D5BPH1803 (S3) (PAGES 2) **Reg. No.....**

Name: .....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

(Supplementary – 2018 Admission)

PHYSICS

APHY5B08T: PHYSICAL OPTICS AND MODERN OPTICS

Time: 3 Hours **Maximum Marks: 80**

SECTION A: Short Answer: Answer *all* questions. Each carries *one* mark.

1. Define optical path.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. What are Fresnel's Half Period Zones? Why are they clalled so?
4. Explain the phenomenon of polarization by double refraction.
5. Define temopral and spacial coherence.
6. How can a plane polarised light be converted to circularly polarised light.
7. What is holography?
8. Explain the phenomenon of total internal reflection.

(8 x 1 = 8 Marks)

SECTION B: Paragraph questions: Answer any *six* questions. Each carries *four* marks.

9. Derive Newton's Lens Formula.
10. Show that the phenomenon of interference does not violate law of conservation of Energy.
11. Explain interferance with white light.
12. Describe the phenomenon of color of thin films.
13. State how zone plates have multiple focii.
14. Explain the diffraction by a circular aperture.
15. Calculate specefic rotation of turpentine, if the plane of polarization is turned through 64^0 when passed through a tube of liquid of length 20 cm and concentration of 0.87 gcm^{-1}.
16. Explain briefly advantages of a hologram.
17. What are the advantages of fibre optic sensors over conventional type sensors?

(6 x 4 = 24 Marks)

SECTION C: Problems: Answer any *eight* questions. Each carries *four* marks.

18. A convex lens (refractive index=1.5) has a focal length of 10 cm. Find its focal length if it is immerced in water.
19. Derive thin lens formula and deduce lens maker's formula.
20. What are the uses of Michelson's interferometer? What is the function of compensating plate in Michelson's interferometer?
21. Using light of wavelength $\lambda=5.9 \times 10^{-7}$ m, it is found that in a thin film of air 7 fringes occur between two points. What is the difference in film thickness at these points?
22. Two plane glass surfaces in contact along one edge are seperated at the opposite edge by a thin wire. If 20 fringes are observed between these edges in sodium light of normal incidence. What is the thickness of the wire? (Wavelength of Sodium light is 5890 A^0)
23. Newton's rings are observed in reflected light of $\lambda=5.9 \times 10^{-7}$ m. The diamter of the 10^{th} dark ring is 0.5 cm. Find the radius of curvature of the lens and thickness of air film.
24. Find the radii of the first three zones of zone plate whose first focal length is 1m for $\lambda=5893$ A^o
25. A plane wave ($\lambda=5000$ A^o) is incident normally on a long narrow slit of width 0.5 mm. Calculate the angles of diffraction corresponding to the first three minima.
26. Calculate the dipsersive power of the grating in the region of 5000 A^o in the third order spectrum.
27. Calculate the thickness of ice required to act as a half wave plate for wave length 590 nm. $\mu_e = 1.313$ and $\mu_o = 1.309$.
28. An optical fibre with $\mu_1 = 1.5$ and $\theta_1=30^0$ and a = 25 μm, Calculate the skip distance.
29. A step index fibre with $\mu_1 = 1.55$ and $\mu_2 = 1.50$. Calculate the numerical aperture and the acceptance angle.

(8 x 4 = 32 Marks)

SECTION D: Long answer: Answer any *two* questions. Each carries *eight* marks.

30. Explain formation of Newton's Rings. Derive an expression for the radii of the rings.
31. With the help of necessary theory, explain the recording and reconstruction of Holographic images.
32. Describe the rectilinear propagation of light on the basis of half period zones.
33. What is specific rotation? How the phenomenon of optical activity can be used to measure the concentration of a solution of an optically active material?

(2 x 8 = 16 Marks)