

Seat No.: _____

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A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE
(AUTONOMOUS) (Grant-in-Aid)
Affiliated to Sardar Patel University
VALLABH VIDYANAGAR-388120



Bachelor of Science (Semester- 3) External Examination – 2025

Subject Code: US03MAPHY01 Subject Name: Physics

Title of the Paper: Optics

Date: 06-10-2025, Monday

Time: 02:00 PM to 04:30 PM (2.5 hrs)

Total marks: 50

NOTE:

1. The symbols have their usual meaning. 2. Figures to the right indicate full marks.

Q-1 Write the most appropriate answer from the following multiple-choice questions. [10]

- (1) The distance between principal point and focal points in the lens combination is known as _____
(a) First length (b) Simple length (c) Equivalent focal length (d) Principal length
- (2) The aberration that occurs due to dispersion of light is called _____ aberration.
(a) Monochromatic (b) Distortion (c) Coma (d) Chromatic
- (3) The power of Huygen's eyepiece is _____.
(a) Negative (b) Positive (c) Very small (d) Zero
- (4) In Newton's rings experiment, the rings are formed due to _____.
(a) Diffraction (b) Interference (c) Polarization (d) Reflection only
- (5) In a Fresnel's biprism experiment using white light, the central fringe is identified as the _____ fringe.
(a) Zero-order (b) First-order (c) Second-order (d) Third-order
- (6) In Fresnel's biprism, the distance between two virtual sources (d) = _____.
(a) $\sqrt{d_1 + d_2}$ (b) $\sqrt{d_1 - d_2}$ (c) $\sqrt{d_1 \div d_2}$ (d) $\sqrt{d_1 \times d_2}$
- (7) A Nicol prism is made from _____ crystal.
(a) Tourmaline (b) Calcite (c) Canada Balsam (d) Quartz
- (8) Malus' Law gives the intensity of light transmitted through a polarizer as a function of the angle θ between the light's polarization and the polarizer. The law is expressed as:
(a) $I = I_0 \sin \theta$ (b) $I = I_0 \sin^2 \theta$ (c) $I = I_0 \tan \theta$ (d) $I = I_0 \cos \theta$
- (9) The numerical aperture of an optical fibre cable (NA) = _____.
(a) $\sin(\theta_0)$ (b) $\sqrt{n_1^2 - n_2^2}$ (c) $n_1 \sqrt{2 \Delta}$ (d) All of these
- (10) Fractional refractive index change (Δ) = _____.
(a) $\frac{n_1 - n_2}{n_1}$ (b) $\frac{n_2 - n_1}{n_1}$ (c) $\frac{n_1 - n_2}{n_2}$ (d) $\frac{n_2 - n_1}{n_2}$

- Q-2** (a) Explain in detail the construction of a Ramsden eyepiece, derive the necessary equations, and draw its cardinal points. [7]
(b) Define and explain the principal points of an optical system, and state their properties. [3]

OR

- Q-2** (a) Write a detailed note on spherical aberration. [7]
(b) Define and explain the nodal points of an optical system, and state their properties. [3]

- Q-3** (a) With a neat diagram, explain the construction and applications of Lloyd's single mirror. Why is a dark fringe observed at the center in Lloyd's mirror? Compare the fringes produced by a biprism and by Lloyd's mirror. [7]
(b) Explain in detail the two techniques for obtaining coherent sources for the interference of light. [3]

OR

- Q-3** (a) Explain the basic principle, construction, and working of a Fabry-Perot interferometer, and discuss how it can be used to measure the wavelength of an unknown monochromatic source. [7]
(b) Explain with neat diagram Fraunhofer diffraction. [3]

- Q-4** (a) State and explain Brewster's law and discuss applications of the law. [7]
(b) Compare: half-wave plate and quarter-wave plate. [3]

OR

- Q-4** (a) Write a short note on Babinet's compensator. [7]
(b) Explain: Specific rotation. [3]

- Q-5** (a) Define optical fibre. Explain the structure of an optical fibre in detail. Mention the important functions of the cladding. [7]
(b) Define and explain acceptance angle of optical fibre. Write its expression. [3]

OR

- Q-5** (a) Explain the phenomenon of total internal reflection. Describe the propagation of light through an optical fibre and derive the expression for the critical angle of propagation. [7]
(b) Draw a block diagram of an optical communication system and explain the function of each component. [3]

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