Reg. No ..... Name **23U327**

B. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023

SEMESTER 3 : PHYSICS

COURSE : **19U3CRPHY3 : OPTICS, LASER AND FIBER OPTICS**

(For Regular - 2022 Admission and Improvement/Supplementary - 2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. Draw the energy level diagram of a He-Ne laser?
2. Distinguish between polarized light and unpolarized light.
3. Under what conditions may we observe circular fringes with a Michelson interferometer?
4. Compare and contrast between multimode graded index fiber and step index fiber.
5. What are biaxial crystals? Give one example each.
6. What are essential components of a laser? Explain their functions.
7. How may we construct a zone plate?
8. Why do we have a central bright spot in the case of a Newton's rings setup to be viewed from below (refraction) ?
9. Define numerical aperture.
10. List any 2 different types of losses observed in an optical fiber.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Calculate the thickness of a double refracting plate capable of producing a path difference of λ/4 between e and o waves. Given λ= 589 nm, refractive index of ordinary light=1.658 and that of extra ordinary light= 1.486.
12. Find the critical angle for a ray travelling from glass with refractive index 1.7 to water with refractive index 1.33.
13. Determine the angle of incidence for which light reflected from glass surface is completely polarized. Refractive index of air glass interface is 1.5.
14. Newton's rings are observed in reflected light of wavelength 590 nm. The diamater of the tenth dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air film.
15. Demonstrate pictorially the paths of ordinary and extraordinary in a negative birefringent crystal.
16. Calculate the length of solution of concentration 50kg/m^3 which produces an optical rotation of 45^0. The specific rotation of the solution is 0.0523 rad.m^2kg^{-1}.
17. A thin equiconvex lens of focal length 4 m and refractive index 1.5, rests in contact with an optical flat and using light of wavelength 546 nm Newton's rings are viewed normally by reflection. What is the diameter of 5th bright ring?
18. A beam of monochromatic light of wavelength 552 nm falls normally on a glass wedge with the wedge angle 20 seconds of an arc. If the refractive index of glass is 1.5, find the number of dark fringes per cm of wedge length.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Describe in detail the various types of optical fibers. Also explain the normalized frequency.
20. What is a quarter wave plate? Explain how it can be used in producing elliptically and circularly polarized light.
21. Discuss the phenomenon of Fraunhoffer diffraction at a single slit.
22. Discuss Young's double slit experiment. Obtain expressions for dark and bright fringes.

(10 x 2 = 20)