



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - PHYSICS

THIRD SEMESTER – NOVEMBER 2013

PH 3810 - SOLID STATE PHYSICS - I

Date : 04/11/2013
Time : 9:00 - 12:00

Dept. No.

Max. : 100 Marks

PART - A

Answer **ALL** questions:

(10 x 2 = 20)

1. Sketch the (111) and (123) planes.
2. What is the energy of the X-ray beam of wave length 2.25 Å?
3. Distinguish between N and U process?
4. What are acoustic and optic mode of lattice vibrations?
5. State Widemann-Franz law.
6. What is Hall effect?
7. List out the main sources of electrical resistance in materials.
8. Distinguish between ceramics and conductors.
9. What are closed and open orbits?
10. Write a note on quantisation of electron orbits.

PART - B

Answer any **FOUR** questions:

(4 x 7.5 = 30)

11. Give the lattice specifications of 14 Bravais lattices.
12. The velocity of sound in gold is 2500 m/s and that in copper is 3800 m/s. If the Debye temperature of copper is 360 K, determine the Debye temperature of gold. The density of copper and gold are respectively 18000 kg/m³ and 8000 kg/m³ and their atomic weights are 197 and 63.54 a.m.u. respectively.
13. Derive the pressure versus volume relationship for a free electron gas at 0 K. Hence obtain the expression for bulk modulus in terms of the average kinetic energy.
14. Distinguish between metals, insulators and semiconductors on the basis of band theory of solids.
15. Explain Harrison's method of construction of 2D Fermi Surface.

PART C

Answer any **FOUR** questions:

(4 x 12.5 = 50)

16. Show that the reciprocal lattice of FCC structure is BCC and that of BCC is FCC.
17. Derive the dispersion relationship for a one dimensional di-atomic crystal and discuss the nature of acoustic and optical modes. Show that the group velocity vanishes at the zone boundary.
18. Discuss the free electron theory of metals. Obtain expressions for Fermi energy and total energy at absolute 0.
19. Outline the various Zone schemes. Explain in detail periodic zone scheme, extended zone scheme and reduced zone scheme with the aid of E-K relationship.
20. Discuss the effect of electric field on the Fermi surface.
