Mid-West University

Examinations Management Office

Surkhet, Nepal

Final Examinations -2079

Bachelor level/ B.Sc /6th Semester — Full Marks: 100

Time: 3 hrs — Pass Marks : 50

Subject : Solid State Physic (PHY463)

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks. Physical constants with their units Planck's constant $h = 6.62 \times 10^{-34}$ *Js Speed of light in vacuum* $c = 3 \times 10^{8}$ *m/s Charge of electron* $e = 1.6 \times 10^{-19}$ *C Mass of electron* $= 9.1 \times 10^{-31} kg$, *1 a.m.u.*$= 1.67 \times 10^{-2}$ *kg Boltzmann constant* $k_B = 1.4 \times 10^{-23} J/K$

Group – A

1. Attempt any eight questions (Short Questions) [8x2 = 16]

a. Describe the structure of CsCl.
b. Define mobility and drift velocity of electron in metal.
c. What is Wiedemann-Franz law?
d. Write the short notes on Fermi energy.
e. Explain the spontaneous magnetization.
f. What are the applications of superconductors?
g. Explain the role of electron at absolute zero temperature in semiconductor?
h. What is superconductivity? Outline the experimental facts about this phenomenon.
i. Difference between phonon and photon?
j. What is ionic bond?
k. Write the short notes on free electron theory in metals

Group – B

2. Attempt any six questions [6x6= 36]

I. What is Miller indices? Calculate the atomic radii all the three types of cubic crystals.
II. What is Einstein Model of specific heat? Derive an expression for the lattice specific heat capacity by Debye model.
III. Define specific heat. Explain the specific heat of a superconducting material in its normal and superconducting state.
IV. Derive an expression for the effective mass of the electron in crystal.
V. Discuss the domain structure in ferromagnetic material and draw the B-H curve for a ferromagnetic material and identify the retentivity and coercivity on the curve.
VI. What is Hall Effect? Derive an expression for hall constant.
VII. What is packing fraction? Deduce the packing factor for cubic,fcc and bcc structures.
VIII. Explain briefly the mechanism of Van der Waals bonding.

Group-C

3. Discuss the Langevin's theory of paramagnetism .Show that the magnetic susceptibility of a paramagnetic material is inversely proportional to the absolute temperature . **[9]**

OR

State and explain the Kronig-Penny model for the band structure of solids.

4. Define periodic potential and explain the Bloch theorem**. [9]**

5. Explain the type-I and Type-II superconductors. **[6]**

6. Define elastic and atomic force constants. Difference between optical and acoustic modes. **[6]**

7. The spacing between the principle planes of NaCl structure is 2.82×10^{-10} m.It is found that first order Braggs reflection occurs at an angle of 10^{0}.What is the wavelength of X-rays**?[6]**

8. 8 .At 6K critical field is 5×10^{3} A/m .Calculate the transition temperature when critical magnetic field is 2×10^{4} A/m at 0 K. **[6]**

9. Find the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} Ω-m.If the metal has 5.8×10^{28} conduction electrons per m^3. **[6]**

OR

Calculate the interplanar spacing for a (321) plane in a simple cubic lattice whose lattice constant is 4.2×10^{-8} cm.

THE END