**24P308** (Pages: 2) Name: .....

Reg.No: .....

**THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025**

(CBCSS - PG)

(Regular/Supplementary/Improvement)

**CC19PPHY3C11 - SOLID STATE PHYSICS**

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

**Section A**

Answer ***all*** questions. Each question carries 1 weightage.

1. Explain the concept of reciprocal lattice and give the condition for X-ray diffraction using reciprocal lattice.
2. What are the merits of Debye model over Einstein's model of specific heat capacity?
3. How does band overlap result in the formation of metals.
4. Explain the concept of intrinsic mobility.
5. Write a short note on ferroelectricity and ferroelectric crystals.
6. Explain first order phase transition based on Landeau theory.
7. Explain the process of spontaneous magnetization in ferromagnets.
8. Derive the London equations.

**(8 × 1 = 8 Weightage)**

**Section B**

Answer any ***two*** questions. Each question carries 5 weightage.

9. What is meant by Madelung interaction? Discuss the nature of cohesion and obtain expression of cohesive energy in ionic crystals
10. Explain the formation of forbidden energy gap in the dispersion relation of the vibration of crystals with diatomic basis
11. (a) Discuss how electronic heat capacity of a metal is described by free electron theory.
    (b) What is Hall effect? Deduce expression for Hall coefficient.
12. Give an account of d.c Josephson effect effect with relevant theory.

**(2 × 5 = 10 Weightage)**

## Section C

Answer any ***four*** questions. Each question carries 3 weightage.

13. Show that for simple cubic lattice $d_{100} : d_{110} : d_{111} = (6)^{1/2} : (3)^{1/2} : (2)^{1/2}$

14. Copper has FCC structure and the atomic radius is 1.278 AU. Calculate its density. Atomic weight of copper = 63.54 (U2)

15. Calculate the Fermi velocity of electrons in potassium, if its Fermi energy is given 2.1 eV .

16. The intrinsic carrier density at room temperature in Ge is 2.37 $x10^{19}$ $m^3$. If the electron and hole mobilities are 0.38 and 0.18 $m^2 V^{-1} s^{-1}$ respectively, calculate the resistivity.

17. When NaCl crystal is subjected to an electric field of 1000 V/m, the resulting polarisation is $4.3x10^{-8}$ $C/m^2$. Calculate the relative permittivity of NaCl?

18. A paramagnetic material has FCC structure with a cubic edge of 2.5 $A^0$. If the saturation value of magnetization is $1.8x10^6$ $Am^{-1}$, calculate the magnetization contributed per atom in bohr magneton.

19. The critical magnetic fields of a superconductor at temperatures 4K and 8K are 11mA/m and 5.5mA/m respectively. Find the transition temperature.

**(4 × 3 = 12 Weightage)**

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