

**B.TECH. DEGREE EXAMINATION, MAY 2014****First and Second Semesters****ENGINEERING PHYSICS**

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

[Common for all branches]

Time : Three Hours

Maximum : 100 Marks

**Part A***Answer all questions.**Each question carries 4 marks.*

1. Explain spontaneous emission and stimulated emissions.
2. What is population inversion ? What are the conditions for it to occur ?
3. Describe how BCS theory explains superconductivity ?
4. Calculate the critical current which can flow through a long, thin superconducting wire of diameter  $10^{-3}$  m. Given  $H_c = 7.9 \times 10^3$  Amp/m.
5. Define and explain atom per unit cell.
6. Polonium belongs to SC lattice. If the lattice constant is 3.35 Å, calculate its density. The atomic mass of polonium is 209.
7. What is dipolar relaxation ? Explain.
8. What is hysteresis curve ? Explain.
9. Calculate the refractive indices of core and cladding of an optical fibre if  $NA = 0.22$  and  $\Delta = 0.012$ .
10. What is the principle underlying the use of optical fibre as a waveguide for light ?

(10 × 4 = 40 marks)

**Part B***Answer all questions.**Each full question carries 12 marks.*

11. With neat energy level diagram, explain the mechanism of Helium-Neon Laser. Explain various applications of Laser.

Or

Turn over

12. (a) With neat diagrams, explain how the state of population inversion is obtained in GaAs Laser. (6 marks)
- (b) Explain the essential requirements for producing Laser action. Outline how these requirements are usually obtained ? (6 marks)
13. (a) Explain the properties of superconducting phase. (8 marks)
- (b) The critical temperature and critical magnetic field for superconducting lead are 7.2 and 800 Gauss respectively. What will be the magnetic field up to which lead will be in the superconducting state at a temperature of 5 K ? (4 marks)

*Or*

14. Explain (i) Meissner effect ; (ii) Isotope effect ; (iii) Josephson junction ; (iv) SQUID. (4 × 3 = 12 marks)
15. Describe the construction and working of a Bragg's X-ray spectrometer. Explain how it is used to determine the interplanar spacing in a crystal.

*Or*

16. Derive an expression for the values of packing factor, co-ordination number and atomic radius in respect of (i) simple cubic ; (ii) body centered cubic ; and (iii) face centered cubic crystal.
17. (a) Explain the concept of dielectric polarization and its applications. (6 marks)
- (b) Explain the piezoelectric method of production of ultrasonics. (6 marks)

*Or*

18. (a) Show that the absorption of energy in a dielectric subjected by an AC field is proportional to the imaginary part of the dielectric constant. (6 marks)
- (b) Explain magnetic permeability and susceptibility. (6 marks)
19. With neat diagrams, describe the basics of a point-to-point communication system using optical fibers. Mention its advantages over the conventional communication systems.

*Or*

20. With necessary diagrams, describe the propagation of light through a step-index fiber. How it differs from that in a graded index fiber ?

[5 × 12 = 60 marks]