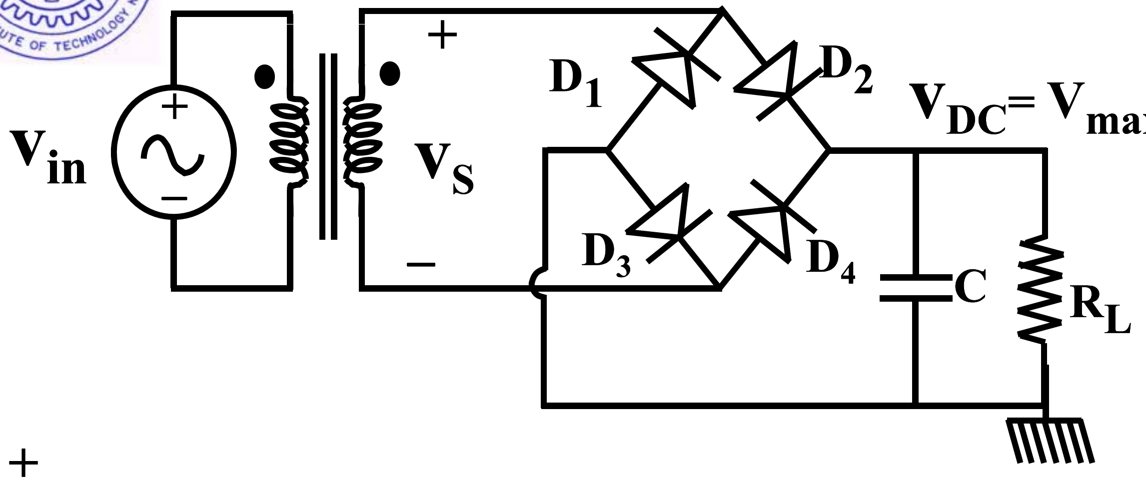
# ESc201, Lecture 17: Unregulated Bridge Power Supply-Full Wave Bridge Rectifier

