Four Layer P-N-P-N Switching Devices
(Uni Junction Transistor)

Lecture – 7

TDC PART – II
Paper - III (Group - A)
Chapter - 4

by:

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- **(Uni Junction Transistor)**
- **Lecture Content :-**
  - **UJT Parameters**
  - (4) Theory of UJT Operation

UJT Parameters

- **(4) Theory of UJT Operation**

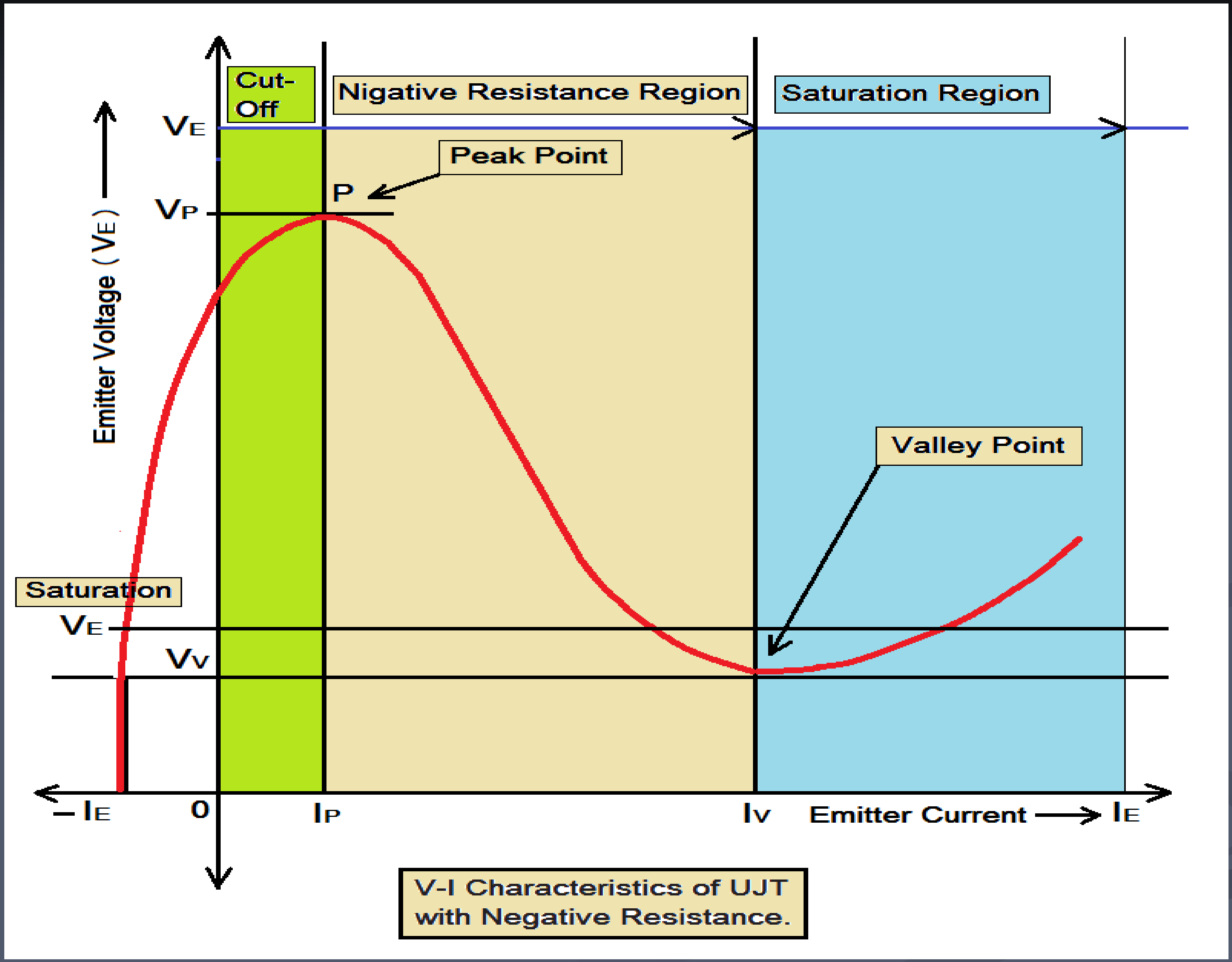
- Initially imagine that the **Emitter Supply Voltage** is turned down to **Zero** then **V_E** is **Zero.** Then the **Intrinsic Stand-off Voltage, Reverse-Biases** the **Emitter Diode D.** If **V_D** is the **barrier voltage** of the **Emitter Diode D,** hence some **Reverse Emitter Current I_E** flows until, the value of **V_E** reaches a point at which

