2016

Time : 3 hours

Full Marks : 80

The figures in the right-hand margin indicate marks.

Answer from both the Sections as directed.

(BASIC SOLID STATE PHYSICS)

Section – A

1. Answer any **four** questions of the following : 4×4 = 16

   (a) What is Covalent bond ? Give the structure of a crystal having this bond.

   (b) Obtain Debye's T^3 law.

   (c) Explain Hall effect.

   (d) Explain origin of energy gap.

   (e) Explain the thermal ionization of donors and acceptors.

   (f) Explain local field in dielectrics.

OR

2. Answer **all** questions from the following : $2 \times 8 = 16$

(a) What is exchange interaction.

(b) Define covalent bond.

(c) Define Fermi-Dirac distribution.

(d) State Ohm's law.

(e) Define heat capacity.

(f) What do you mean by energy gap ?

(g) Define diffusion.

(h) Define intrinsic semiconductor.

Section – B

Answer **all** questions : $16 \times 4 = 64$

3. (a) What are ionic crystals ? Explain the formation of an ionic crystal and obtain an expression for its cohesive energy.

OR

(b) Discuss lattice dynamics of a diatomic lattice and explain what are acoustic and optical phonons.

4. (a) Define phonon heat capacity and explain the Debye's theory of specific heat.

OR

(b) Explain free electron gas in three dimensions and deduce Wiedemann-Franz law.

5. (a) Discuss the Kronig-Penny model for the motion of an electron in a periodic potential.

OR

(b) State and explain Block Theorem and obtain the approximate selection near a zone boundary.

6. (a) Describe, with suitable diagrams, different point defects in a crystal lattice.

OR

(b) Discuss Lorentz field in solid dielectric and hence derive the Clausius-Mossotti relation.