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PHY-503
Solid State Physics

M.Sc. PHYSICS (MSCPHY-12/13/16/17)

First Year, Examination-2019

Time: 3 Hours **Max. Marks: 80**

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Note:- This paper is of Eighty (80) marks divided into two (02) Section A and B. Attempt the question contained in these sections according to the detailed instructions given therein.

Section-A

(Long Answer Type Question)

Note:- Section - A contains five (05) long answer-type questions of fifteen (15) marks each. Learners are required to answer any three (03) questions only. (3×15=45)

1. Describe the Powder method of the X-ray diffraction and explain how it is used for the determination of crystal structure.

2. Discuss Kronig-Penney model for the energy band structure of solids. Show that each band can accommodate 2N electrons, where N is the total number of atoms in the crystal.

3. Explaining the assumptions clearly, derive an expression for the specific heat of a linear continuous chain of atoms according to the Debye theory. Discuss the high and low temperature limits.

4. Explain briefly about the structure of $BaTiO_3$ and also explain the temperature and frequency dependence of its dielectric properties.

5. Explain briefly about Heisenberg's theory of ferromagnetism and derive the relation between the exchange integral and the exchange field constant

Section-B

(Short Answer Type Question)

Note:- Section-B contains eight (08) short answer type questions of seven (07) marks each. Learners are required to answer any five (05) questions only. (5×7=35)

1. Find the expression for the spacing between the successive (hkl) lattiee planes in a lattice.

2. What are color centers? How are they produced?

3. What is Hall Effect and derive an expression for the Hall coefficient of a metal.

4. What is Fermi Surface? Give its importance. How it is experimentally determined for metals.

5. Describe the Umklapp processes and show how they contribute to the thermal conductivity of solids.

6. Distinguish between different types of magnetic materials.

7. Establish a relation between polarizabilty and dielectric constant of a solid using Claussius-Mosssotti equation.

8. Explain briefly about BCS theory in case of superconductors.

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