

E 2217

(Pages : 3)

Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2011

Fifth Semester

Core Course—PHYSICAL OPTICS AND PHOTONICS

(Common for (1) Model I Physics ; (2) Model II Physics ; (3) Physics — EEM and
(4) Physics Instrumentation)

Time : Three Hours

Maximum Weight : 25

Part A (Objective Type Questions)

Answer all questions.

Each bunch of four questions carries a weight of 1.

Bunch I

Choose the correct answer :

1. Interference is due to the superposition of :

- | | |
|-----------------------------------|------------------------------|
| (a) Coherent waves. | (b) Waves of same amplitude. |
| (c) Waves of different amplitude. | (d) None of these. |

2. The function of a zone plate is similar to that of a :

- | | |
|------------------------|-------------------------|
| (a) Convex lens. | (b) Concave lens. |
| (c) Plano convex lens. | (d) Plano concave lens. |

3. Double refraction is associated with :

- | | |
|-------------------|------------------|
| (a) Interference. | (b) Diffraction. |
| (c) Polarisation. | (d) Refraction. |

4. Through suitable pumping mechanism, the medium is taken into the state of :

- | | |
|--------------------|---------------------------|
| (a) Lasing action. | (b) Population inversion. |
| (c) Equilibrium. | (d) None of these. |

Bunch II

Fill in the blanks :

5. In Newton's ring arrangement, the ——— of the air film at the point of contact is zero and gradually increases as we move outward.
6. When unpolarised light is incident at ——— angle on a smooth glass plate, the reflected light is totally polarized.
7. The ruby laser has a ——— level pumping scheme.
8. Numerical aperture is the ——— of the acceptance angle.

Turn over

Bunch III

State True or False :

9. In Michelson interferometer, circular fringes are produced with monochromatic light when the mirrors M_1 and M_2 are exactly perpendicular to each other.
10. Joseph Fraunhofer used the first grating which consisted of a large number of parallel fine wires stretched on a frame.
11. The half-wave plate will not invert the handedness of elliptical or circular polarized light.
12. A semiconductor diode laser emits coherent light when it is reverse biased.

Bunch IV

Match the following :—

- | | | |
|-----------------------|-----------------|---------------|
| 13. Zone plate | Calcite crystal | Graphene |
| 14. Double refraction | Fresnel | Cladding |
| 15. Holography | Core | Diffraction |
| 16. Sheath | Holos | Nichol prism. |

(4 × 1 = 4)

Part B (Short Answer Questions)

Answer any five questions.

Each question carries a weight of 1.

17. How can coherent sources be obtained in practice ?
18. What do you mean by localized fringes ?
19. What is a zone plate ? Explain.
20. What is pile of plates ?
21. What is a quarter wave plate ?
22. Explain population inversion.
23. What is holography ? Explain.
24. What is graded index fiber ?

(5 × 1 = 5)

Part C (Short Essay/Problems)

Answer any four questions.

Each question carries a weight of 2.

25. Newton's rings are formed in reflected light using a plano convex lens of radius of curvature one metre and a plane glass plate. Find the radius of the 10th dark ring if sodium light of wavelength 590 nm. is used.
26. For a sodium lamp, the distance moved by the moving mirror of Michelson interferometer is 0.289 mm. for two distinct appearances for the fringe system. Calculate the difference in wavelength. Mean $\lambda = 589$ nm.

27. Distinguish between Fresnel and Fraunhofer classes of diffraction.
28. Determine the polarizing angle on the surface of water. Refractive index of water air interface is 1.333.
29. Bring out the role of metastable states in laser media.
30. Find the relative populations of the two stages in ruby laser that produces a light beam of wavelength 694 nm. of 300 K.

(4 × 2 = 8)

Part D (Essay)

Answer any two questions.

Each question carries a weight of 4.

31. Discuss the theory of Newton's rings and determination of wavelength.
32. Distinguish between Plane polarized, circularly polarized and elliptically polarized light.
33. Give an account on the working of solid state ruby laser.

(2 × 4 = 8)