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D5BPH2203 **Reg. No: .....**

Name: .....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2024

(Regular/Improvement/Supplementary)

PHYSICS

GPHY5B08T: OPTICS

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.

(Ceiling 20 marks)

1. State Fermat's principle of light propagation.
2. Mention the essential conditions for two beams of light to be coherent.
3. In interference with white light, why the central fringe is always white whereas other fringes are coloured?
4. What is cosine law in interference from thin films?
5. What is Rayleigh's criterion for resolution of light from two point sources?
6. Why oil immersion objectives are used in many optical instruments?
7. Distinguish between Fresnel's type and Fraunhofer's type of diffraction.
8. Explain why the zones of a zone plate are called half period zones.
9. Distinguish between uniaxial and biaxial crystals.
10. Mention two applications of holography techniques.
11. What is a pseudoscopic image in holography?
12. Draw the refractive index profile curves of step index and graded index optical fibers.

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 30 marks)

13. Write down the thin lens equation. Using it explain why a convex lens of glass diverges a beam of light once placed in a medium of greater refractive index.
14. Give five points of comparison between grating and prism spectra.
15. What is a quarter wave plate? Mention how it can be used to distinguish between circularly polarized light and unpolarized light.
16. Briefly outline the various processes involved in holography.

(PTO)

17. Sodium light of wavelength 589.3 nm., from a narrow slit illuminates Fresnel's biprism made of glass of refractive index 1.50. The biprism is twice as far from a screen on which fringes are obtained as it is from the slit. The fringes are obtained with a separation of 0.03 cm. Find the angle of the prism.
18. Calculate the width of the rectangular slit that will produce a central maximum in the Fraunhoffer pattern produced by a single slit, having an angular breadth of 30 degrees with light of wavelength 550 nm.
19. The specific rotation of glucose is 20.5 degrees. A glucose solution of unknown concentration is contained in a 12 cm long tube and is found to rotate linearly polarized light by 1.23 degrees. Find the concentration of the solution. The rotation of polarized light by an optically active medium is approximately proportional to the inverse square of the wavelength. Upon passing through a medium, red light (700 nm.) is found rotated through 15 degrees. What rotation can be expected for violet light (400 nm.)?

SECTION C: Answer any one question. Each question carries *ten* marks.

20. Explain Newton's rings experiment. Arrive at an expression for the radius of the rings observed. Explain how the set up can be used to find the wavelength of a monochromatic beam of light.
21. Explain the mechanism of propagation of light through a step index fiber. Arrive at the expressions for critical propagation angle, acceptance angle and numerical aperture for a fiber.

(1 × 10 = 10 Marks)