25U208 (Pages: 2) Name : .....

Reg. No : .....

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2026

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UPHY2MN104 - OPTICS AND LASERS

(Physics - Minor Course)

(2024 Admission onwards)

Time: 2.0 Hours Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 3 marks.

1. State, how the refractive index of a medium vary with wavelength? [Level:1] [CO1]
2. Define reflection and state laws of reflection with a neat diagram. [Level:1] [CO1]
3. Discuss the laws of reflection. [Level:1] [CO2]
4. Explain how the lens equation is applied to concave lenses. [Level:3] [CO2]
5. How does the nature of the image formed by a convex mirror differ from that formed by a concave mirror? [Level:2] [CO2]
6. Define the condition for minima in the diffraction pattern of a single slit. [Level:2] [CO3]
7. Define the term "population inversion" and state why it is essential for laser operation. [Level:2] [CO4]
8. Briefly explain different types of lasers [Level:2] [CO4]
9. draw the graph showing interference in terms of intensity distribution [Level:1] [CO3]
10. Derive the expression for the fringe width (β) in terms of the wedge angle (θ) and wavelength (λ). [Level:3] [CO3]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. Given that the speed of light in a vacuum is 3×108m/s, find the momentum of a photon with a wavelength of 600 nm? [Level:1] [CO1]
12. An object is placed 10 cm in front of a concave lens of focal length 20 cm. Determine the image position and magnification. [Level:3] [CO2]

13. Explain how the interference pattern changes when the wavelength of light is varied in a Young's double-slit experiment. [Level:2] [CO3]

14. How does the electric field vector behave in plane-polarized light? Illustrate with a diagram [Level:2] [CO3]

15. Newton's rings are observed in reflected light of $\lambda = 5.9 \times 10^{-5}$ cm. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air film. [Level:3] [CO3]

16. Discuss the diffraction pattern formed due to a single slit and explain the appearance of secondary maxima and minima. [Level:2] [CO3]

17. Explain how interference in thin films is responsible for the rainbow colors observed on the surface of a soap bubble. [Level:2] [CO3]

18. Discuss the process of lasing action and how photons are amplified within the optical resonator. [Level:2] [CO4]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

19. Explain the phenomenon of double refraction using a calcite crystal, and describe the behavior of ordinary and extraordinary rays. [Level:2] [CO3]

20. Derive the refraction equation at a spherical surface and explain how it is used to determine the image position when light passes from one medium to another. Discuss the significance of the refractive indices of the media involved and provide examples of practical applications where refraction at spherical surfaces is important. [Level:2] [CO2]

(1 × 10 = 10 Marks)

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