

R. 18

(i) Printed Pages : 3 Roll No.

(ii) Questions : 7 Sub. Code :

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Exam. Code :

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B.A./B.Sc. (General) 5th Semester
1128

PHYSICS

Paper—A : Condensed Matter Physics—I

Time Allowed : Three Hours] [Maximum Marks : 22

Note :- Attempt FIVE questions in all, selecting at least two questions each from Section A and B. Section-C (Q.No. 7) is compulsory. Use of Non-programmable Calculator is allowed. You can ask for log tables.

SECTION—A

- 1. (a) What is meant by packing fraction ? Calculate the values of packing fraction for S.C., B.C.C. and F.C.C. crystals. Also find the packing fraction for Diamond. 2½
- (b) Calculate the spacing between (011), (101), (112), (111) and (100) planes in terms of lattice constant 'a' of a cubic lattice. 2
- 2. (a) Discuss Laue theory of diffraction and find the Laue Equations. 2½
- (b) Describe with the help of diagram, the first Brillouin Zone of the B.C.C. lattice. 2

3. (a) What is K-space ? Show that F.C.C. lattice is the reciprocal lattice of B.C.C. with lattice constant $\frac{2\pi}{a}$. 2½
- (b) What do you understand by lattice, unit cell and basis ? Discuss Bravais lattice for two dimensions. 2

SECTION—B

4. (a) Obtain expression for the Fermi Energy, total energy and density of states for a free electron gas in one dimension. Also show the variation of density of states with energy. 2½
- (b) Explain Thermal Conductivity and prove Weidemann-Franz Law using Lorentz-Drude Theory. 2
5. Discuss Kronig-Penny model for electron energy in solids and show how it explains forbidden bands. 4.5
6. (a) Obtain and discuss the expression for electrical conductivity of an intrinsic semiconductor. Discuss the variation of conductivity with temperature. 2
- (b) A semiconductor has electron density 0.45×10^{12} per cubic meter and hole density 5×10^{20} per cubic meter. Find its conductivity.
- Given $\mu(\text{electron}) = 0.135$ SI units
- $\mu(\text{holes}) = 0.048$ SI units
- Also specify the type of semiconductor. 2½

SECTION—C

7. Attempt any **eight** :—

- (i) What is Coordination Number ?
- (ii) What is meant by Axis of Symmetry ?
- (iii) Define Atomic Scattering factor.
- (iv) State Bragg's condition.
- (v) What is the position of Fermi level at 0K ?
- (vi) Define mean free path and relaxation time.
- (vii) Just state Bloch Theorem.
- (viii) What do you understand by Energy Gap ?
- (ix) What is Hall Effect ?
- (x) N-type or P-type semiconductors are electricity neutral.
Explain.

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