

16P307

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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, OCTOBER 2017

(Regular/Supplementary/Improvement)

(CUCSS - PG)

CC15P PHY3 C11 - SOLID STATE PHYSICS

(Physics)

(2015 Admission Onwards)

Time : Three Hours

Maximum : 36 Weightage

Section-A

(Answer *all* Questions. Each question carries weightage one)

1. Explain in detail the structure of NaCl crystal. Give some examples of crystals showing the same structure.
2. Derive the Bragg's diffraction equation using reciprocal lattice.
3. Define Acoustic and Optical phonons.
4. What are the distinguished characteristics of metallic bonds?
5. Distinguish between Einstein model and Debye model of specific heats.
6. Derive the expression for intrinsic carrier concentration of a pure semiconductor.
7. What is meant by "effective mass of electron"? Find the expression for effective mass.
8. Distinguish between Type I and Type II superconductors.
9. Distinguish between direct band gap and indirect band gap semiconductors
10. Write a note on paramagnetism.
11. Explain the variation of spontaneous polarization below transition temperature in case of first order and second order ferroelectric phase transition.
12. Explain briefly the 'DC Josephson effect'.

(12×1=12 Weightage)

Section-B

(Answer *any two* questions Each question carries weightage 6)

13. Discuss the theory of vibration of a diatomic lattice. Bring out the dispersive relation and sketch the graph.
14. (a). Explain energy gap and isotope effect in super conductors,
(b). Derive the London equation and explain penetration depth in superconductors.
15. Distinguish between Ferro and Antiferro magnetism. Obtain an expression for temperature variation of spontaneous magnetization in a ferromagnet. What conclusion may be drawn from the plot of spontaneous magnetization verses temperature.

16. (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.

(2×6=12Weightage)

Section – C

(Answer *any four* Questions. Each Question carries weightage three)

17. Gold (fcc) has density of 19.3 g/cm^3 and atomic weight of 197.0. Calculate number of gold atoms per cm^3 and length of cube edge.

18. Density of silver is 10.5 g/cm^3 and its mass number is 107.87. Assuming that it is a monovalent metal with spherical Fermi surface; calculate its Fermi Energy.

19. Evaluate the carrier concentration and conductivity of intrinsic Germanium at room temperature (300K) using following data.

$$m_e = m_h = 9.1 \times 10^{-31} \text{ kg (rest mass of electron),}$$

$$E_g = 0.68 \text{ eV,}$$

$$\mu_e = 0.38 \text{ m}^2/\text{V}\cdot\text{sec,}$$

$$\mu_n = 0.18 \text{ m}^2/\text{V}\cdot\text{sec,}$$

$$K_b = 1.38 \times 10^{-23} \text{ J}^\circ\text{.K}$$

20. If $v_0 = 105 \text{ cm/sec}$, obtain frequency of sound waves of wavelength 10^{-7} cm for acoustic waves and optical waves in a linear medium.

21. A plane makes intercepts of $1A^\circ$, $2A^\circ$, $0.5 A^\circ$ on crystallographic axes of orthorhombic crystal with $a:b:c = 3:2:1$. Determine Miller indices of this plane.

22. There are about 5.9×10^{28} conduction electrons / m^3 in silver. Calculate its Fermi Energy.

(4×3= 12Weightage)
