D 71337 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2014

(CUCSS)

Physics

PHY 3C 11—SOLID STATE PHYSICS

(2012 Admission onwards)

Time : Three Hours Maximum : 36 Weightage

Part A

Answer **all** *questions.*
Each question carries 1 *weightage.*

1. Define : (a) Primitive (b) Unit cell.
2. What is Cohesive energy and electron affinity ?
3. Why does density of iron increase when metallic iron changes from bcc structure to fcc structure ?
4. What are the salient features of quantum theory of specific heat of solids ?
5. What are the drawback of classical free electron theory ?
6. What is meant by imperfections in a crystal ?
7. What is Fermi energy and Fermi momentum ?
8. Give the nature of motion of an electron in a periodic potential.
9. Explain hysteresis in magnetic materials.
10. What is magnetostrictive energy ?
11. What is Superconductivity ? Give one use.
12. Explain the principle of SQVID. Give its engineering applications.

(12 × 1 = 12 weightage)

Part B

Answer any **two** *questions.*
Each question carries 6 *weightage.*

1. Explain symmetry elements in crystals. Describe the various types of symmetry elements and symmetry operations of a cubic crystal.
2. Discuss the Kronig-Penney model for the motion of an electron in a periodic potential.
3. Derive an expression for the specific heat capacity of solid using Deby's theory. How does the result agree with experimental data ?

4. Discuss Weiss theory of ferromagnetism. How is hysteresis and Curie point explained based o this theory ?

(2 × 6 = 12 weightag

Part C

Answer any **four** *questions.*
Each question carries 3 *weightage.*

1. Calculate the compressibility of sodium chloride assuming a respulsive potential of the form B/r^2 t act between nearest neighbours, of distance 0.281nm. Madelung constant = 1.7476.

2. In a one dimensional crystal with atomic spacing 2.5A°, calculate the free electron energy at whic the first Bragg reflection occurs.

3. Evaluate the carrier concentration and conductivity of the intrinsic Ge at T = 300 K $m = 9.1 \times 10^{-31}$/kg, Eg = 0.68ev, $\mu e = 0.38 m^2$/V-sec, $\mu h = 0.18 m^2$/V-sec, $k_B = 1.38 \times 10^{-23}$J/K an $h = 1.055 \times 10^{-34}$ J-sec.

4. A paramagnetic salt contains 10^{28} ions/m^3 with magnetic moment of one Bohr magneton. Calculat the paramagnetic susceptibility and the magnetization produced in a uniform magnetic field o 10^6 amp/meter at 300K.

5. Calculate the change in magnetic moment of an electron in a hydrogen atom orbiting in an orbit o radius 0.5A° if a magnetic field of induction 2 weher/m^2 acts at right angles to the plane of th orbit.

6. Define London Penetration depth. Calculate the value of the London Penetration depth λ_0 at 0 K for lead whose density is 11.3×10^3kg/m^3 and the atomic weight is 207.19 (T_c = 7.22K). Calculat the increase in λ at 3.61K from 0 K.

(4 × 3 = 12 weightage