

24U209

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Name :

Reg. No :

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2025

(FYUGP)

CC24UPHY2MN104 - OPTICS AND LASERS

(Physics- Minor Course)

(2024 Admission - Regular)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

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

1. Mention the concept of rest mass for a photon? [Level:1] [CO1]
2. Define geometric path? [Level:1] [CO1]
3. Write the relationship between the object distance, image distance, and the radius of curvature in refraction at a spherical surface. [Level:2] [CO2]
4. Describe how the focal length of a concave mirror changes when immersed in water. [Level:2] [CO2]
5. Analyze how the curvature of lens surfaces affects its focal length according to the lens maker's formula. [Level:2] [CO2]
6. Explain what happens if incoherent waves superimpose. [Level:2] [CO3]
7. Explain the concept of population inversion in the context of laser action. [Level:1] [CO4]
8. Explain the role of the active medium in the operation of a laser. [Level:2] [CO4]
9. Derive the expression for the angular position of the nth minimum in the diffraction pattern of a single slit. [Level:3] [CO3]
10. What is the significance of the phase of secondary wavelets in Fresnel diffraction? [Level:1] [CO3]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

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

11. If a light ray strikes a glass surface at an angle of 45° from air (refractive index of air = 1, refractive index of glass = 1.5), Find the angle of refraction in the glass? [Level:1] [CO1]
12. An object is placed 20 cm in front of a plane mirror. Calculate the image distance and describe the characteristics of the image formed. [Level:3] [CO2]

13. Explain the difference between unpolarized and polarized light. Provide examples of each. [Level:2] [CO3]
14. 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]
15. Derive the condition for Maxima and Minima in interference due to reflected light. [Level:3] [CO3]
16. Compare the three types of polarization: plane (linear) polarization, elliptical polarization, and circular polarization. [Level:4] [CO3]
17. Summarize the method to determine the thickness of the air wedge in a thin film interference experiment. [Level:2] [CO3]
18. Explain the basic working parts of laser and specify any one of the laser and briefly explain the working [Level:2] [CO4]

(Ceiling: 36 Marks)

Part C (Essay questions)

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

19. Determine an expression for the optical path difference in the interference pattern of a thin parallel film. [Level:3] [CO3]
20. Explain the laws of reflection with necessary derivations and illustrate the behavior of light rays at a plane mirror. [Level:3] [CO2]

(1 × 10 = 10 Marks)
