B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2013

Fifth Semester

Core Course—PHYSICAL OPTICS AND PHOTONICS

(Common for Model I and Model II B.Sc. Physics, B.Sc. Physics EEM and
B.Sc. 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. Which of the following can be deduced from Fermat's principle :

    (a) principle of reversibility.   (b) lens makers formula.

    (c) thin lens formula.   (d) all of the above.

2. Two light sources are said to be coherent, when :

    (a) their wavelengths are equal.

    (b) their frequencies are equal.

    (c) their amplitudes are equal.

    (d) their frequencies are equal and their phase difference is a constant.

3. In a five slit diffraction pattern, there are ———— number of interference minima and ————
    number of secondary maxima.

    (a) 5,5.   (b) 4,3.

    (c) 3,4.   (d) 4,4.

4. A quarter wave plate is used to produce :

    (a) circularly polarized light.   (b) elliptically polarized light.

    (c) linearly polarized light.   (d) all are correct.

BUNCH II

5. It is possible to change the colour of the laser beam through :

    (a) second harmonic generation.   (b) sum and difference frequency generator.

    (c) parametric oscillation.   (d) all are correct.

6. Pulse dispersion is due to :

    (a) pulse broadening.   (b) various propagation phenomena.

    (c) various single mode propagation. (d) multimode propogation.

7. Optical beams have frequencies in the range of :

    (a) 500 MHz-900 MHz.   (b) 10^{14} Hz to 10^{15} Hz .

    (c) 600 KHz to 2 MHz .   (d) 5 MHz to 100 MHz.

8. A semiconductor laser can give rise to a colour :

    (a) UV.   (b) IR.

    (c) red, green or blue.   (d) anywhere in the spectrum from UV to IR.

BUNCH III

9. In a Michelson Interferometer, instead of monochromatic light, if white light is used, interference obtained will :

    (a) coloured.   (b) circular.

    (c) straight.   (d) none of these.

10. Sunlight filtering through tree leaves often makes circular patches in the ground because :

    (a) the sun is round.   (b) the space through light penetrates is round.

    (c) light is transverse in nature .   (d) of different effects.

11. A -ve zone forms a :

    (a) real image.   (b) virtual image.

    (c) both real and virtual.   (d) none of these.

12. A Nicol prism is based on the principle of :

    (a) refraction.   (b) dichroism.

    (c) scattering.   (d) double refraction.

BUNCH IV

13. Laser comes under the general name :

    (a) Electronics.   (b) Optoelectronics.

    (c) Photonics.   (d) Optics.

14. The best material suitable for making non-reflecting film is :

    (a) CaF_2.   (b) NaF_2.

    (c) MgF_2.   (d) none of these.

15. Compact disc shows colour in white light due to :

    (a) interference.   (b) diffraction.

    (c) polarization.   (d) scattering.

16. The different faces of a zone plate $f_1:f_2:f_3$ are in the ratio :

    (a) 1:2:3.   (b) 3:2:1.

    (c) 15:5:3.   (d) none of these.

                                                                        $(4 \times 1 = 4)$

Part B (Short Answer Questions)

Answer any five questions.
Each question carries a weight of 1.

17. What is an air wedge ?

18. Why an extended source of light is essential to observe colours in thin films ?

19. Why diffraction of sound is more evident in daily life than light ?

20. What are Fresne's half period zones ?

21. Define refractive index of (a) ordinary ray (b) extra ordinary ray.

22. Define the acceptance angle. Give an expression for it.

23. Explain what is meant by a metastable state.

24. What are uniaxial and biaxial crystals ? Give one example each.

                                                                        $(5 \times 1 = 5)$

Part C (Short Essay/Problems)

Answer any four questions.
Each question carries a weight of 2.

25. A 20 cm long tube containing 50 cm³ sugar solution produces an optical rotation of 10°. Calculate the quantity of sugar solution contained in the solution. Specific rotation of sugar is 65°.

26. A radius of first zone in the zone plate is 0.05 cm. If a plane wavefront of wave length equals 5000°A is incident on it. Find the distance of the screen from the zone plate so that light is focused to bright spot.

27. How population inversion is achieved in a semiconductor ?

28. Derive an expression for fringe in wedge shaped film.

29. Obtain an expression for numerical aperture for step index fibre.

30. In the Michelson Interferometer arrangement, if one of the mirrors is moved by a distance of 0.08 mm, 250 fringes cross the field of view. Calculate the wavelength.

                                                                        $(4 \times 2 = 8)$

                                                                        Turn over

Part D (Essays Type)

*Answer any **two** questions.*
Each question carries a weight of 4.

31. Discuss the principle, construction and working of a Ruby Laser.

32. What is a zone plate ? How it forms the image of an object and derive an expression for its focal length ?

33. Explain the formation of Newton's Rings. How can it be used to determine the wavelength of a monochromatic light ?

$$(2 \times 4 = 8)$$