E 2788　　　　　　　　(Pages : 4)　　　　　　Reg. No...................................

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B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH/APRIL 2012

Fourth Semester

Complementary Course—PHYSICAL OPTICS, LASER PHYSICS AND SUPERCONDUCTIVITY

(For the Programmes B.Sc. Chemistry Model-I, B.Sc. Geology and B.Sc. Chemistry—
Environment and Water Management)

Time : Three Hours　　　　　　　　　　　　　　　　　　Maximum Weight : 25

Part A

Answer all questions.
Objective Type Questions–Weight 1 for each bunch of four questions.

Bunch I

1. The resultant intensity of light at the point of destructive interference will be :

    (a) Greater than the sum of the intensities due to individual waves.

    (b) Less than the sum of the intensities due to individual waves.

    (c) Equal to the sum of the intensities due to individual waves.

    (d) None of these.

2. The half period zones differs from its neighbor by a phase difference of :

    (a) $\pi/2$.　　　　　　　　　　　　　(b) π.

    (c) 2π.　　　　　　　　　　　　　(d) $\pi/4$.

3. Of the following which produces o-ray and e-ray :

    (a) Uniaxial crystal.　　　　　　　　(b) Biaxial crystal.

    (c) Isotropic crystal.　　　　　　　　(d) Anisotropic crystal.

4. The number of spontaneous transitions depends on :

    (a) Number of atoms at the excited state.

    (b) Number of atoms at the equilibrium state.

    (c) Number of atoms at the lower state.

    (d) None of these.

Bunch II

5. The optical path difference between the waves emerging from the slits in the Young's double experiment is :

    (a) xd/D.　　　　　　　　　　(b) $x\mathrm{D}/d$.

    (c) $d\mathrm{D}/x$.　　　　　　　　　　(d) $xd\mathrm{D}$.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　Turn over

Part D

Answer **two** *questions.*
Essay–Weight 4 each.

31. Discuss Young's experiment to demonstrate interference in light. Obtain relationship for bandwidth.

32. Give the theory of plane transmission grating. Explain how the spectrum of a polychromatic source of light is formed.

33. Describe the construction, working and theory of a four level laser.

$(2 \times 4 = 8)$

6. The ability of an optical instrument to produce distinctly separate images of two objects located very close to each other is its :

  (a) Dispersive power.   (b) Resolving power.

  (c) Separation power.   (d) None of these.

7. For a positive crystal for double refraction :

  (a) $\mu_e > \mu_0$.   (b) $\mu_e < \mu_0$.

  (c) $\mu_e = \mu_0$.   (d) All the above.

8. The population inversion in ruby laser is due to :

  (a) Electrical pumping.   (b) Magnetic pumping.

  (c) Optical pumping.   (d) None of these.

Bunch III

9. According to Newton's rings theory, the radii of the dark rings are proportional to :

  (a) Natural numbers.

  (b) Square root of ode natural numbers.

  (c) Square root of even natural numbers.

  (d) Square root of natural numbers.

10. The path difference between the secondary waves emerging from the extreme points of the grating will be :

  (a) 3λ.   (b) 2λ.

  (c) 4λ.   (d) λ.

11. The phase of difference between e-ray and o-ray introduced by a half wave plate is :

  (a) 90°.   (b) 180°.

  (c) 270°.   (d) 360°.

12. Carbon dioxide laser is a :

  (a) Two level one.   (b) Three level one.

  (c) Four level one.   (d) None of these.

Bunch IV

13. In the formation of Newton's rings in reflected system, the central spot is :

  (a) Dark.   (b) Bright.

  (c) Uniformly illuminated.   (d) None of these.

14. Light in which the planes of vibration are symmetrically distributed about the propagation of direction of the wave :

  (a) Polarised light.   (b) Unpolarised light.

  (c) Linearly polarised light.   (d) Circularly polarized light.

15. At thermal equilibrium the population at the energy levels is given by :

    (a) Dalton's theory.   (b) Boltzmann's law.

    (c) Partition function.   (d) All the above.

16. According to BCS theory, superconductivity is due to :

    (a) Super cooling.   (b) Super heating.

    (c) Pairing of electrons.   (d) None of these.

$$(4 \times 1 = 4)$$

Part B

*Answer **five** questions.*
Short Answer Questions—Weight 1 each.

17. How can coherent sources be obtained in practice ?

18. What is interference ? Explain.

19. Why Newton's rings are circular ?

20. What is dispersive power ? Explain.

21. Explain double refraction in uniaxial crystal.

22. Distinguish between Quarter wave plate and Half wave plate.

23. What are Einstein coefficients ?

24. What is Meissner effect ?

$$(5 \times 1 = 5)$$

Part C

*Answer **four** questions.*
Short Essay / Problems—Weight 2 each.

25. Newton's rings are formed in reflected light using a plano convex lens of radius of curvature 1m and a plane glass plate. Find the radius of the tenth dark ring if sodium light of wavelength 590 nm is used.

26. Find the highest order spectrum of sodium light of wavelength that can be observed using a grating with 6×10^5 lines per meter.

27. A grating has a total of 15000 lines on it. Find its resolving power at a wavelength 500 nm in the first order and second order.

28. Calculate the thickness of quarter wave plate of quartz crystal to be used with light of wavelength 500 nm if the refractive index of extraordinary light is 1.553 and that of ordinary light is 1.544.

29. Estimate whether amplification and hence laser production is possible using a radiation of wavelength 600nm irradiated on a medium at a temperature of 500 K.

30. What is superconducting phenomenon ? Give examples. Distinguish between type I and type II superconductors.

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

Turn over