Fundamentals of Electronics Devices

Unit-1

Lecture-6

Planes and Directions

- In discussing crystals it is very helpful to be able to refer to planes and directions within the lattice.
- The notation system generally adopted uses a set of three integers to describe the position of a plane or the direction of a vector within the lattice.

- The three integers describing a particular plane are found in the following way:

1. Find the intercepts of the plane with the crystal axes and express these intercepts as integral multiples of the basis vectors (the plane can be moved in and out from the origin, retaining its orientation, until such an integral intercept is discovered on each axis).

2. Take the reciprocals of the three integers found in step 1 and reduce these to the smallest set of integers *h, k and l,* which have the same relationship to each other as the three reciprocals.
3. Label the plane (*hkl*).

Introduction

- The interaction of electrons in neighboring atoms of a solid serves the very important function of holding the crystal together.
- For example, alkali halides such as NaCl are typified by *ionic bonding.*
- in the NaCl lattice, each Na atom is surrounded by six nearest neighbor Cl atoms and vice versa.

- Each Na^+ ion exerts an electrostatic attractive force upon its Cl^- neighbors, and voce versa.
- These coulombic forces pull the lattice together until a balance is reached with repulsive forces.
- A reasonably accurate calculation of the atomic spacing can be made by considering the ions as hard spheres being attracted together.

- An important observation in the NaCl structure is that all electrons are tightly bound to atoms.
- Once the electron exchanges have been made between the Na and Cl atoms to form Na^+ and Cl^- ions, the outer orbits of all atoms are completely filled.