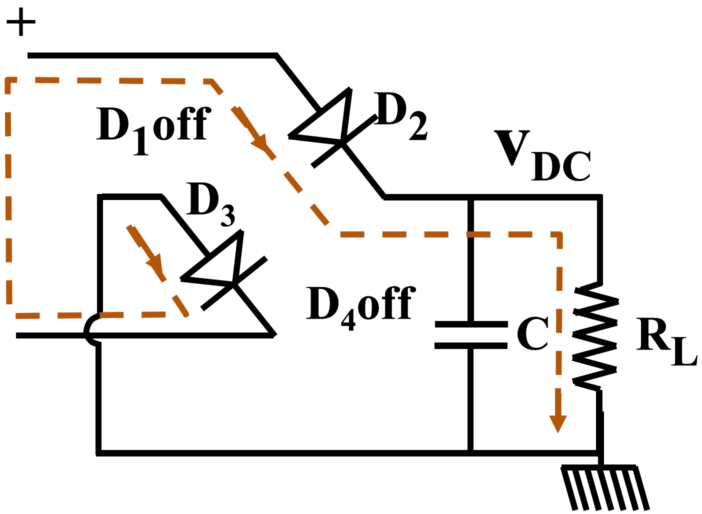



$V_{DC} = V_{max} - 2V_{on}$

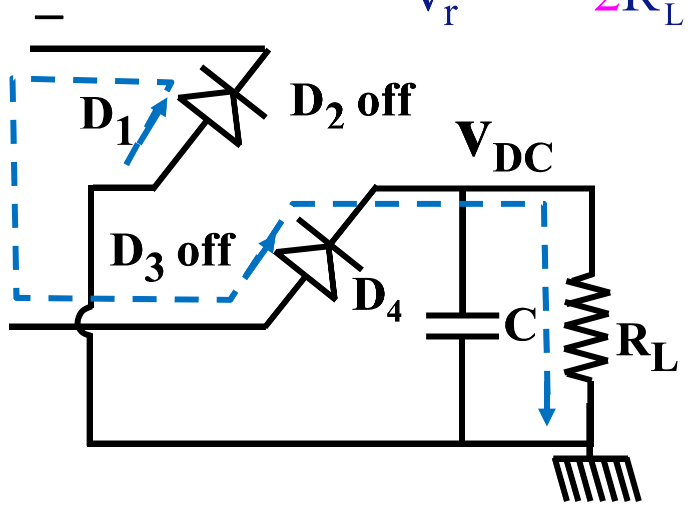
Advantage : PIV = $V_{max}$ in contrast to $2V_{max}$ in the others (HWR & FWR).

C required (smallest) is slightly different from that of FWR and from HWR.

$$C = \frac{(V_{max} - 2V_{on})}{V_r}\frac{T}{2R_L}$$




$$I_{D,\,max}\Big|_{HWR} = 2\,I_{D,\,max}\Big|_{FWR} = 2I_{D,\,max}\Big|_{BR}$$




Advantage : Center Tapped Transformer NOT REQUIRED

Disadvantage : FOUR Diodes are required.

**Design a rectifier to provide a DC output of 15V with no more than 1% ripple at $I_L$=2A.**

**Unknowns: 1) Circuit Topology, 2) Transformer Voltage, 3) Filter capacitor, 4) Diode PIV, 5) Diode Power rating (i.e. repetitive current rating), and 6) Diode Peak Current Rating.**

**Choose a Full Wave Bridge Rectifier topology as it requires the lowest PIV, Smallest Filter Capacitor, and no center-tapped transformer is required.**

**Approximations: $V_r << V_{DC}$, $\Delta t << T/2$, and $V_{on} = 0.6V$.**

$$V_{rms} = \frac{V_{max}}{\sqrt{2}} \cong \frac{V_{DC} + 2V_{on}}{\sqrt{2}} = \frac{15+1.2}{\sqrt{2}} = 11.46 \text{ rms}$$

$$C = \frac{(V_{max} - 2V_{on})}{V_r} \frac{T}{2R_L} \cong \frac{V_{DC}}{R_L} \frac{T}{2V_r} = I_{DC} \frac{T/2}{V_r} = (2A) \times \frac{1/(2\times 50)}{15/100} = 0.13333 \text{ F}$$

$$\Delta t = \frac{1}{\omega} \sqrt{\frac{2V_r}{V_{max}}} = \frac{1}{100\pi} \sqrt{\frac{2\times 0.15}{16.2}} = 433 \ \mu\text{s}$$

$$I_{D_{max}} = I_{DC} \left(\frac{2}{\Delta t}\right) \frac{T}{2} = (2A) \times \frac{1/50}{433\times 10^{-6}} = 92.4 \text{ A}$$

$$I_{D_{surge}} = \omega C V_{max} = 100\pi \times 0.13333 \times 16.2 = 678.6 \text{ A}$$

# ESc201, Lecture 17: Bipolar Junction Transistor

Q2 → Oct 3
→ Oct 17

**Bipolar Junction Transistors (BJTs):** ***Bipolar: both electrons and holes contribute to current transport through the device*** **(Basically two** ***back-to-back diodes)***

