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Total Number of Pages : 02

M.Sc.I
FPYC803

8th Semester Regular Examination 2017-18
BASIC CONDENSED MATTER PHYSICS

BRANCH : M.Sc.I(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : C259

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

- Q1. Answer the following questions :** (2 x 10)
- a) What is Wigner-Seitz cell? How is Wigner-Seitz cell constructed?
 - b) What are the different symmetry elements in a crystal?
 - c) Prove that five fold rotation axis doesn't exist
 - d) What is carbon nanotubes?
 - e) An X-ray beam of wavelength of 0.71 Å is diffracted by a cubic crystal of density $1.99 \times 10^3 \text{ kg/m}^3$. Calculate the interplanar spacing for (200) planes and Glancing angle for 2nd order reflection? Mol. Wt. of KCl=74.6 amu
 - f) Write any two applications of superconductors.
 - g) What is flux quantisation?
 - h) What is packing efficiency? What are its values for sc, bcc, and fcc structures?
 - i) What is a screw axis?
 - j) A certain crystal has lattice parameters of 4.24, 10 and 3.66 Å on X, Y, Z axes respectively. Determine the Miller indices of a plane having intercepts of 2.12, 10 and 1.83 Å on the X, Y and Z axes.
- Q2. a)** Derive an expression for the lattice heat capacity of a solid following Debye's model. (7)
- b)** How the specific heat of a solid at room temperature will change if the Planck's constant were decreased by three folds? (3)
- Q3. a)** Write Bloch's theorem. (2)
- b)** Write the formation of allowed and forbidden energy bands on the basis of Kronig-Penney model. Write the extreme condition when the energy levels are either discrete or continuous. (8)
- Q4. a)** Deduce vibrational modes of a finite one –dimensional monoatomic lattice. (7)
- b)** Show that at low frequency the phase velocity is equal to the group velocity. (3)
- Q5. a)** What is a perovskite structure? (4)
- b)** Obtain an expression for the packing fraction for the hcp structure and hence show that c/a ratio for an ideal hcp lattice is 1.633. (6)

- Q6. a)** What are d.c. and a.c. Josephson effect? Give the theory of a. c. Josephson effect. **(8)**
- b)** A superconducting sample has a critical temperature of 4.1 K in zero magnetic field and critical field of 0.0505 T at 0 K. Find the critical field at 2 K. **(2)**
- Q7. a)** Give a qualitative description of BCS theory. **(5)**
- b)** Show that how the London equations lead to the Meissner effect and the flux penetration through thin films of superconductors. **(5)**
- Q8. Write notes on :** **(2.5 x 4)**
- a)** Diamond structure
 - b)** Liquid crystal
 - c)** Momentum of phonons
 - d)** Difference between type I and type II superconductors