B. Sc. (Physics) Semester – VI

Paper – 603 : *Solid State Physics*

Time: 2 -30 Hours] **Code No: 4615** **[Total Marks70**

April : 2016

Instructions: 1. Symbols have their usual meaning.

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

1. (a) Derive dispersion relation for the diatomic crystal and discuss different cases. [14]

OR

1. Write note on : (1) "Restrahlen band" and (2) "Phonon" [14]

2. (a) Mention the drawbacks of classical theory and Einstein's theory of specific heat. Write the formula total energy of a solid according to Debye's theory and prove that for high temperatures it fellows the classical nature and for extreme low temperatures it follows the T^3 nature. [10]

(b) Discuss Debye's cut off approximation for theory of specific heat. [04]

OR

2. (a) Explain the terms : Einstein Temperature and Debye Temperature [04]

(b) Obtain an expression for the specific heat capacity of a solid on basis of Einstein's theory. Discuss its cases. [10]

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

(b) Mention features of Sommerfeld quantum theory discuss how Sommerfeld quantum theory of free electron gas explains the occurrence of long mean free path. [07]

OR

3. (a) Explain the terms : " Fermi energy and Fermi function". [06]

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

4. (a) What is "ISOTOP EFFECT " , discuss the role of phonon in BCS theory to resolves the drawbacks of F-H Landon's of Superconductivity [10] [04]

(b) Write note on : "Coherence Length"

OR

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

(b) Discuss a role of temperature and magnetic field on occurrence of superconductivity. [06]

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

(b) Calculate the temperature required to bring mercury superconductor to its normal state under magnetic field 3 T. (T_c = 4.12 K, H_0= 3.3 x 10^4 T) [05]

OR

5. (a) State and prove Bloch theorem. [09]

(b) The Debye temperature of diamond is 1850 *K*. Calculate the specific heat per *K* mol for diamond at 100 *K*. [05]