Reg. No ..... Name **25U659**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2025

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY12 : SOLID STATE PHYSICS**

(For Regular 2022 Admission and Supplementary 2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. Briefly discuss the origin of covalent bonding?
2. Distinguish between mono crystalline and polycrystalline substances?
3. Define the Fermi level in a semicondcutor.
4. Name different crystal systems?
5. How does the energy gap in superconductors differ from the energy gap in insulators? How does it vary with temperature for superconductors?
6. Give the general expression connecting the inter atomic bonding force and the atomic separation between two atoms in solids. Also explain each term?
7. Explain local electric field.
8. Give an example of a crystal that is piezoelectric but not ferroelectric.
9. What are Bravias lattices?
10. Explain the concept of hole.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. The critical temperature of a super conductor at zero magnetic field is Tc. Determine the temperature at which the critical filed becomes half of its value at 0K.
12. The first order spectrum of a beam of X-rays diffracted by a silicon crystal corresponds to an angle of 30. The distance between the corresponding parallel planes is 3 A^0. Calculate the wavelength of X-rays used?
13. An electric field of 100 V/m is applied to a sample of n-type semiconductor whose Hall co-efficient is -0.0125 m^3/coulomb. Determine the current density. Given, the electron mobility is 0.36 m^2/V-s.
14. What is the frequency of the electromagnetic wave radiated by a Josephson junction across which a dc voltage of 1 milli volt is applied?
15. The resistivity of an intrinsic semiconductor is 4.5 ohm-m at 20°C and 2.0 ohm-m at 32°C. What is the energy band gap?
16. For a superconducting specimen, the critical fields at 13 K and 14 K are 4.2x 10^5 amp/metre and l.4x 10^5 amp/metre respectively. Determine the transition temperature and critical field at 0K.
17. The density of sodium chloride is 2.18 g/cc. Determine the lattice constant. Given structure is fcc and molecular weight is 58.5.
18. Analyse the conduction mechanism for n-type and p-type semiconductors.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Explain the representation of crystal planes. Briefly explain the procedure to obtain the Miller indices of a plane?

20. What is Meissner effect? Show that superconductors exhibit perfect diamagnetic behavior. Discuss the BCS theory of superconductivity.

21. Describe Hall Effect in metals. Prove that Hall voltage is proportional to current density. Explain Hall Coefficient.

22. Discuss the essentials of free electron theory. Write down the Schrödinger equation for a free electron gas in one dimension. Obtain the eigen functions and the eigen values?

(10 x 2 = 20)