QP CODE: 25020399

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE / MERCY CHANCE EXAMINATIONS, FEBRUARY 2025

Sixth Semester

CORE COURSE - 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

F6B7B942

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. Define space lattice.
2. State the values of coordination number for hcp structure.
3. What is k space?
4. What is the origin of ionic bonding ?
5. What is the origin of hydrogen bonding?
6. What are the basic assumptions of free electron model?
7. What do you mean by the first Brillouin zone?
8. Write two applications of a dielectric material.
9. Mention the different sources of polarisability.
10. Write down Curie law for paramagnetic substances.
11. Distinguish between antiferro and ferrimagnetic materials.
12. What is ceramic superconductors and write the main advantages?

(10×1=10)

Part B

*Answer any **six** questions.*

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

13. Find the Miller indices of a plane that makes intercepts of 2Å, 3Å and 4Å on the axes of an orthorhombic crystal with a : b : c = 4 : 3 : 2.

14. Electrons are accelerated through 344 volt and are reflected from a crystal. The first reflection maximum occurs when the angle between it and the normal to the crystal is 30 deg. Determine the interplanar distance.

15. Obtain the electronic specific heat of one kilomol of copper at 300 K. Given, the Fermi energy of copper is 7.05 eV (assume this value to be independent of temperature).

16. In intrinsic GaAs, the electron and hole mobilities are 0·85 and 0·04 m^2/V-s respectively and the corresponding effective masses are 0·068 m and 0·5 m respectively, where m is the rest mass of the electron. Given the band gap of GaAs at 300 K as 1·43 eV. Determine the intrinsic carrier concentration and conductivity.

17. 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.

18. An iron rod 0.5 m long and 2 mm^2 cross-section is placed in a long solenoid of 25 turns per centimetre carrying a current 2 A. Assume the relative permittivity of iron to be 400, determine the magnetic moment of the bar magnet?

19. Discuss the important property changes that occur in materials when they change from normal to superconducting state. Write some practical uses of superconductivity.

20. Describe the isotope effect in superconductor.

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. Illustrate diamond, NaCl, CsCl, Zinc blande structure using neat diagrams.

23. Obtain an expression for the effective mass of an electron in a crystal. Explain the reason for the negative effective mass.

24. Obtain an expression for the carrier concentration and Fermi level of an extrinsic semiconductor.

25. Discuss the effect of temperature and magnetic field in superconductors. Distinguish between type I and type II superconductors.

(2×10=20)