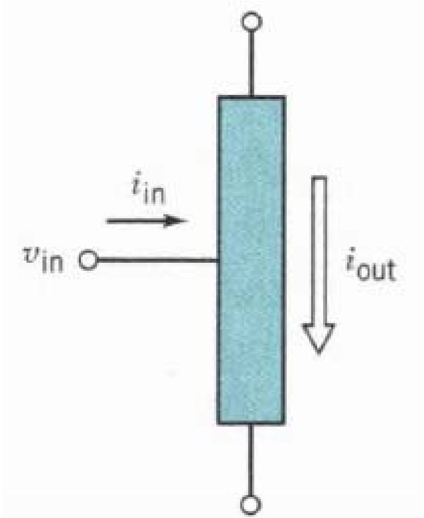
$$\beta = \frac{I_C}{I_B}$$

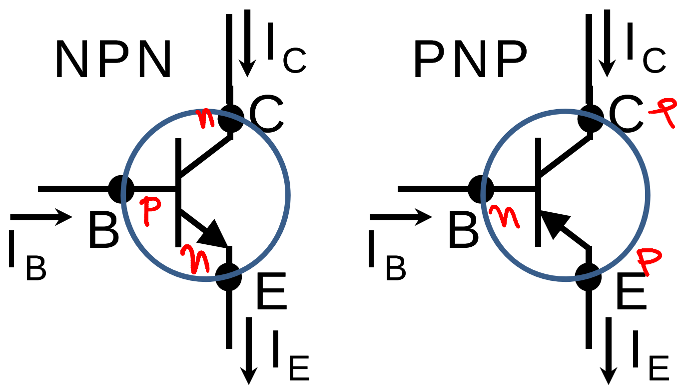
**Name originates from** ***Transfer of Resistor***

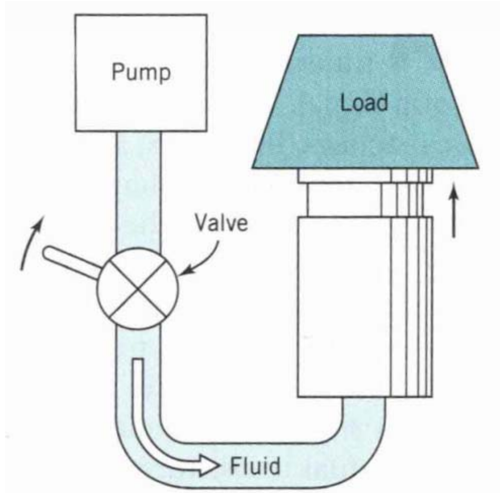
***Three-Layer/Terminal device [Emitter (E), Base*** **(B),** ***Collector (C)***

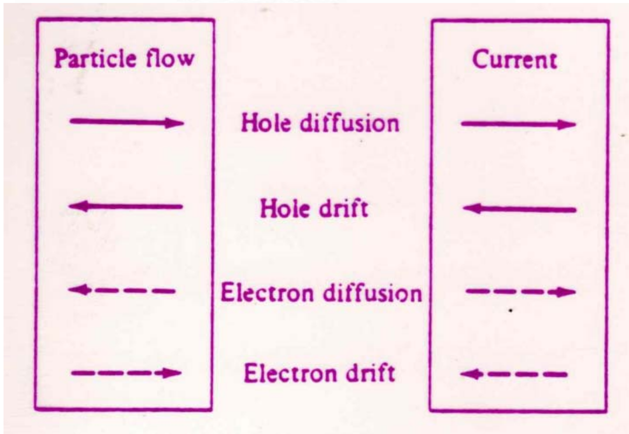
***[ Two-Junction [Base-Emitter (BE), Base-Collector (BC)]***

**Current through two terminals (E and C) can be** ***controlled by the current through the*** **third terminal (B)** **Current controlled device**



