Or

(*b*) Obtain the solution of the central equation and explain the number of orbitals in a metals and insulators.

6. (*a*) Distinguish between intrinsic and impurity semiconductor with examples. Discuss the theory of intrinsic conductivity of a semiconductor.

Or

(*b*) Explain what is meant by polarization in dielectrics. Arrive at the relation between the dielectric constant and atomic polarizability.

M.Sc.—Phy-IIS (203)

2019

Time : 3 hours

Full Marks : 80

Answer from **both** the Sections as per direction

The figures in the right-hand margin indicate marks

Candidates are required to answer in their own words as far as practicable

(BASIC SOLID STATE PHYSICS)

SECTION – A

1. Answer any *four* questions : 4 × 4

(*a*) If n for KCl is 5·77, madelung constant is 1·75 and nearest separation 0·314 nm, calculate the cohesive energy [$I = 4{\cdot}1$ eV and $E = 3{\cdot}6$ eV].

(*b*) Explain the effect of temperature on the Fermi-Dirac distribution function.

(*c*) Write a note on electrical conductivity.

(*d*) Explain the number of orbitals in a band.

(*e*) Explain the local electric field in dielectrics.

(*f*) Find the total polarizability of CO_2, if its susceptibility is $0{\cdot}985 \times 10^{-3}$. Density of carbon dioxide is 1·977 kg/m^3.

Or

2. Answer *all* questions : 2 × 8

(*a*) What is a covalent bond in crystals ? Explain.

(*b*) What do you mean by long-wavelength limits ?

(*c*) Define phenon heat capacity.

(*d*) Explain ohm's law

(*e*) What do you mean by energy gap ? Explain.

(*f*) Define diffusion in semiconductor.

(*g*) Define local field in solid dielectrics.

(*h*) Define lattice energy.

SECTION – B

Answer **all** questions : 16 × 4

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

Or

(*b*) Discuss in detail the vibration of a dietomic linear chain.

4. (*a*) Obtain Debye's T^3 law and explain the Einstein's theory of the specific heat in free electrons.

Or

(*b*) Explain the free electron gas in three dimensions and obtain an expression for heat capacity of electron gas.

5. (*a*) Describe nearby free electron model and explain the origin of the energy gap.