

# Junction Diode

## Lecture - 9

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**B.Sc (Electronics)  
TDC PART - I  
Paper – 1 (Group – B)  
Unit – 5  
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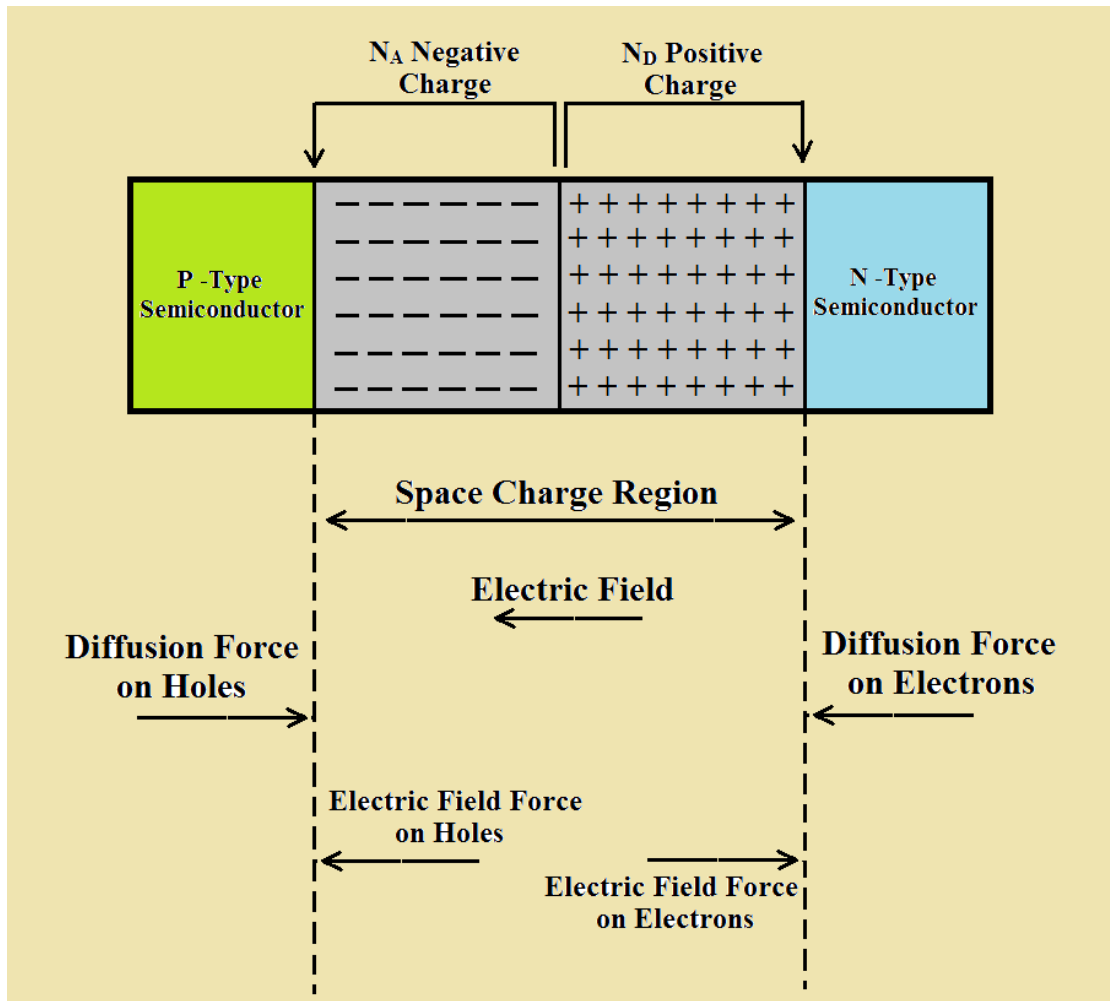


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### ➤ **Space Charge at a P-N Junction**

- ⇒ We already learn in **Lecture – 3** of Unit -5 (Junction Diode), that the interface separating the N – Type region and P – Type region is called the **Metallurgical Junction**.
- ⇒ Let us consider a **Step Junction** in which the **Doping Concentration** is **uniform** in each region but there is an **Abrupt change** in **doping** at the **junction**. Initially, at the **Metallurgical Junction**, there is a **Very Large Density Gradient** in both the Electron and Hole concentrations. Majority carrier Electrons in the N – Type region will begin diffusing into the P – Type region and Majority carrier Holes in the P – Type region will begin diffusing into the N – Type region.



**Fig. (1)** Shown Space Charge Region, Electric Field and Forces Acting on the Charge Carriers.

- ⇒ From above **Figure (1)**, it represents the **Net Positively** and **Negatively Charged** regions for a semiconductor P-N junction where there are **no external connection, no applied voltage, no field etc.**
- ⇒ The **Net Positive and Negative charges** in the N – Type region and P – Type region **induce** an **Electric Field** near the junction in the **direction from the Positive to the Negative charge**, or **from the N – Type region to the P – Type region**. Since the Electrons and Holes are both pushed out of the **Space Charge Region** by the Electric Field, the region is depleted of any mobile charge and is called **the Depletion Region**.

⇒ **Density Gradients** still exist in the **Majority Carrier Concentrations** at each Edge of the Space Charge Region. A **density gradient** may be considered as producing a **“Diffusion Force”** acting on the majority carriers. These **Diffusion Forces**, acting on the **Electrons and Holes** at the Edges of the **Space Charge Region**, are indicated in the above **Figure (1)**.

⇒ The **Electric Field** in the **space charge region** develops another force on the Electrons and Holes which is in the **opposite direction** to the **diffusion force** for each type of particle. In Thermal Equilibrium, the **Diffusion Force** and **Electric Field force** exactly balance each other.

⇒ In the next **Lecture - 10**, we will discuss the detailed of the **Energy Band Structure of an Open-Circuited P-N Junction**.

**to be continued .....**

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