D 70335

(Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 08/APY 5B 09—PHYSICAL OPTICS AND MODERN OPTICS

Time : Three Hours

Maximum : 80 Marks

The symbols used in the question paper have their usual meanings.

Section A

Answer in a word **or** *a phrase.*
Answer **all** *questions.*
Each question carries 1 *mark.*

1. The determinant of translation matrix is ————.
2. The light gathering power in an optical fibre is given by ————.
3. In Newton's rings central spot is ————.
4. Several images can be recorded in a ————.
5. The optical path traversed by light wave when reflected from the lower surface of a thin film ———— with increase of refractive index of the film

Write True *or* False :

6. In N slit Fraunhofer diffraction pattern the principal maximum becomes sharper as N decreases.
7. The diffraction pattern due to circular aperture for a plane wave are concentric circular rings.
8. Both Ordinary ray and Extra ordinary rays are plane polarized.
9. Larger the grating element larger will be the angular dispersion.
10. A hologram records both intensity and phase of light wave.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 *marks.*

11. State Fermats principle of stationary time. Explain with respect to elliptical reflector.
12. To get more directionality for sound waves how will you select the diameter of the loud speaker ?

Turn over

13. For the normal incidence of a parallel light beam on a thin film of refractive index n, state the condition for destructive and constructive interference. Explain.
14. Explain colour of thin films.
15. State and explain the principle of superposition of light waves.
16. Describe any one application of Holography.
17. Interference colours are not observed in thick plates or glass slabs. Why ?

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions in paragraph of about a* **half a page to one page.**

Each question carries 4 marks.

18. Derive the condition for image plane with respect to a refracting surface.
19. Discuss on the resolving power of a microscope. Why oil immersion objectives are preferred in microscopes ?
20. Explain the construction of Fresnel's half period zones on a plane wave front. Find the area of each zone.
21. Describe Michelson interferometer with neat diagram and explain how it can be used to measure wavelength of light.
22. Discuss the application of the thin film interference phenomenon in reducing the reflectivity of lens surfaces.
23. Represent the effect of translation of a ray through a distance D in a homogenous medium of refractive index μ by the translation matrix.
24. Give the theory of Holography.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*

Each question carries 4 marks.

25. Find the system matrix for a thin lens placed in air and made of refractive index 1 .6 and radii of curvature 40cm each.
26. In a biprism experiment, interference fringes are observed at a distance of 1 m away from it. The refractive index of the material of the biprism is 1.5. If the distance between the source and the biprism is 10cm, calculate the fringe width when wave length of light used is 5000A°. Given that the biprism has refracting angle 1^0.

27. Newton's rings are observed in reflected light of wavelength 6×10^{-7}m. The diameter of the 10th dark ring is 0.3cm. Find the thickness of the air film and the radius curvature of the lens.

28. If the diameter of the pupil of the eye is 2mm, find the minimum separation between two points to be resolved by eye. Given that the distance of the points from the eye is 30m and the points are red in colour with wavelength 6×10^{-7}m.

29. A zone plate has radii $r_n = 0.001 \sqrt{n}m$ for $\lambda = 4.5 \times 10^{-7}$m, find the positions of foci.

30. Calculate the thickness of double refracting plate capable of producing a path difference of $\lambda/4$ between extraordinary and ordinary waves. Given $\lambda = 5500A^0$, refractive index of e-ray = 1.54, refractive index of o-ray = 1.53.

31. For a step index fibre the refractive index of core is 1.50, and refractive index of cladding is 1.48. Calculate the temporal broadening after 1 km. The core radius is such that the ray optics is valid.

(4 × 4 = 16 marks)

Section E (Essays)

Answer in about **two pages.**
Answer any **two** *questions.*
Each question carries **10** *marks.*

32. What are coherent sources ? Derive an expression for the resultant intensity when two coherent beams of light are superposed. What will be the intensity when two sources are incoherent ?

33. Discuss Fraunhofer diffraction pattern produced by a long single slit. Find positions of maximum and minimum intensity.

34. Describe how you produce circularly and elliptically polarized lights ? How will you analyse the type of polarization ?

35. Describe the propagation of light through an optical fibre. Examine the pulse dispersion with respect to step index fibre. Explain how pulse dispersion is reduced in Graded indexed fibre.

(2 × 10 = 20 marks)