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PAT-1603010802020800 Seat No. _____

M. Sc. (Physics) (Sem. II) Examination

August / September - 2020

Physics : CT-08

(Solid State Physics)

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Mathematical symbols have equal meanings.

- 1** Answer in brief any **seven** : **14**
- (a) Define unit cell. **2**
 - (b) Define reciprocal lattice and Miller indices. **2**
 - (c) Draw (011) and (0 $\bar{1}$ 1) planes in cubic crystal. **2**
 - (d) What is aliovalence? **2**
 - (e) Define the superconductivity. **2**
 - (f) What are the applications of superconductors? **2**
 - (g) Draw the spin arrangements for various magnetic materials. **2**
 - (h) What are the limitations of Langevin's classical theory of paramagnetism? **2**
 - (i) Explain in brief the Slater's criteria. **2**
 - (j) What is the total energy of ferromagnetic domains? **2**
- 2** Answer any **two** of following questions : **14**
- (a) Describe in detail various symmetry elements. **7**
 - (b) State Bragg's law of X-ray diffraction. Describe various X-ray diffraction experimental set ups. **7**
 - (c) Explain scattering of X-rays and atomic scattering factor in detail. **7**

- 3 (a) Discuss in detail various contributions of magnetic moment of atoms in paramagnetic materials. 7
- (b) Describe the paramagnetism in (i) rare earth ions and (ii) iron group ions. 7

OR

- 3 (a) Discuss the Heisenberg exchange integral and Slater's criteria. 7
- (b) Draw the plots of $1/\chi$ versus temperature for different five types of magnetic materials. 7

4 Answer any **two** of following questions : 14

- (a) Provide list of defects in solids. Discuss in detail Schottky defects in ionic crystals. 7
- (b) Derive expressions for the number of vacancy defects and self interstitial defects in solids. 7
- (c) Explain in brief charge compensation and non-stoichiometry in solids. Write a detailed note on diffusion in solids. 7

5 Answer any **two** of following questions : 14

- (a) Explain qualitative BCS theory of superconductivity with its ground state. 7
- (b) Discuss the types of superconductors. Write a note on London equations for superconductivity. 7
- (c) Explain DC and AC Josephson effect in superconductors. Describe the construction (schematic) and working of a SQUID. 7
- (d) Write a note on tight binding approximation. 7
