Rounding (III) BSc (III) (Solid-State-Physics)

Section-C

(Thermal Properties of Solids and free electron Theory of metals)

Q1. Define lattice heat capacity. on the basis of Einstein's Theory. desive an expression for it. write the main assumptions and basis drawbacks of this model.

Q2. Give the assumptions of free electron gas model, Desive expression for the fermi energy.

Q3. (A) what is the Position of fermi level at 0K?.

(B) Consider Silver in the metallic state with one free electon per atom. calculate fermi energy. Given the density of Silver = 11 gm/cm^3. and atomic-weight = 108.

Q4. (A) what do you mean by density of state?.

(B) A metallic Conductor carries a current of 1 Amp, its area of cross-section is 1 cm^3, The specific-Resistance of Conductor is 1.7×10^{-6} Ω cm, calculate the electric field inside the conductor.

Q5. (A) What is the fundamental diffesence between elastic Vibrations and e.m. waves?.

(B) Draw only diagram for Describe Inelastic Scattering of Photons by Phonons.

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Rounding (III)

"Solid State Physics - B.Sc III"

"SECTION -D"

Q1. Give the basic ideas of BCS theory and show that this theory provides adequate explanation of Super-Conducting state.

Q2. (a) Describe briefly thermal properties of superconductors.
(b) Discuss Bloch theorem.

Q3. (a) Explain the assumption made in quantum theory to overcome the drawbacks of classical free electron theory of metals.
(b) Differentiate a good conductor and a good insulator taking the resistivity range.

Q4. Prove that for the Kronig-Penney potential with $P<<1$, the energy of lowest energy band at B.Z. $k=0$ is

$$E = \hbar^2 P / m a^2$$

Q5. (a) What is isotope effect in superconductivity.
(b) What do you mean by Coherence length?
(c) What is flux quatization? Explain.

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(Free electron Theory) "SOLID - STATE - PHYSICS" B.Sc - III

Section - C (PART - II) (Test - 4)

(Rounding 1)

Q1 Derive expression for the fermi - Energy and density of state for a free electron gas in one dimension.

Q2. (A) Define Wiedemann Franz Law.

(B) what are the limitations of free electron Theory?.

Q3. Find the fermi - velocity of the electron if the number - density of electrons in Sodium is $2.52 \times 10^{28}\ mt^{-3}$ at Room - temperature.

Q4. (A) what are SI units of conductivity?.

(B) Define mean - free Path and Relaxation time?.

(C) How does the free electron gas differ from the ordinary gas containing molecules.

Q5. SHOW That in one - dimensional Problem, the average Kinetic - energy in the ground state is one third of the fermi - Energy.

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(SOLID-STATE-PHYSICS) Bsc-III

Section – D (Test → 5) [Rounding – 1].

(Band-Theory and Super-Conductivity).

Q1. Given the solution of Schrodinger equation for a one-dimensional crystal lattice with Periodic Potential as $\frac{P\sin\alpha a}{\alpha a} + \cos\alpha a = \cos ka$, discuss the formation of bands in a Solid.

Q2. (A) What are Bloch functions?.

(B) What is Meissner effect.

(C) Discuss The Type I and Type II Super Conductors.

Q3. Discuss BCS Theory of Super-Conductors.

Q4. Writes notes on →

(A) ENERGY GAP

(B) ENTROPY CHANGE IN SUPER-CONDUCTORS.

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(Lattice Vibration, Phonon)

Solid - State - PHYSICS BSc - III

Section - C (PART - I) (Test → 3)

Rounding 1

Q1. Obtain an expression for the dispersion Relation in case of mono - atomic linear chain of atoms.

Q2. Discuss the Debye Model of lattice Heat capacity and using it, explain Dulong and Petit's Law.

Q3. (A) What is Einstein temperature?

(B) What are phonons?

(C) What are the basic drawbacks of Einestein's model of specific Heat?

Q4. The Transverse and longitudinal waves have velocities are 30 m/sec and 60 mt/sec in aluminium respectively. find Debye temp. and Debye frequency. Given $\frac{N}{V} = 6 \times 10^{23} \frac{\text{atoms}}{m^3}$.

Q5. find cut off frequency of one dimensional mono - atomic lattice which have spring constant 15 N/mt and atomic mass 6 gm.

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