## C.B.C.S.S.—B.Sc. DEGREE EXAMINATION, APRIL 2011

### Fourth Semester

### Complementary Course—PHYSICAL OPTICS, LASER PHYSCIS AND SUPERCONDUCTIVITY

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

Time : Three Hours                                                          Maximum Weight : 25

### Part A (Objective Type Questions)

*Answer all the questions.*
*Each bunch of four questions carries a weight of 1.*

Bunch I

1. The superposition of two sinusoidal waves having the same frequency but with a phase difference produces a sinusoidal wave with the same frequency but with :

    (a) Different amplitude.            (b) Different velocity.

    (c) Different wavelength.           (d) None of these.

2. The half period zones differs from its neighbour by a path difference of :

    (a) $\lambda$.                          (b) $2\lambda/2$.

    (c) $\lambda/4$.                        (d) $\lambda/2$.

3. Along optic axis $e$-ray and $o$-ray has :

    (a) Same velocity.                  (b) Different velocity.

    (c) Greater velocity for $e$-ray.   (d) Greater velocity for $o$-ray.

4. The population inversion in a medium is possible with :

    (a) Cooling.                        (b) Magnetizing.

    (c) Pumping.                        (d) None of these.

Bunch II

5. The fringe separation in Young's double slit experiment is :

    (a) $Dd\lambda$.                    (b) $\lambda d/D$.

    (c) $4\lambda/Dd$.                  (d) $\lambda D/d$.

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) Both (a) and (b).               (d) None of these.

Turn over

7. For a negative crystal for double refraction :

    (a) $\mu_e > \mu_o$.

    (b) $\mu_e < \mu_o$.

    (c) $\mu_e = \mu_o$.

    (d) All the above.

8. The phenomenon of forced photon emission by an excited atom due to the action of an external agency is called :

    (a) Induced emission.

    (b) Stimulated emission.

    (c) Spontaneous emission.

    (d) None of these.

**Bunch III**

9. In Newton's rings the spacing between fringes get :

    (a) Farther and farther at the outer rings.

    (b) Closer and closer at the outer rings.

    (c) The same spacing through out.

    (d) None of these.

10. The proposer of plane transmission grating was :

    (a) Fraunhoffer.

    (b) Fresnel.

    (c) Young.

    (d) Newton.

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

    (a) $90°$.

    (b) $180°$.

    (c) $270°$.

    (d) $360°$.

12. Which of the following is generally not superconductors :

    (a) Trivalent metal.

    (b) Divalent metal.

    (c) Monovalent metal.

    (d) All the above.

**Bunch IV**

13. The colours of thin films are due to :

    (a) Diffraction.

    (b) Polarization.

    (c) Dispersion.

    (d) Interference.

14. The expression $\mu = \tan \theta_p$, for plane polarized light is :

    (a) Malu's law.

    (b) Brewster's law.

    (c) Snell's law.

    (d) None of these.

15. The pumping in He-Ne laser is :

    (a) Electrical.

    (b) Optical.

    (c) Magnetical.

    (d) All the above.

16. When a magnetic material is super cooled it becomes :

    (a)  Ferromagnetic.                    (b)  Diamagnetic.

    (c)  Paramagnetic.                     (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. Explain why two independent sources of light of the same wavelength cannot produce interference fringes.

18. What is resolving power ? Explain.

19. How would obtain Newton's rings with bright center ?

20. State and explain Malu's law.

21. What is double refraction ?

22. What is a Polaroid ? Explain.

23. Write three applications of laser beams.

24. What is Josephson's effect ? Explain.

                                                                        $(5 \times 1 = 5)$

## Part C (Short Essay/Problems)

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

25. Green light of wavelength 510 nm from a narrow slit is incident on a double slit. On a screen placed 200 cm. away, the separation fo 10 fringes is found to be 2 cm. Find the slit separation.

26. Newton's rings are formed in reflected light of wavelength 589 nm using a convex lens of radius 1.1 m. and a glass plate. Find the radius of the seventh dark ring.

27. Find the resolving power of a grating with 6000 lines per cm. and 3 cm. wide in the first order spectrum.

28. Determining the polarizing angle on the surface of water. Refractive index of water air interface is 1.35.

29. Discuss on the energy levels of ruby laser.

30. Calculate the ratio of spontaneous emission to stimulated emission if wavelength of radiation is 600 nm at 2500 K. Given $h = 6.6 \times 10^{-34}$ JS and $K_B = 1.538 \times 10^{-23}$ SI units.

                                                                        $(4 \times 2 = 8)$

## Part D (Essay)

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

31. With a neat diagram, explain the formation of Newton's rings. How can you determine the wavelength of light ?

32 Explain plane, circular and elliptical polarization of light. How can you produce and detect them ?

33 What is superconductivity ? Briefly outline the BCS theory. What are the possible applications of superconductivity ?

                                                                        $(2 \times 4 = 8)$