(Pages : 4) **R – 1250**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme under CBCSS

Physics

Core Course XI

PY 1643 – CLASSICAL AND MODERN OPTICS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. When can we say a film is thin?
2. What is coherence?
3. Why do the secondary maxima and minima be not observed in the diffraction pattern of gratings?
4. State the Rayleigh criterion for resolution.
5. What is dispersion of light?
6. Is it correct to exchange a polarizer and analyser? Explain.
7. Define plane of polarization.

8. What makes laser an extremely useful tool for industrial applications?

9. Give the cross sectional view of the optical fibre.

10. How does a hologram be useful in three dimensional photography?

(10 × 1 = 10 Marks)

SECTION – B

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

11. Distinguish between constructive interference and destructive interference.

12. Explain with reason about Newton's rings formed under reflection by a white light source.

13. What is the Fresnel's principle of diffraction?

14. Why do convex lenses be used in Fraunhofer diffraction?

15. Give an account of the features of the central maximum due to Fraunhofer diffraction at a single slit.

16. Differentiate between ordinary and extraordinary rays.

17. Explain the structure of Nicol prism.

18. State and explain Malu' s law.

19. What is meant by phase matching?

20. Explain how population inversion is achieved in semiconductor lasers?

21. Distinguish between spatial coherence and temporal coherence.

22. List out the advantages of fibre optic communication system.

(8 × 2 = 16 Marks)

SECTION – C

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

23. When a thin sheet of transparent material of thickness 5×10^{-4} cm is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the 5th fringe. If $\lambda = 532$ nm, find the refractive index of the sheet.

24. A biprism is used to determine the wavelength of laser. Interference fringes of 0.4 cm width are observed when the source and screen are separated by 80 cm. The prism is made of a material with refractive index 1.50 and has a base angle 20'. It is kept 2 cm from the source. Determine the wavelength.

25. In an experiment using 500 nm light, the distance between the slit source and the edge is 5 m and between the edge and the eyepiece is also 5 m. Calculate the position of the first three maxima and their positions

26. Determine the minimum number of lines in the grating to resolve the sodium D lines of wavelengths 589.0 nm and 589.6 nm.

27. How many orders are possible for the spectra with a plane transmission grating having 15,000 lines per inch when a light of wavelength 532 nm is used?

28. Show that superposition of two plane polarized waves which are out of phase by 90° produce an elliptically polarized wave.

29. A laser beam produces a spot of 1 mm diameter at a distance of 1 m while the spot size is 2 mm at 5 m from it. Find its divergence.

30. The acceptance angle of an optical fibre is 30° The refractive for the core is 1.5. Calculate the refractive index of the cladding, critical angle and numerical aperture.

31. A reflection hologram is constructed using 532 nm laser on a film of refractive index 1.54 at angle 30°. Determine the spacing between interference maxima.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Explain the working and an application of Michelson's interferometer.

33. What is a zone plate? Compare it with a convex lens. Explain the action of a zone plate for an incident spherical wavefront.

34. With supporting diagrams explain the working of He-Ne laser.

35. Discuss about various types of fibres.

(2 × 15 = 30 Marks)