- **$V_E = \eta V_{BB}$**

- This is the point where the curve touches the **Y-axis** then the total **Reverse Bias Voltage V_E** is
- $V_E = V_A + V_D$
- When V_{BB} is **Switched ON**, V_A is developed and **Reverse-Biases the Junction.** If (**Silicon Diode Forward Voltage drop) V_D** is the barrier voltage of the **P-N Junction**, then total **Reverse Bias Voltage V_E** is
- $V_E = V_A + V_D$

- From **Lecture – 5** and **equation (5),**
- $V_A = \eta V_{BB}$, then we get
- $V_E = \eta V_{BB} + V_D$
- Value of V_D for **Si** is **0.7 V**.
- $V_E = \eta V_{BB} + V_D$
- $V_E = \eta V_{BB} + 0.7\ V$

- It is obvious that **Emitter Junction** will not become **Forward-Biased** unless its **applied voltage V_E exceeds ($\eta V_{BB} + V_D$) or $V_E = \eta V_{BB} + 0.7$ V .** This value of **V_E** is called **Peak -Point Voltage V_P** which is **shown in below Figure (16).**



- **Fig (16)** Shown V-I Characteristics of UJT with Negative Resistance.

- When $V_E = V_P$, **Emitter Peak Current I_P** starts to flow through **R_{B1}** to ground (i.e. **B_1**). The **UJT is then said** to have been **Fired** or **Turned ON.** Due to the flow of **I_E (= I_P)** through **R_{B1}**, number of **charge carriers** in **R_{B1}** is **Increased** which **Reduces its Resistance.** As η depends on **R_{B1}**, **its value is also Decreased**.

- Hence, we find that as **V_E** and hence **I_E** **Increases** (beyond **I_P**), **R_{B1}** **Decreases**, η **Decreases** and **V_A** **Decreases**. This **Decrease in V_A** causes more **Emitter Current** to flow which causes a further **Reduction** **in R_{B1}**, η and **V_A**. Obviously, the process is **Regenerative**; **V_A** as well as **V_E** quickly drops as **I_E** **Increases.** Since, **V_E** **Decreases** when **I_E** **Increases** the **UJT Possesses** **Negative Resistance.**

- Beyond the **Valley Point V_V, UJT** is in **Saturation Region** and **V_E Increases Very Little** with an **Increasing I_E.** It is seen that only **Terminals E** and **B_1** are the active terminals whereas **B_2** is the bias terminal i.e. it is meant only for applying external voltage across the **UJT**.

- Generally, **UJT** is triggered into conduction by applying a **suitable Positive Pulse** at its **Emitter Terminal E.** It can be brought back to **OFF State** by applying a **Negative Trigger Pulse**. **Three other important Parameters for the UJT** is **I_P, V_V** and **I_V** and is defined below:

- **Peak-Point Emitter Current. (I_P) : -** It is the **Emitter Current** at the **Peak Point.** It repre-sents the**Minimum Current** that is required to **trigger the device (UJT).** It is **Inversely Proportional to the Inter-Base Voltage V_{BB}.**

- **Valley Point Voltage (V_V)** :- The **Valley Point Voltage** is the **Emitter Voltage** at the **Valley Point.** The **Valley Voltage Increases** with the **Increase in Inter-Base Voltage V_{BB}.**

- **Valley Point Current (I_V)** :- The **Valley Point Current** is the **Emitter Current** at the **Valley Point.** It **Increases** with the **Increase in Inter-Base Voltage V_{BB}.**

to be continued ……………….