K17P 0820

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree (Supplementary) Examination, March 2017
PHYSICS
(2013 and Earlier Admn.)
PH 203 : Solid State Physics

Time : 3 Hours Max. Marks : 50

PART – A

Answer **any two** questions. **Each** question carries **10** marks.

1. Derive the dispersion relation for a one dimensional atomic crystal. Discuss the nature of acoustic and optical modes. Show that the group velocity vanishes at zone boundary.
2. Derive the expression for density of states of free electron gas in three dimensions.
3. What is single particle tunneling ? Discuss d.c. and a.c. Josephson's effects and explain their importance.
4. Give an account for the quantum theory of paramagnetism. Discuss the magnetic behaviour of rare earth ions. **(2×10=20)**

PART – B

Answer **any five** questions. **Each** question carries **3** marks.

1. State why we cannot use visible light for Bragg reflection.
2. Obtain the expression for density of states in one dimension.
3. Briefly explain the origin of energy gaps on the basis of nearly free electron model.
4. Explain donors and acceptors with examples.
5. Briefly explain London penetration depth.
6. Briefly explain the process of cooling by isentropic demagnetization.
7. Briefly explain top-down approach with an example. What is its disadvantage ?
8. Explain how particle size is determined using XRD. **(5×3=15)**

P.T.O.

PART – C

Answer **any three** questions. **Each** question carries **5** marks.

1. Determine the reciprocal lattice vectors which define the Brillouin zones of bcc lattice.
2. Gold has the same structure as copper. The velocity of sound in gold is 2100 ms^{-1} and that in copper is 3800 ms^{-1}. If the Debye temperature of copper is 348 K, determine the Debye temperature of gold. The densities of gold and copper are 1.93×10^4 kgm^{-3} and 8960 kgm^{-3} their atomic weights are 197.0 and 63.54 amu respectively.
3. If a dust particle of one microgram requires to cross a distance of which is the separation between two rigid walls of the potential, determine the quantum number described by this motion.
4. Estimate the intrinsic coherence length of aluminium if the size of the energy gap is 3.4×10^{-4} eV, $v_F = 2.02 \times 10^6$ ms^{-1}.
5. Consider an atom with L = 2 and 0 spin angular momentum placed in a uniform magnetic induction of 2 Wbm^{-2}. Calculate the rate of precession of the resultant magnetic moment. **(3×5=15)**
