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ALL SAINTS COLLEGE TRIVANDRUM NO.

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

First Degree Programme under CBCSS

Physics

Core Course XI

PY 1643 : CLASSICAL AND MODERN OPTICS

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. Each question carries **1** mark.

1. What are coherent waves?
2. Write down the condition for constructive interference and destructive interference in terms of optical path difference and wavelength.
3. Why does the intensity of the image formed by zone plate be less?
4. Plot the intensity distribution of the diffraction pattern due to straight edge.
5. What is the significance of a small Abbe's number?
6. What is meant by uniaxial crystals? Give an example.

7. Which are the methods helpful for the practical production of plane polarized light?

8. Which are the essential components of a laser?

9. What are the advantages of fibre optic sensors?

10. Which are the steps involved in the construction of holograms?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions, not exceeding a paragraph. Each question carries **2** marks.

11. Why do we call the interference in thin films as interference by division of amplitude?

12. State the principle of superposition of waves. Why is it important in optics?

13. Explain the principle of Michelson's interferometer.

14. Compare a zone plate and a convex lens.

15. What will happen to diffraction if we gradually increase the size of the opening?

16. Compare Fresnel and Fraunhoffer diffractions.

17. Show that in Fraunhofer diffraction with N slits, the angular separation between the interference maxima becomes sharper as N increases.

18. Explain achromatic combination of prisms.

19. Make a comparison between polarized and unpolarized lights.

20. What is a half wave plate?

21. How does Nicol prism work as a polarizer?

22. Optical pumping is not used in gas lasers. Why?

23. Explain nonlinear polarization.

24. What are the characteristics of laser beam?

25. What is the role of coating and buffer in optical fibre?

26. Give the block diagram of a fibre optic communication link.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

27. A thin plano convex lens of focal length 2 m and refractive index 1.51 is used to form Newton's rings by reflection with a source of wavelength 628 nm. What is the diameter of the 10^{th} bright ring?

28. A glass wedge of angle 0.01 radian is illuminated by 500 nm light falling normally. At what distance from the edge of the wedge will the 10^{th} fringe be observed by reflected light?

29. 600 nm light falls normally on a slit of width 2.0 μm. Calculate the angular position of the first two minima on either side of the central maximum.

30. 600 nm light is used for Fresnel diffraction at a straight edge which at equal distance of 25 cm from both source and screen. Determine the position of 1^{st} maximum and minimum.

31. Find the radius of the first half period zone of a zone plate with focal length 60 cm with 600 nm light.

32. From the following data of crown and flint glasses determine which of them have higher dispersive power.

	n_v	n_g	n_r
Crown	1.5145	1.5170	1.5230
Flint	1.6444	1.6520	1.6637

33. A dielectric plate has a refractive index of 1.5. Find its Brewster angle. What is its significance?

34. Prove that if unpolarized light of intensity I is incident on a polarizer, the intensity of light transmitted through the polarizer is I/2.

35. Find the ratio of Einstein's coefficients for medium with refractive index 1.33 at 532 nm.

36. At what temperature are the rates of spontaneous and stimulated emission equal? Assume $\lambda = 550\,\text{nm}$.

37. With the help of Snel's law find the numerical aperture for a step index fibre.

38. A transmission hologram is constructed using 628 nm laser on a film of refractive index 1.52 at angle 30°. Determine the spacing between interference maxima.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

39. Analyse the working of Fresnel's biprism. How is it used for the determination of wavelength?

40. Discuss about plane transmission grating and its resolving power.

41. Discuss the production and analysis of plane, circularly and elliptically polarized light.

42. With supporting diagrams explain the working of ruby laser.

43. Explain pulse dispersion in optical fibres.

44. Discuss the classification of holograms.

(2 × 15 = 30 Marks)
