - c) both longitudinal and transverse in nature
 - d) none of these in nature
- (ii) The idea of secondary wavelets for the propagation of a wave was first given by
 - a) Newton
 - b) Huygens
 - c) Maxwell
 - d) Fresnel
- (iii) The wavenumber of a transition is 2000 cm^{-1} . Choose the part of the electromagnetic spectrum from the following.
 - a) Ultraviolet-visible light
 - b) Infrared
 - c) Microwave
 - d) Radio-wave
- (iv) Calculate the critical angle for glass ($\mu = 1.5$) immersed in oil ($\mu = 1.1$)
 - a) $i_c = \sin^{-1}(11/15)$
 - b) $i_c = \cos^{-1}(0.8)$
 - c) $i_c = \tan^{-1}(11/15)$
 - d) $i_c = \cot^{-1}(11/15)$
- (v) Which of the following phenomena proves that light is a transverse wave?
 - a) Interference
 - b) Dispersion
 - c) Diffraction
 - d) Polarization
- (vi) The optic axis is a direction along which
 - a) the O-ray travels faster than the E-ray
 - b) the E-ray travels faster than the O-ray
 - c) both O-ray and E-ray travel with the same velocity
 - d) none of these
- (vii) In Newton's ring experiment, coherent waves are produced by means of
 - a) division of wavefront
 - b) diffraction

- c) division of amplitude
 (viii) In He-Ne laser neon atoms get energy
 a) on collision with He atoms
 c) from electrical pumping
 (ix) In a ruby laser, name the pumping process to achieve population inversion
 a) Optical pumping
 c) Chemical reaction
 (x) The ratio of Einstein's A and B coefficient is proportional to
 a) ν
 c) ν^3
 (xi) Solid angle is expressed in terms of
 a) radians / meter
 c) steradians
 (xii) "Lux" is a unit of
 a) luminous intensity of a source
 c) transmission coefficient of a surface
 (xiii) The illumination is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. Above statement is associated with
 a) Planck's law
 c) Bunsen's law of illumination
 (xiv) Which of the following lamp gives nearly monochromatic light?
 a) Sodium vapor lamp
 c) Tube light
 (xv) The technique by which image is obtained from a hologram is called as
 a) Formation
 c) Reconstruction
- d) none of these
 b) from chemical reactions
 d) from optical pumping
 b) Inelastic atom-atom collision
 d) Applying strong electric field
 b) ν^2
 d) $1/\nu$
 b) radians
 d) degree
 b) illuminance on a surface
 d) luminous efficiency of source of light
 b) Macbeth's law of illumination
 d) Lambert's cosine law
 b) GLS lamp
 d) Mercury vapor lamp
 b) Construction
 d) Projection

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Show that the energy is conserved in interference, taking two coherent waves of amplitude a_1 and a_2 . (3)
3. Explain Rayleigh scattering. (3)
4. Compute the missing orders for a double-slit Fraunhofer diffraction pattern if the slit widths are 0.16 mm and they are 0.8 mm apart. (3)
5. Deduce the fringe width in Young's double slit experiment. (3)
6. An unpolarized light is incident on a pair of ideal linear polarizers whose transmission axis make an angle of 45° with each other,. What percentage of the incident light will be transmitted through both polarizers? (3)

OR

Calculate the thickness of a mica sheet required to make a quarter wave plate for $\lambda = 546$ nm. The refractive indices for the O-ray and E-ray in mica are 1.586 and 1.592 respectively. (3)

Group-C
(Long Answer Type Questions)

5 x 6=30

7. State and explain the principle of photometry. (5)
8. Discuss the Nicol prism working as a polarizer. (5)
9. What is Rayleigh criterion of resolution? What is the limit of resolution of an optical instrument? (5)
10. Write down the expression for intensity due to Fraunhofer double slit diffraction. Draw the intensity distribution curve for the same. (5)
11. Deduce the Brewster's law in polarization. (5)
12. Calculate the ratio of population inversion of the two states in thermal equilibrium at 300 K. The wavelength corresponding to the energy gap between the two states is 600 nm. (5)

OR

In a He- Ne laser transition from E_3 to E_2 level gives a laser emission of wavelength 632.8 nm. If the energy of the E_2 level is 15.2×10^{-19} J, Calculate the required pumping energy, if there is no energy loss in He- Ne laser. (5)

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