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Sixth Semester B.Sc. Degree Examination, April 2022

First Degree Programme under CBCSS

Physics

Core Course XI

PY 1643 – CLASSICAL AND MODERN OPTICS

(2014 & 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What is fringes of equal thickness?
2. Define fringe width.
3. What is division of amplitude?
4. State the Raleigh's criterion for resolution.
5. Write the condition for Fraunhofer diffraction.
6. State Brewster's law.
7. What is a quarter wave plate?
8. Give the difference between conventional photograph and hologram.

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9. For high frequency transition which is more prominent spontaneous emission or stimulated emission?

10. Write the relation connecting numerical aperture and acceptance angle.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Give the differences between interference and diffraction.

12. How will you distinguish elliptically polarized light and partially polarized light?

13. State the explain Malus Law.

14. Give the applications of holography.

15. Distinguish between spontaneous emission and stimulated emission.

16. Show that zone plate has multiple focii.

17. Explain the action of Nicol prism as analysis.

18. Distinguish between normal and anomalous dispersion.

19. Write any four applications of Lasers.

20. What is white-light reflection holography?

21. Write the important characteristics of laser beam.

22. Explain fiber optic sensors.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Calculate the thickness of a calcite plate, which would convert plane-polarized light into circularly polarized light. The principal refractive indices are $\mu_0 = 1.658$ and $\mu_e = 1.486$ at the wavelength of 5893 Å.

24. A plane transmission grating produces first order diffraction maximum at 19.5° for light of wavelength 5462 Å. Calculate the number of lines on the grating per unit length.

25. In a Newton's rings experiment, the diameter of the 15^{th} ring was found to be 0.59 cm and that of the 5^{th} ring was 0.336 cm. If the radius of the Plano-Convex lens is 100 cm calculate the wavelength of light used.

26. What is the highest order of spectrum which may be seen with monochromatic light of wavelength 6000 Å by means of a diffraction grating with 5000 line per cm.

27. How many half period elements are there in a circular portion of $10^{-2} m$ radius of a plane wave front given that the wavelength is $6 \times 10^{-7} m$ and the distance of the point of observation of the wave front is one meter?

28. The initial and final readings of a Michelson interferometer screw are $10.7347\,mm$ and 10.6903 mm as 150 fringes pass. Calculate the wavelength of light used.

29. A Narrow slit is illuminated by monochromatic light of wavelength $6 \times 10^{-7} m$. It is placed at a distance of 0.1m from a straight edge. If measurements are carried out at a distance equal to 1 m from the edge, what is the distance between the first and second dark bands.

30. A diffraction grating has 0.15 m of surface ruled with 6×10^5 lines/meter. What is its resolving power in the first order?

31. In an optical fibre, the core material has refraction index 1.6 and refractive index of clad material is 1.3. What is the valve of critical angle and acceptance angle?

(6 × 4 = 24 Marks)

SECTION – D

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

32. Explain the formation of interference fringes by an air-wedge. Derive an expression for the fringe width. How can the above method be used to measure the diameter of a thin wire accurately?

33. What is double refraction? Discuss Huygen's explanation for double refraction in uniaxial crystal.

34. Explain the working principle of Ruby laser and He-Ne laser.

35. (a) Distinguish between a step index fibre and graded index fibre.

(b) Enumerate the importance of optical fibre in communication.

(2 × 15 = 30 Marks)
