Name **24U329**

Reg. No .....

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2024

SEMESTER 3 : PHYSICS

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

(For Regular 2023 Admission and Improvement/Supplementary 2022/2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. What is a half wave plate?
2. Diffrentiate between a zone plate and a convex lens.
3. State Malu's law.
4. Justify the necessity of broad absorption at pumping level.
5. What are polaroid’s?
6. Under what condition(s) will the rings in the case of a Newton's rings system remain closely spaced?
7. Deal the difference between Fresnel diffraction and Fraunhoffer diffraction.
8. Explain spontaneous emission.
9. Explain the principle of an optical fiber.
10. Describe micro bending loss. Compare it with macro bending loss.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. 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}.
12. Distinguish between positive and negative crystals.
13. A step index fiber of diameter 50 µm has a numerical aperture of 0.23. If the wavelength of input light energy is 0.82 µm, find the number of modes in the cable.
14. Calculate the thickness of quarter wave plate for wavelength of 600nm when ordinary and extra ordinary rays have refractive indices of 1.55 and 1.44 respectively.
15. When a thin sheet of transparent material of thickness 6.6 microns is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the sixth fringe. If the wavelength used is 546 nm, find the refractive index of the sheet.
16. A soap film (n = 1.33) 0.5 microns thick, is viewed at an angle of 35 degrees to the normal. Find the wavelengths of light in the visible spectrum which will be absent from the reflected light.
17. A fiber cable has an acceptance cone 60^0 and a core index of refraction 1.3. Find out the refractive index of the cladding.
18. A photon of wavelength 550 nm excited an electron to move from energy level E1 to E2. Evaluate the energy gap in eV (associated with these levels E1 and E2).

(4 x 6 = 24)

PART C
Answer any 2 (10 marks each)

19. Describe the working of He-Ne gas laser. Compare and contrast between ruby laser and He-Ne laser.
20. Obtain the intensity at a point due to a plane wavefront, using Fresnel's method.
21. Bring out the diffraction due to a straight edge.
22. Considering 2 level energy system: Discuss Absorption,spontaneous emission and stimulated emission process and write down its rate of transistions when the system is interacting with a stream of photons (such that freq of radiation = (E2-E1)/h, where h is the Planck's constant)

(10 x 2 = 20)