Oct-2015

B. Sc. (Physics) Semester – VI

Paper – 605 : *Solid State Physics*

Time: 2 Hours] 4615 **[Total Marks70**

Instructions: 1. Symbols have their usual meaning.

2. Figures on right hand side show marks of that question.

1. Derive dispersion relation for the diatomic crystal. Draw the graph of $\omega \rightarrow K$ and justify the name of branches the graph. [14]

OR

1. (a) Discuss the effect of masses of lighter and heavier atoms on the branches of $\omega \rightarrow K$ for diatomic crystal. [07]

(b) Write note on : "Phonon" [07]

2. (a) Mention the drawbacks of classical theory of specific heat. Derive the formula of total energy of a solid according to Einstein's theory and prove that for Low temperatures it fellows the exponential nature. [10]

(b) The Debye temperature of diamond is 1850 *K*. Calculate the specific heat per *K* mol for diamond at 100 *K*. [04]

OR

2. (a) Mention assumptions and the drawback of Einstein's theory of specific heat [04]

(b) Obtain an expression for the specific heat capacity of a solid on basis of Debye's theory. Justify that the theory correctly derive the experimental facts. [10]

3. (a) Discuss the success of classical theory of free electron gas. [07]

(b) Discuss the Sommerfeld quantum theory of free electron gas in three dimensions [07]

OR

3. (a) Write note on : "Fermi energy". [06]

(b) Discuss Kronig-Penney Model of Solids. [08]

4. (a) Derive F-H Landon's Equations to describe phenomena of Superconductivity. [10]

(b) Write note on : "Cooper pair of electrons" [04]

OR

4. (a) Explain striking features of superconductor. [08]

(b) Discuss BCS ground state of superconductivity. [06]

5. (a) Discuss in brief the applications of superconductivity. [09]

(b) A superconducting tin has a critical temperature of 3.7 K in zero magnetic field and a critical field of 0.0306 T at zero K. Find the critical magnetic field (in CGS unit) at 3 K. [05]

OR

5. (a) Why band theory of solid is required? [09]

State and prove Bloch theorem.

(b) Calculate the temperature required to bring mercury superconductor to its normal state under magnetic field 2 T and 4 T. (T_c = 4.12 K, H_0= 3.3 x 10^4 T) [05]