19U508S (Pages: 3) Name: ……..……..

Reg. No: ……

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS-UG)

CC15U PH5 B08 - PHYSICAL OPTICS AND MODERN OPTICS

(Physics - Core Course)

(2015 to 2018 Admissions – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

Section A

Answer all questions. Each question carries 1 mark.

1. Optical fibre communication is based on the principle of …….
2. Crystals which have only one optic axis is known as …….
3. When Sun light falls on a soap bubble, different colours are seen. This is due to …….
4. The laser beams used to construct hologram are called reference beam and ……. beam
5. To observe diffraction phenomena, the size of an obstacle should be …….

Write True or False:

6. The value of the determinant of translation matrix is zero.
7. Refractive index is the ratio of velocity of light in vacuum to that in a medium.
8. Sound waves cannot be polarized like light waves.
9. Resolving power is a dimensionless quantity.
10. Optical path is always larger than geometrical path of light

(10 x 1 = 10 Marks)

Section B

Answer all questions. Each question carries 2 marks

11. Distinguish between Fresnel diffraction and Fraunhofer diffraction.
12. State Fermat's principle of least time.
13. Define resolving power.
14. What are the necessary conditions for producing sustained interference?
15. What are the applications of holography?
16. Define acceptence angle. Give an expression for it.
17. What is a wave plate?

(7 × 2 = 14 Marks)

Section C

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

18. Derive the system matrix for a thick lens.
19. Compare the action of a zone plate with a convex lens.
20. Derive an expression for Numerical aperture.
21. Distinguish between positive and negative crystals.
22. Obtain an expression for the resolving power of a grating.
23. Derive a condition for the missing orders of interference maxima in double slit diffraction pattern.
24. How will you distinguish a circularly polarised light, elliptically polarised light and partially polarised light?

(5 × 4 = 20 Marks)

Section D

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

25. An optic fiber has a core of refractive index 1.54 and cladding of refractive index 1.45. Calculate the numerical aperture and acceptance angle.
26. Calculate the thickness of a quarter wave plate and a half wave plate for the light of wavelength 500 nm Given μ_e=1.553 and μ_o=1.544.
27. In a biprism experiment with sodium light (λ= 5893Å) the micro meter reading is 2.32 mm when the eyepiece is placed at a distance of 100 cm from the source. If the distance between two virtual sources is 2 cm, find the new reading of micro meter when the eyepiece is moved such that 20 fringes cross the field of view.
28. Light of wavelength 5880 Å is incident on a thin film of glass of μ= 1.5 such that the angle of refraction in the plate is 60°. Calculate the smallest thickness of the plate which will make it dark by reflection.
29. Newton's rings are observed in reflected light of $\lambda = 5.6 \times 10^{-7} m$. The diameter of the 10th dark ring is 1 cm. find the radius of curvature of the lens and the thickness of the air film.
30. Calculate the dispersive power of the grating in the region of 5000 Å in the third order spectrum. Number of lines per cm of the grating is 4000.
31. When the movable mirror of a Michelson interferometer is moved by 0.0589 mm, a shift of 200 fringes is observed. What is the wavelength of light used?

(4 × 4 = 16 Marks)

Section E (Essays)

Answer any ***two*** questions. Each question carries 10 marks

32. Discuss the Fraunhofer class of diffraction of light on a single slit and to establish a relation for intensity variation of the diffraction pattern on the screen.
33. Explain with theory the production of circularly polarised and elliptically polarised light waves. How we can detect these waves?
34. State and explain Fermat's principle of stationary time. Derive the laws of refraction using this principle.
35. What is holography? Discuss the technique in recording a hologram and reconstruction of image from a hologram. Explain some applications of holography.

(2 × 10 = 20 Marks)

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