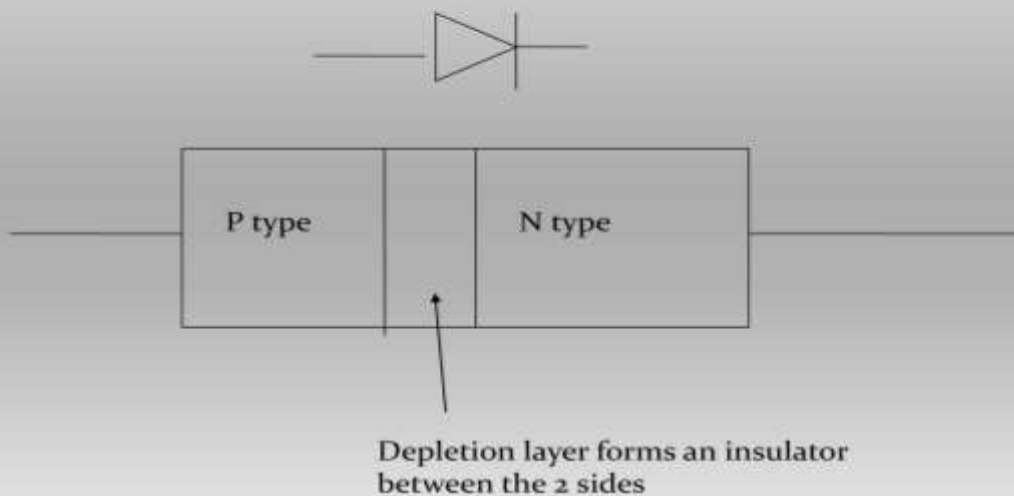




## Lecture 6

***P-N JUNCTION*** :-A p–n junction is a boundary or interface between two types of semiconductor material, p-type and n-type, inside a single crystal of semiconductor. It is created by doping.

- **Electronic Symbol** .....the triangle shows indicated the direction of current



# Formation of depletion layer

the excess electrons in the N region cross the junction and combine with the excess holes in the P region.

N region loses its electrons .....becomes +vely charged

P region accepts the electrons .....becomes -vely charged

At one point , the migratory action is stopped.

- An additional electrons from the N region are repelled by the net negative charge of the p region.

Similarly,

- An additional holes from the P region are repelled by the net positive charge of the n region.

- Net result

a creation of a thin layer of each side of the junction .....which is depleted (emptied) of mobile charge carriers.... This is known as DEPLETION LAYER

..Thickness is of the order of  $10^{-6}$ meter.

- The depletion layer contains no free and mobile charge carriers but only fixed and immobile ions.
- Its width depends upon the doping level..
- Heavy doped.....thin depletion layer
- lightly doped.....thick depletion layer

## POTENTIAL BARRIER

- The electrons in the N region have to climb the potential hill in order to reach the P region
- Electrons trying to cross from the N region to P region experience a retarding field of the battery and therefore repelled. Similarly for holes from P region.
- Potential thus produced are called ..potential barrier
- Ge..0.3 V Si ..0.7V

PN junction can basically work in two modes, (*A battery is connected to the diode*)

forward bias mode ( positive terminal connected to p-region and negative terminal connected to n region)

reverse bias mode ( negative terminal connected to p-region and positive terminal connected to n region) .

## Forward biased PN junction

- . It forces the majority charge carriers to move across the junction  
....decreasing the width of the depletion layer.

- Once the junction is crossed, a number of electrons and the holes will recombine .
- For each hole in the P section that combines with an electron from the N section, a covalent bond breaks and an electron is liberated which enters the positive terminal
- Thus creating an electron hole pair.
- Current in the N region is carried by ....electrons
- Current in the P region is carried by .... Holes.

## Reverse biased pn junction

- If the + of the battery is connected to the n-type and the - terminal to the p-type,

*the free electrons and free holes are attracted back towards the battery, hence back from the depletion layer, hence the depletion layer grows.*

Thus a reverse biased pn junction does not conduct current.

- Thus the P N junction diode allows the electrons flow only when P is positive .
- This property is used for the conversion of AC into DC ,Which is called **rectification**.

## APPLICATIONS-

- ....as rectifiers to convert AC into DC.
- As an switch in computer circuits.
- As detectors in radios to detect audio signals
- As LED to emit different colours.

## ADVANTAGES:

- No filament is necessary
- Occupies lesser space
- Long life.