

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

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Exam. Code :

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M.Sc. Physics 3rd Semester
(2125)

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 Units I to IV. Unit-V is compulsory to attempt.

UNIT—I

1. (a) Show that velocity of transverse waves in the [111] direction of the cubic crystal is given by :

$$v_s = [(C_{11} - C_{12} + C_{44})/3\rho]^{1/2} \quad 6$$

- (b) Define elastic constant for a crystal. Prove that elastic stiffness constants are symmetrical $C_{ij} = C_{ji}$. 6

2. (a) Derive the expression for the evaluation of Dynamical matrix for pair potential. Discuss Acoustic and optical modes. 7

- (b) Explain anharmonicity. Derive an expression for thermal expansion coefficient. 5

UNIT—II

3. (a) How Kroning-Penney model explains the width of allowed and forbidden bands with the change in strength of periodic potential? 7
- (b) Derive an expression for the position of Fermi level in doped semiconductors 5
4. (a) What is nearly free electron approximation? Using nearly free electron approximations, find the magnitude of forbidden energy gap at zone boundary. 6
- (b) Using tight binding approximation construct the energy band from s-state in FCC Solid. 6

UNIT—III

5. (a) What is magneto resistance? Derive the expression for the same. 6
- (b) Find the expression for thermal conductivity in terms of electrical conductivity and hence discuss Wiedemann-Franz law. 6
6. (a) Calculate relaxation time in metals using Boltzmann Transport Equation. 6
- (b) Considering Transport theory of metals, obtain the expression for Boltzmann Transport Equation. 6

UNIT—IV

7. (a) Derive Claussius Mossoti equation. Discuss the variation of dielectric constant of ferroelectric materials above Curie temperature. 6
- (b) What is piezoelectric effect? Explain its origin. Discuss the application of piezoelectric crystals. 6
8. (a) Derive Kramers-Kroning relations and discuss their importance. 6
- (b) Explain the dipolar, ionic, electronic polarizabilities. 6

UNIT—V

(Compulsory)

9. Answer any **Six** of the following questions :
- (i) Write a short note on binding in solids.
- (ii) Draw and explain the position of Fermi levels in pure and doped semiconductors.
- (iii) Explain the phenomenon of anti-ferroelectricity.
- (iv) Describe the umklapp and N-processes.
- (v) What is effective mass & what are elastic waves?
- (vi) What are Brillouin zones?
- (vii) What is Hall Effect? Explain.
- (viii) What is piezoelectric effect? 6×2=12