FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017
(CUCBCSS—UG)

Physics/Applied Physics

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

Time: Three Hours 

Maximum: 80 Marks

Section A (Answer in a Word or Phrase)

Answer all questions.

Each question carries 1 mark.

1. To determine optical rotation of solutions ——— is used.
   (a) Interferometer. 
   (b) Spectrometer.
   (c) Magnetometer. 
   (d) Polarimeter.

2. Wide separation of spectral lines indicates:
   (a) High resolving power.
   (b) High magnifying power.
   (c) High dispersive power.
   (d) None of these.

3. A biprism produce N1 fringes with light of wavelength \( \lambda_1 \). The number of fringes with wavelength \( \lambda_2 \) is ———
   (a) \( \lambda_1 N_1/\lambda_2 \).
   (b) \( \lambda_2 N_1/\lambda_1 \).
   (c) \( \lambda_1/\lambda_2 N_1 \).
   (d) \( [\lambda_1/\lambda_2]^2 N_1 \).

4. The inability of a spherical lens to produce point image of point object is called ———.

5. Phase difference/path difference ———.
   (a) \( \lambda \).
   (b) \( 2\pi \).
   (c) \( \lambda/2\pi \).
   (d) \( 2\pi/\lambda \).

6. The basic principle of optic fiber is ———.

7. The sine of acceptance angle is called ———.

8. Transverse nature of light was established by the phenomenon ———.

9. In the case of grating \( \lambda/d\lambda \) is called ———.

10. ——— eye piece is achromatic for all colours.

(10 x 1 = 10 marks)

Turn over
Section B
(Answer in a short paragraph-three or four sentences).
Answer any all questions.
Each question carries 2 marks.

11. What is meant by optical path?
13. What are fiber optic sensors?
14. Define Translation matrix and refraction Matrix of an optical system.
15. Compare a zone plate and a convex lens.
16. When Newton's rings are formed with white light which colour will be on the outer edge. Why?
17. How are the hologram classified? Explain.

(7 x 2 = 14 marks)

Section C
(Answer in a paragraph of about half a page to one page)
Answer any five questions.
Each question carries 4

18. State and explain Fermat's principle of extremum path and use it to deduce the laws of reflection and refraction of light.
19. Explain advantages of optical communication.
20. Show that for a thin air film enclosed between a convex lens and glass plate radii of dark rings of interference pattern are directly proportional to square root of natural numbers.
21. Distinguish between step index fiber and graded index fiber.
22. What are coherent sources? Explain conditions for interference.
23. Explain working of Michelson interferometer.
24. Explain colour of thin film in white light.

(5 x 4 = 20 marks)

Section D
(Problems- write all relevant formulas. All important steps carry separate marks).
Answer any four questions.
Each question carries 4

25. A soap film $5 \times 10^{-6}$ cm. thick is viewed at an angle of $35^\circ$ to the normal. Find the wavelength of light in the visible spectrum which will be absent from the reflected light. Given $\mu = 1.33$?
26. What is the radius of the 1st half period zone in a zone plate behavior like a convex lens of focal length 60 cm. for light of wavelength 6000 Å?

27. Calculate the thickness of (a) Quarter wave plate; and (ii) A half wave plate. Given that \( \mu_0 = 1.973, \mu_e = 2.656 \) and \( \lambda = 590 \) nm.

28. Show that areas of half period zones are equal.

29. Calculate the angle of acceptance of a given optical fiber, if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively.

30. The critical angle of incidence for total reflection in case of water is 48°. What is its polarization angle? What is the angle of refraction corresponding to the polarization angle?

31. In Fraunhofer diffraction pattern due to a narrow slit a screen is placed 2 m. away from the lens to obtain the pattern. If the slit width is 0.2 mm and the first minimum lie 5 mm. on either sides of the central maximum, find the wavelength of light.

\( (4 \times 4 = 16 \text{ marks}) \)

Section E (Essays - Answer in about two pages)

Answer any two questions.

Each question carries 10 marks.

32. With a diagram explain diffraction by circular aperture. Using the theory of grating, explain how wavelength of light is determined in normal incidence mode.

33. Describe with theory Young’s experiment for the determination of band width of interference pattern due to two coherent sources? Also draw the intensity distribution for the same.

34. Explain the rectangular propagation of light on the basis of Fresnel’s half period zone.

35. Write principle of holography? Describe the recording and rerecording process in holography with the help of suitable diagrams.

\( (2 \times 10 = 20 \text{ marks}) \)