21101947

QP CODE: 21101947

Reg No : .....

Name : .....

# B.Sc DEGREE (CBCS)EXAMINATION, AUGUST 2021

## Third Semester

## Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

A7CD392D

Time: 3 Hours

Max. Marks : 60

### Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. State the principle of superposition of light waves.
2. If two coherent sources are separated by a distance less than a wavelength of light, what will happen to the interference pattern?
3. Write the condition for obtaining dark fringes in interference pattern due to transmitted light ?
4. What is the condition for producing circular fringes using Michelson's interferometer?
5. Eventhough you cannot see someone around the corner of an open doorway, you can hear them speaking. Explain.
6. Distinguish between prism spectra and grating spectra.
7. What happens when an elliptically polarized light passes through a quarter wave plate?
8. What is optical activity?
9. Why is laser action not possible in a two level gas laser system?
10. He-Ne Laser is considered superior to Ruby Laser. Why?
11. Write any two applications of laser.
12. What is a multimode fiber?

(10×1=10)

## Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A single slit is illuminated by a monochromatic light source. A screen is placed 5.0 m away from this slit and two very narrow, parallel slits, 0.5 mm apart, are placed half way between the single slit and the screen. Interference fringes are visible on the screen with 10 fringe spaces measure 20 mm on the screen. **a)** What is the wavelength of the light? **b)** What happens if you use double slits with half the spacing between them? **c)** What happens if you cover one of the double slits?

14. When a thin soap film of refractive index 1.34 is observed by light of wavelength 589.3nm reflected normally, it appears black. Find the minimum thickness of the film.

15. Fringes of equal thickness are observed in a thin glass wedge of refractive index 1.52. The fringes spacing is 1mm. Wavelength of light is 589.3nm. Find the angle of the wedge.

16. A monochromatic light of 589 nm, located at a distance of 0.1m from a straight edge is allowed to incident on it. If the screen is kept at a distance of 0.5m from the edge, calculate the distance between the first and the second dark band.

17. Explain why the intensity of the secondary maxima become weaker with the increasing order of secondary maxima in diffraction.

18. Prove that when the angle of incidence corresponds to the Brewster angle, the reflected and refracted rays are at right angles to each other.

19. Discuss various pumping methods used in the Lasers for obtaining population inversion.

20. A glass fiber has a core material of refractive index 1.46 and cladding material of refractive index of 1.42 . If it is surrounded by air, compute the critical angle (i) at core cladding boundary (ii) at cladding air boundary

21. An optical fiber of 1 mW is launched into an optical fiber of length 100 cm. If the power emerging from the other end is 0.3mW, calculate the fiber attenuation.

(6×5=30)

## Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. What are Newton's rings? How are they formed? Derive an expression for the radius of the $m^{th}$ dark ring formed by reflection. Also obtain the expression to determine the wavelength of monochromatic light using Newton's rings..

23. What is a zone plate? Explain Fresnel zone construction for a plane wave front and compare it with a convex lens. Show that the amplitude due to complete wavefront is the sum of the amplitudes of odd numbered zones when zone plate is used.

24. Describe the phenomenon of birefringence. With neat diagrams, discuss Huygens's theory of double refraction through uniaxial crystals.

25. (i) Derive Einstein's relations and write its inferences. (ii) Why is it difficult to achieve laser action in X-rays?

(2×10=20)