(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 9 Sub. Code : 3718

Exam. Code : 0474

M.Sc. Physics 3rd Semester

(2123)

CONDENSED MATTER PHYSICS—I

Paper : PHY-8033

Time Allowed : Three Hours] **[Maximum Marks : 60**

Note :— Attempt *five* questions in all, selecting one question each from Unit I to Unit IV. Unit V is compulsory.

UNIT—I

1. (a) Define cohesive energy of ionic crystals. Derive its expression in terms of Madelung constant.

   (b) Define structure factor of cubic crystals. Compute its values for BCC and FCC crystals. 8+4

2. (a) Define elastic stiffness constants for a solid. Prove that these elastic constants are symmetric so that 36 elastic constants reduce to 21.

   (b) Describe the acoustic and optical modes in a diatomic linear chain. 8+4

UNIT—II

3. (a) What is Bloch function ? Compute the expression for the energy bands of a square lattice using the tight binding approximation.

   (b) Explain the concept of effective mass of electrons in solids. Show that it can also have negative values. 8+4

4. (a) Discuss the OPW method for solving the Schroedinger equation of electrons in solids.

   (b) Describe the different zone schemes for plotting the energy bands in solids. 8+4

UNIT—III

5. (a) Write and discuss the physical quantities and different terms of Boltzmann transport equation.

   (b) Describe the thermoelectric effects using the Boltzmann transport theory. 8+4

6. (a) Find the expression for the thermal conductivity of electrons using the Boltzmann transport equation.

   (b) Using the Boltzmann transition equation prove Wiedmann-Franz law for metals. 8+4

UNIT—IV

7. (a) Describe different types of polarizabilities. Derive the dispersion relation of electrical polarizability using the classical theory.

   (b) Discuss dielectric constant and its experimental measurements. 8+4

8. (a) Derive and discuss the Clausius-Mosotti relation.

(b) Describe the domain theory of ferroelectricity. Show that electrical susceptibility of ferroelectric crystals obey Curie-Weiss law. 8+4

UNIT—V

9. Answer any **SIX** out of the following questions :

(i) What is atomic structure ? Explain briefly.

(ii) What is Madelung constant ? Explain briefly.

(iii) Why ionic crystals are brittle in nature ?

(iv) Distinguish between direct and indirect band gap semiconductors.

(v) What is Hall effect ? Explain.

(vi) What is magneto-resistance ? Explain.

(vii) What is piezoelectric effect ? Explain.

(viii) Explain the phenomena of anti-ferroelectricity. 6×2=12