

QP CODE: 25020399

Reg No	:	
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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.

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- 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 m²/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.
- An electric field of 100 V/m is applied to a sample of n-type semiconductor whose Hall coefficient is -0.0125 m³/coulomb. Determine the current density. Given, the electron mobility is 0.36 m²/V-s.
- 18. An iron rod 0.5 m long and 2 mm² 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.

