QP CODE: 26017190

26017190

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE / MERCY CHANCE EXAMINATIONS, MARCH 2026

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

60EBFD8F

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. Define space lattice.
2. Name the different crystal systems in three dimensions.
3. What do you mean by an Ewald construction?
4. Plot the variation of the potential energy of interaction versus the atomic separation between two atoms in a solid.
5. Discuss the origin of metallic bonding.
6. Give the Fermi-Dirac distribution and plot it at absolute zero temperature.
7. What are the properties of Bloch function?
8. Write two applications of a dielectric material.
9. What are piezoelectric materials?
10. What is diamagnetic action?
11. Draw the temperature dependence of the resistance of a normal and superconducting material.
12. What is meant by virtual phonon?

(10×1=10)

Part B

*Answer any **six** questions.*

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

13. Calculate the interplanar spacing for (321) planes in scc lattice with lattice constant a = 4.12 Å.

14. Determine the packing fraction of an hcp structure.

15. The resistivity of intrinsic silicon at room temperature is 3000 ohm m. Calculate the intrinsic carrier density. Given electron mobility = 0.14 m^2/V-s and hole mobility = 0.05 m^2/V-s.

16. What is the number density of impurity atoms that is to be added to a pure germanium crystal to make it 10^{-1} ohm m n-type germanium? Given that the electron mobility is 0.15 m^2/V-s.

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. 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. Describe Meissner effect.

20. A superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at 0 K. Find the critical field at 2 K.

21. Discuss about the existence of energy gap in superconductors.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Describe the powder method for X-ray diffraction. Discuss the formation of X-ray diffraction pattern.

23. Write down the Schrödinger equation for a free electron gas in three dimensions. Obtain the eigen functions and the eigen values.

24. Distinguish between conductors, insulators and semi-conductors using suitable energy band diagrams.

25. What is ferromagnetism? Discuss the domain theory of ferromagnetism and explain hysteresis curve on the basis of domain theory.

(2×10=20)