 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **PHYSICS**

THIRD SEMESTER – **APRIL 2012**

# PH 3810 / 3807 - SOLID STATE PHYSICS - I

Date : 21-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART – A**

**Answer ALL the questions: (10 X 2 = 20)**

1. List all the two dimensional lattices and the corresponding lattice specifications
2. Find the Miller indices for a plane with intercepts a/2,b,∞
3. How do you account for thermal expansion of solids?
4. State Widemann-Franz law.
5. State the assumptions of free electron theory of metals.
6. Plot phonon dispersion curve for a diatomic lattice.
7. Give the significance of effective mass of an electron.
8. What is forbidden energy gap?
9. Explain the concept of hole. Which has greater mobility, electron or hole?
10. Explain “quantization of electron orbits”.

**PART – B**

**Answer any FOUR questions: (4 X 7.5 =30)**

1. What is a reciprocal lattice? Obtain the primitive translation reciprocal lattice vectors for an FCC direct lattice.
2. Derive an expression for the thermal conductivity of a solid in terms of specific heat capacity.
3. Explain Hall effect based on the free electron theory of metals.
4. Discuss the different zone schemes by plotting suitable E-K curves.
5. Explain in detail the effect of electric field on the Fermi surface.

**PART – C**

**Answer any FOUR questions: (4 X 12.5 =50)**

1. i) Discuss the formation of diffraction pattern on the photographic film with the necessary theory of X- ray powder diffraction. (8.5)

ii) Write a short note on point defects. (4)

1. Derive an expression for the specific heat of solids on the basis of Debye model.
2. Obtain an expression for the density of states as a function of energy for electron gas in 3D at 0K. Hence derive expressions for Fermi energy and total energy.
3. Outline the theory of the Kronig-Penny model and hence discuss the formation of allowed and forbidden energy bands.
4. Describe any one experimental method of determining the Fermi surface.