FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2013

(UG-CCSS)

Physics (Core Course)

PH 5B 11/AP 5B 13—PHYSICAL OPTICS AND MODERN OPTICS

(Common for Applied Physics)

Time : Three Hours   Maximum : 30 Weightage

Section A

Answer all questions.

1. The superposition of two or more waves in a medium is known as :

    (a) Reflection.   (b) Refraction.

    (c) Interference.   (d) Polarisation.

2. The waves that cannot be polarised :

    (a) Light waves.   (b) Sound waves.

    (c) Electromagnetic waves.   (d) None.

3. Malus law is :

    (a) $I = I_0 \cos^2 \theta$.   (b) $I = I_0^2 \cos^2 \theta$.

    (c) $I = I_0 \sin^2 \theta$.   (d) $I = I_0^2 \sin^2 \theta$.

4. Optical fibre works on the principle of :

    (a) Refraction.   (b) Total internal reflection.

    (c) Interference.   (d) Diffraction.

5. In interference there is redistribution of :

    (a) Amplitude.   (b) Frequency.

    (c) Phase.   (d) Energy.

6. If the light is completely polarised by reflection at a plane refracting surface, then the angle between reflected and refracted light is :

    (a) π.   (b) $\dfrac{\pi}{2}$.

    (c) $\dfrac{\pi}{4}$.   (d) zero.

Turn over

7. Polarisation of light proves :

   (a) Quantum nature of light.   (b) Corpuscular nature of light.

   (c) Transverse nature of light.   (d) Longitudinal nature of light.

8. Colours in a thin film results from :

   (a) Dispersion of light.   (b) Interference of light.

   (c) Absorption of light.   (d) Scattering of light.

9. Two coherent sources of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resultant beam is :

   (a) 5 I and I.   (b) 9 I and I.

   (c) 5 I and 3 I.   (d) 9 I and 8 I.

10. The focal length of the zone plate is :

    (a) $f = \dfrac{r_n^3}{n\lambda}$.   (b) $f = \dfrac{r_n}{n\lambda}$.

    (c) $f = \dfrac{r_n^2}{n\lambda}$.   (d) $f = \dfrac{r_n}{n^2\lambda}$.

11. The path difference between ordinary and extraordinary ray in a quarter wave plate is :

    (a) λ.   (b) $\dfrac{\lambda}{2}$.

    (c) $\dfrac{\lambda}{4}$.   (d) Zero.

12. The inner portion of optical fibre is called :

    (a) Core.   (b) Cladding.

    (c) Jacket.   (d) None.

    (12 × ¼ = 3 weightage)

Section B

Answer all questions.

13. What is meant by system matrix ?

14. A very thin film does not show colour, why ?

15. Distinguish between interference bands and diffraction bands.

16. Compare zone plate with a convex lens.

17. What is optical activity ?

18. What is double refraction ?

19. What is a hologram ? How does it differ from a photograph ?

20. Mention a few applications of optical fibre.

21. What are coherent sources ? Give *two* examples.

$(9 \times 1 = 9$ weightage)

Section C

Answer any five questions.

22. In an Young's double slit experiment, the two slits have a width ratio of 1 : 4. Find the ratio of maximum intensity to minimum intensity in the interference pattern.

23. A parallel beam of light $(\lambda = 5890 A^\circ)$ is incident on a thin glass plate $(n = 1.5)$ such that the angle of refraction is 60°. Calculate the smallest thickness of the plate which will appear dark by reflection.

24. In Newton's ring experiment the diameter of the 4th dark ring is 0.34 cm. using a light of wavelength 589.3 nm. Calculate the radius of the curvature of the convex lens.

25. Calculate the size of the circular aperture on a screen which would transmit 4 Fresnel's zones to a point 10 m away, if the wavelength of light used is 589 nm ?

26. What is the longest wavelength of light for which a spectrum can be obtained using a grating of 6000 lines per cm, under normal incidence ?

27. Calculate the minimum thickness of a quarter wave plate of calcite for a wavelength 5893 A°. Given $\mu_0 = 1.652, \mu_E = 1.488$.

28. What is the concentration of sugar solution of length 15 cm. if the optical rotation produced is 7° and specific rotation is 65°.

$(5 \times 2 = 10$ weightage)

Section D

Answer any two questions.

29. Give the theory of zone plate. Derive an expression for its focal length.

30. With necessary theory, explain the formation of colours in thin film.

31. What is numerical aperture ? Derive an expression for it.

$(2 \times 4 = 8$ weightage)