

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2015****Fourth Semester****Complementary Course—PHYSICAL OPTICS, LASER PHYSICS AND  
SUPER CONDUCTIVITY**

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

[Prior to 2013 Admissions]

Time : Three Hours

Maximum Weight : 25

**Part A**

Answer **all** questions.

Objective type question-Weight 1 for each bunch.

**BUNCH I**

- In Young's double slit experiment the coherent sources and screen are at distance of "D" and the separation between the coherent sources are 'd' The Band width  $\beta =$  \_\_\_\_\_.  
(a)  $\frac{\lambda d}{D}$  (b)  $\frac{\lambda D}{d}$   
(c)  $\frac{\lambda D d}{Q}$  (d)  $\frac{\lambda D}{Q}$
- In Newton's rings experiment, the finger are.  
(a) Elliptical in shape. (b) Cylindrical in shape.  
(c) Circular in shape. (d) Spherical Shape.
- The first successful laser using a large synthetic ruby crystal was built by :  
(a) Teodore H Maimann. (b) Charles Townes.  
(c) Feimann. (d) Albert Einstein.
- The Super conducting materials are :  
(a) Paramagnets. (b) Ferro magnets.  
(c) Diamagnetic. (d) None of these.

**BUNCH II**

- The phenomenon of polarization proves that the light was in \_\_\_\_\_.  
(a) Longitudinal.  
(b) Transverse.  
(c) Combination of Transverse and Longitudinal.  
(d) Progressive waves.

**Turn over**

6. A laser beam of wave length  $8000 \text{ \AA}$  is sent to Satellite at a distance of  $4 \times 10^5 \text{ Km}$  from the Earth. The angular spread of beam when the aperture is  $5 \times 10^{-3} \text{ m}$  is :
- (a) 1.6 radian. (b)  $1.6 \times 10^{-12}$  radian.  
 (c)  $1.6 \times 10^{-4}$  radian. (d)  $1.6 \times 10^{-9}$  radian.
7. Red light of wavelength  $650 \text{ nm}$  from a distant source falls on a slit  $0.5 \text{ mm}$  wide slit is placed  $1.8 \text{ m}$  from it. The band width is :
- (a)  $5 \times 10^{-3} \text{ m}$ . (b)  $.5 \times 10^{-3} \text{ m}$ .  
 (c)  $15 \times 10^{-3} \text{ m}$ . (d) None of these.
8. The YAG Laser is a solid state laser. It is a :
- (a) Two level laser. (b) Three level laser.  
 (c) Four level laser. (d) Single level laser.

## BUNCH III

9. According to the B.Sc. Theory the Super conductive is due to :
- (a) Cooper pairs. (b) Super Colling.  
 (c) Super heating. (d) Electromagnetic wave propagation.
10. For a negative crystal the E - ray travels faster than O- ray hence :
- (a)  $\mu_0 = \mu_E$ . (b)  $\mu_0 > \mu_E$ .  
 (c)  $\mu_E > \mu_0$ . (d) None of these.
11. Which of the following statement is correct :
- (a) Laser light is highly incoherent highly monochromatic and highly directional.  
 (b) Laser light is highly mono chromatic, highly monochromatic and highly directional.  
 (c) Laser light is highly in coherent and highly intense.  
 (d) Laser light is unidirectional, in coherent and less interest.
12. A slit of width 'a' is illuminated by light of wavelength  $650 \text{ nm}$  falls at angle of diffraction  $= 15^\circ$ . Then the slit width 'a' is ( $n = 1$ ).
- (a)  $2.51 \text{ }\mu\text{m}$ . (b)  $5.2 \text{ }\mu\text{m}$ .  
 (c)  $10 \text{ }\mu\text{m}$ . (d)  $11.8 \text{ }\mu\text{m}$ .

## BUNCH IV

13. The half width of gain profile of a He-Ne laser is  $2 \times 10^{-3} \text{ nm}$ . The emission wave length of the laser is  $6328 \text{ \AA}$  and the length of cavity is  $30 \times 10^{-2} \text{ m}$ . The separation between consecutive longitudinal mode is given by :
- (a)  $0.66 \times 10^{-3} \text{ nm}$ . (b)  $66 \text{ \AA}$ .  
 (c)  $66.8 \text{ \AA}$ . (d)  $960 \text{ nm}$ .

14. By the colour exhibited by their film. When the thickness of an film is large in the reflected system. Then :
- The film appears uniformly illuminated and no fringes appears in the field given.
  - The film appears perfectly dark.
  - Coloured fringes are produced.
  - All the above statements are correct.
15. The super conducting Quantum interferences devices is an example of :
- Meisner effect.
  - Hyper cooling effect in presence of a magnetic field.
  - Cooper-pair-formation in the presence of an electric field.
16. The dispersive power of a gravity is given a :
- $\frac{Nn}{\sin\theta}$
  - $\frac{Nn}{\tan\theta}$
  - $\frac{Nn}{\cos\theta}$
  - $\frac{Nn}{\sin\cos\theta}$

(4 × 1 = 4)

**Part B (Short answer question)***Answer any five questions.**Weight 1 for each.*

- What are Coharent Sources ? How can Coharent sources be obtained in practice ?
- Distinguish between interference and diffraction patterns.
- What is the principle of Laser action ?
- Explain Meisner effect in super conductivity.
- Obtain the Resolving power of a plane transmission grating.
- What is double refraction ? Explain.
- What are the different types of fringes exhibited by thin films ?
- Calculate the fringe width of a wedge - shaped air films ?

(5 × 1 = 5)

**Part C (Short Essay/Problem)***Answer any four questions.**Weight 2 for each.*

- A parallel bean of light of wave length  $500\text{\AA}$  incident normally on a place transmission grading. The second order special line is observed at an angle of incidence of  $30^\circ$ . Calculate the number of liner per meter of the grating ?

**Turn over**

26. The diameter of the  $n^{\text{th}}$  dark ring in Newton's ring arrangement changes from 3 mm to 2.5 mm. When a liquid is introduced in between the glass plate and the piano convex lense. Calculate the refractive index of the liquid.
27. Calculate the thicken of half wave plate when light of wave length 589 nm falls on it. The refractive indices of O-ray and E-ray are respectively 1.55 and 1.54.
28. A laser beam has a wave length of 400nm in direction towards the moon from earth of distance  $4 \times 10^5$  kms (from the earth) through an aperture  $2 \times 10^{-3}$  m.
29. Distinguish between circularly polarized and unpolarized light.
30. Explain briefly the B.C. S. theory of Super conductivity.

(4 × 2 = 8)

**Part D (Essay)**

*Answer any two questions.*

*Weight 4 for each.*

31. What is interference ? Explain the analytical theory of interference.
32. Explain the Fresnel's theory of rectilinear propagation of light.
33. Describe the construction, working and theory of a four level laser.

(2 × 4 = 8)