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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, March 2021

First Degree Programme under CBCSS

Physics

Core Course XI

PY 1643 : CLASSICAL AND MODERN OPTICS

(2018 Admission Regular)

Time : 3 Hours

Max. Marks : 80

PART – A

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

1. List the conditions for producing Haidinger fringes.
2. State the criteria to define the limit of resolution in grating.
3. What is Huygens-Fresnel principle?
4. Distinguish between crown and flint glasses based on dispersion.
5. Which is the law governing the polarization by reflection?
6. Name the optical phenomenon which is used for polarization with the help of pile of plates.
7. What are the steps involved in holography?

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8. What do you mean by pulse dispersion in optical fibers?

9. What is the major advantage of dye lasers?

10. $2p \rightarrow$ 1s transition in hydrogen has mean lifetime 1.6ns. Find Einstein's A coefficient.

(10 × 1 = 10 Marks)

PART – B

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

11. How can you use the Young's double slit experiment to measure the thickness of a thin transparent material?

12. On rainy days we can see coloured patches on roads. How does this occur? Explain.

13. List the characteristics of the interference fringes.

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

15. Explain what is meant by Poisson spot?

16. Distinguish between Fresnel and Fraunhofer diffractions.

17. Distinguish between normal and anomalous dispersion.

18. Explain the working of Nicol prism.

19. State and explain Malu's law.

20. Why do we consider hologram as a reliable medium for data storage?

21. What are the medical applications of holography?

22. What is meant by coherent bundle?

23. Explain the broad classification of fiber optic sensors.

24. What are the characteristics of laser? Explain.

25. What are some requirements needed for second harmonic generation?

26. What is the significance of the line shape function? What are the broadening mechanisms which affect it?

(8 × 2 = 16 Marks)

PART – C

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

27. In a biprism experiment to determine the wavelength of laser interference fringes of 0.3 cm width is observed when the source and screen are separated by 50 cm. The prism is made of a material with refractive index 1.5 and has a base angle 20'. It is kept 2 cm from the source. Determine the wavelength.

28. In Michelson interferometer experiment with sodium lamp, the distance traversed by the mirror between two successive disappearances is 0.289 mm. Calculate the difference in the wavelengths of the D lines, assuming that $\lambda = 589\ nm$.

29. How many half period elements can be obtained for a circular portion of 0.5 cm radius which is used with 500 nm light and the point of observation is 1 m away from the zone plate?

30. In Fresnel diffraction at straight edge, the second diffraction maximum is observed at 0.0866 cm. The source and screen are kept an equal distance of 25 cm from the straight edge. Find the wavelength of the light used and the position of the first diffraction minimum.

31. Write down the Cauchy's dispersion relation and obtain the expression for dispersive power of the medium from it.

32. A left circularly polarized beam of wavelength 532 nm is incident on a quartz crystal of thickness 0.025 mm. Determine the state of polarization of the emerging beam. Given $n_o = 1.54425$ and $n_e = 1.55336$.

33. For what wavelength in the visible region a quartz crystal of 0.015 mm thickness will act as a quarter wave plate. Given $n_o = 1.54425$ and $n_e = 1.55336$.

34. A laser of 600 nm is used to record a hologram made up a material of refractive index 1.495 at angle 60°. Calculate the spacing between the maxima.

35. In an optical fibre the refractive indices for core and cladding are 1.50 and 1.43 respectively. What is the value of the critical angle? Also find the angle of acceptance of cone.

36. Using Snell's law find acceptance angle for a step index fibre.

37. Find the ratio of Einstien's coefficients for a medium with refractive index 1.5 at 532 nm.

38. Draw the schematic representation of fiber optic communication system and explain the function of the components.

(6 × 4 = 24 Marks)

PART – D

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

39. Discuss with necessary theory, the Newton's ring experiment to determine the refractive index of a liquid.

40. Discuss the Fraunhofer diffraction at a double slit. Explain for the occurrence of missing orders in diffraction pattern.

41. Discuss the superposition of waves linearly polarized at right angles and analyse its different cases.

42. Discuss the classification of holograms.

43. Analyse the structure, principle, properties and types of optical fibers.

44. Analyse the working of He-Ne laser.

(2 × 15 = 30 Marks)
