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B. Sc  
MSPH 3601

6<sup>th</sup> Semester Examination (2012 Syllabus): Mar-Apr 2016

SOLID STATE PHYSICS-I

Full Marks: 60

Time: 3 Hrs.

*Answer Question No.1 which is compulsory and any Five from the rest.*

*The figure in the right hand margin indicates marks.*

PART – A

[10x1.5=15]

1. a) What do you mean by Madelung constant?
- b) Classify each of the following materials according to crystalline bonding.  
i) Argon ii) Sodium iii) Calcium carbonate
- c) How is lattice vibration quantized?
- d) Mention the high and low temperature limits of specific heat of a linear continuous chain according to Debye's theory.
- e) Calculate the Hall Coefficient of sodium on the basis of free electron model.
- f) Explain Neel Temperature.
- g) What is P-N junction?
- h) State the law of Mass action.
- i) State Laue's condition of X-ray diffraction.
- j) State Curie's law.

PART – B

[5x9=45]

2. a) Explain the various symmetry elements associated with the crystals. [3]
- b) Show that the actual crystal cannot possess a fivefold rotational symmetry. [6]
3. a) Show that an ideal hexagonal close packed structure has a  $\frac{c}{a}$  ratio of  
$$\left(\frac{8}{3}\right)^{\frac{1}{2}} = 1.633$$
 [7]
- b) Prove that the density of atomic packing of hexagonal close-packed (hcp) structure is equal to that of the face centered cubic (fcc) structure. [2]
4. a) What is Meissner's effect? [2]
- b) State London equations. Show how do they lead to Meissner's effect? [7]
5. a) Obtain the vibrational spectrum of a linear diatomic lattice. [6]
- b) Show that the vibrational spectrum consists of two branches. Mention the main features. [3]