M.Sc., Final Degree Examinations,
December 2017

(Directorate of Distance Education)

PHYSICS

Paper– VIII: DPB – 540: SOLID STATE PHYSICS – II

Time: 3 hrs]   *[Max. Marks: 75/85*

Note:

Answer any FIVE questions from parts A, B and C without omitting any part (Common to All) Part – D is for the students whose max. marks is 85.

PART – A

1. a) What is a Magnon? Obtain Bloch's $T^{3/2}$ law for a ferromagnet.

   b) Explain (qualitatively) the effect of temperature on the spontaneous magnetization. $(10 + 5)$

2. a) Discuss with relevant theory the temperature variation of magnetic susceptibility in the case of an antiferromagnetic material.

   b) Explain the properties and applications of Ferrimagnetic materials. $(10 + 5)$

3. Discuss the thermodynamical theory of Casimir and Dupre for spin-lattice relaxation and obtain expressions for the real and imaginary parts of the paramagnetic susceptibility. (15)

PART – B

4. a) Describe the salient features of intrinsic and extrinsic semiconductors.

   b) Discuss with relevant theory the effect of temperature and impurity density on the concentration of charge carriers in the case of a semi conductor containing N_d and N_a number of donor and acceptor impurity atoms per unit volume. $(5 + 10)$

5. a) Discuss with relevant theory the variation of electrical conductivity with respect to temperature and impurity concentration in the case of an n – type semi conductor.

   b) Write a note on impurity band conductivity. $(10 + 5)$

6. a) What is Hall effect? Explain.

   b) Obtain an expression for the Hall co-efficient in the case of a semiconductor in terms of the densities and mobilities of charge carriers. $(3 + 12)$

PART – C

7. a) What is Gunn effect? Obtain expression for drift velocity and electron temperature.

   b) Mention any two important applications of Gunn effect. $(12 + 3)$

8. a) Explain the formation of space charge region in the case of an abrupt $p - n$ junction diode.

   b) Obtain the expression for barrier potential and barrier thickness in the case of an unbiased $p - n$ junction diode. $(3 + 12)$

9. a) What is Meissner effect? Explain.

   b) Discuss the theory of dc Josephson effect in super conductors. $(3 + 12)$

PART – D

10. *Answer any TWO of the following:* $2 \times 5 = 10$

    a) Ferromagnetic domains.

    b) Phase diagram of Liquid Helium 4

    c) Photovoltaic effect

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