



22100928

QP CODE: 22100928

Reg No : .....

Name : .....

**B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS,**

**APRIL 2022**

**Sixth Semester**

**CORE - PH6CRT12 - SOLID STATE PHYSICS**

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

EE3A7B58

Time: 3 Hours

Max. Marks : 60

**Part A**

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Define space lattice.
2. Define packing fraction.
3. What is k space?
4. Explain the origin of covalent bonding.
5. Explain the origin of van der Waals bonding.
6. What are the properties of Bloch function?
7. Give an expression for the conductivity of an n-type semiconductor.
8. What is an isotropic medium?
9. Distinguish between linear and non-linear magnetic materials.
10. What is spontaneous magnetisation?
11. Which is the first made superconductor?
12. Draw the magnetisation curve in Type II superconductors.

(10×1=10)

**Part B**

*Answer any **six** questions.*

*Each question carries **5** marks.*





13. Explain the crystal structure of Diamond with a neat diagram.
14. Find the glancing angle for incidence of X-rays of wavelength  $0.58 \text{ \AA}$  on the plane (132) of NaCl which results in second order diffraction maxima taking the lattice spacing as  $3.81 \text{ \AA}$ .
15. Obtain the Fermi energy and Fermi temperature in a metal for which the Fermi velocity is  $0.75 \times 10^6 \text{ m/s}$ .
16. An intrinsic sample of gallium arsenide has a hole density of  $5 \times 10^{13} \text{ per cm}^3$  at room temperature. When doped with bismuth, the hole density decreases to  $10^{11} \text{ per cm}^3$  at the same temperature. What is the majority carrier density?
17. Find the Hall voltage in Si doped with  $10^{23}$  phosphor atoms per cubic meter. The Si sample is 100 micrometer thick with a current flow of 0.5 milli ampere for a magnetic field of 0.1 T.
18. Explain the meaning and origin of piezoelectricity.
19. What is curie law for a paramagnetic material? Explain the significance.
20. Prove that susceptibility of superconductor is -1 and relative permeability is zero.
21. Explain how the electron-phonon interaction helps to produce the cooper pairs in superconductors.

(6×5=30)

### Part C

Answer any **two** questions.

Each question carries **10** marks.

22. What are symmetry operations? Describe the principal symmetry operations applicable to a 3D lattice. Show that the five fold rotational axis is not permissible in case of lattices.
23. Obtain an expression for the Fermi energy, ground state energy and density of states for a free electron Fermi gas in one dimension.
24. Distinguish between conductors, insulators and semi-conductors using suitable energy band diagrams.
25. Describe in detail the DC and AC Josephson effect. Discuss the working principles and applications of SQUID.

(2×10=20)

