

Marwari college Darbhanga

Subject---physics Hons

Class--- B. Sc. Part 2

Paper---04 ; Group—B

Topic--- Tunnel Diode (Electronics)

Lecture series --76

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Tunnel Diode

Tunnel diode definition

A Tunnel diode is a heavily doped p-n junction diode in which the electric current decreases as the voltage increases.

In tunnel diode, electric current is caused by “Tunneling”. The tunnel diode is used as a very fast switching device in

computers. It is also used in high-frequency oscillators and amplifiers.

Symbol of tunnel diode

The circuit symbol of tunnel diode is shown in the below figure. In tunnel diode, the p-type semiconductor act as an anode and the n-type semiconductor act as a cathode.

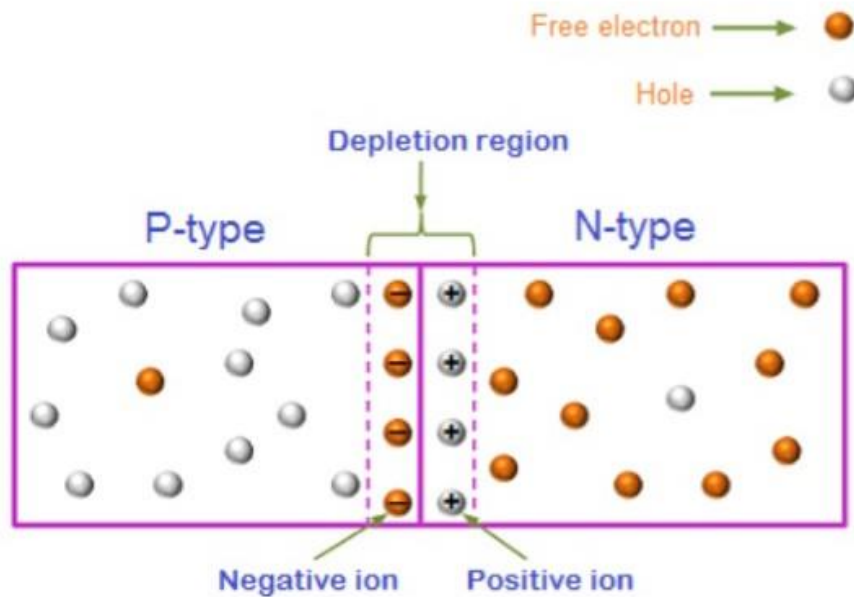


Tunnel diode symbol

We know that a anode is a positively charged electrode which attracts electrons whereas cathode is a negatively charged electrode which emits electrons. In tunnel diode, n-type semiconductor emits or produces electrons so it is referred to as the cathode. On the other hand, p-type semiconductor attracts electrons emitted from the n-type semiconductor so p-type semiconductor is referred to as the anode.

tunnel diode is also known as Esaki diode which is named after Leo Esaki for his work on the tunneling effect. The operation of tunnel diode depends on the quantum mechanics principle known as “Tunneling”. In electronics, tunneling means a direct flow of electrons across the small

depletion region from n-side conduction band into the p-side valence band.



Tunnel diode

germanium material is commonly used to make the tunnel diodes. They are also made from other types of materials such as gallium arsenide, gallium antimonide, and silicon.

Concept of tunneling

The depletion region or depletion layer in a p-n junction diode is made up of positive ions and negative ions. Because of these positive and negative ions, there exists a built-in-potential or electric field in the depletion region. This electric field in the depletion region exerts electric force in a direction opposite to that of the external electric field (voltage).

Another thing we need to remember is that the valence band and conduction band energy levels in the n-type semiconductor are slightly lower than the valence band and conduction band energy levels in the p-type semiconductor. This difference in energy levels is due to the differences in the energy levels of the dopant atoms (donor or acceptor atoms) used to form the n-type and p-type semiconductor.

Advantages of tunnel diodes

- Long life
- High-speed operation
- Low noise
- Low power consumption

Disadvantages of tunnel diodes

- Tunnel diodes cannot be fabricated in large numbers
- Being a two terminal device, the input and output are not isolated from one another.

Applications of tunnel diodes

- Tunnel diodes are used as logic memory storage devices.
- Tunnel diodes are used in relaxation oscillator circuits.
- Tunnel diode is used as an ultra high-speed switch.
- Tunnel diodes are used in FM receivers.

