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Total Number of Pages : 02

M.Sc.
16MPYE404

4th Semester Regular Examination 2017-18

CONDENSED MATTER PHYSICS-II

BRANCH : M.Sc.(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : C303

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1. Answer the following questions : (2 x 10)**
- a) Write two examples of multiferroic compound.
 - b) Graphically show the variation of magnetic susceptibility with temperature for ferromagnetic materials.
 - c) How many numbers of slip systems exist in a *bcc* crystal?
 - d) What is the spin of the Ferric ion?
 - e) Write two examples of superconducting materials.
 - f) What is Neel temperature?
 - g) If the number of magnetic dipoles (spins) in a ferromagnetic material is $3 \times 10^{28} / \text{m}^3$ and the spin magnetic moment is $3 \times 10^{-23} \text{ Am}^2$ then determine the saturation magnetization.
 - h) Write down the approximate energy of a screw dislocation.
 - i) Can color of the crystal be affected due to defects? Give an example.
 - j) Write two applications of superconductivity.
- Q2. a) Describe the Weiss molecular field theory of ferromagnetism and derive the Curie-Weiss law. (7)**
- b) Explain what you mean by ferromagnetic domains. (3)**
- Q3. a) What are magnons and establish their dispersion relation in terms of Bloch's Law. (7)**
- b) Write the draw backs of Mean field theory in ferromagnetic domain. (3)**
- Q4. a) What are Schottky defects? Establish the expression for concentration of Schottky defect at temperature T. (2+5)**
- b) The density of Schottky defects in a certain sample of sodium chloride is $5 \times 10^{11} \text{ m}^{-3}$ at 300 K. If the inter ionic separation is 2.82 \AA , what is the average energy required to create one Schottky defect. (3)**
- Q5. a) Establish the solution of BCS Hamiltonian in terms of spin analog method. (7)**
- b) Calculate the frequency of AC current produced when a DC voltage of $5 \mu\text{V}$ is applied across the Josephson junction. (3)**

- Q6. a)** What do you mean by nano structured materials? Classify on the basis of dimensional confinement. **(7)**
- b)** What is the main difference between 1st order and 2nd order phase transition? **(3)**
- Q7.** What do you mean by excitons? Write the properties of excitons and classify them. Find out the energy eigen value of exciton wave. **(10)**
- Q8. Write short answer on any TWO :** **(5 x 2)**
- a)** SQUID
 - b)** F- center
 - c)** Quantum dots
 - d)** Magnons