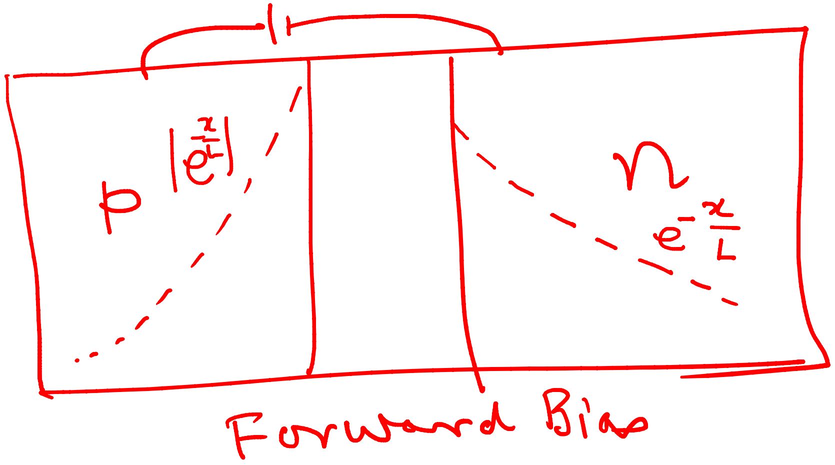



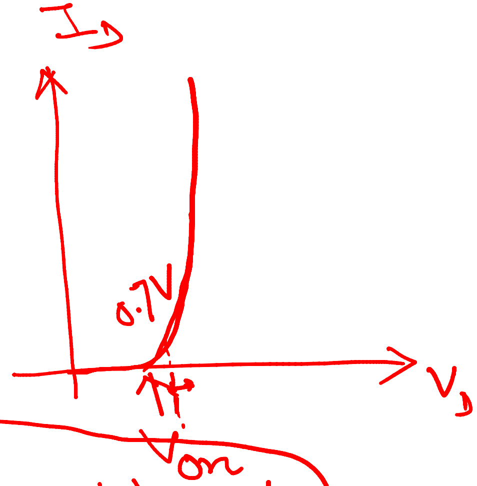



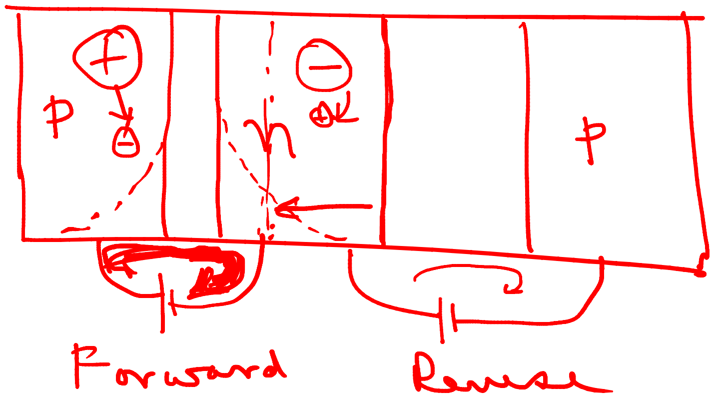

**Active device capable of producing voltage/current/power gain**

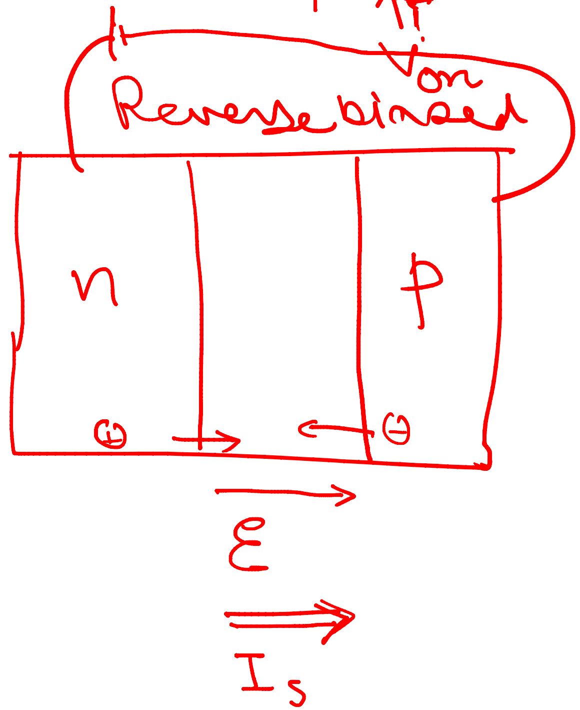
- **Two basic usage: 1 Amplification (Analog Circuits) , 2 Switching (Digital Circuits)**
- **Two types: npn and pnp (only npn transistor applications would be done)**

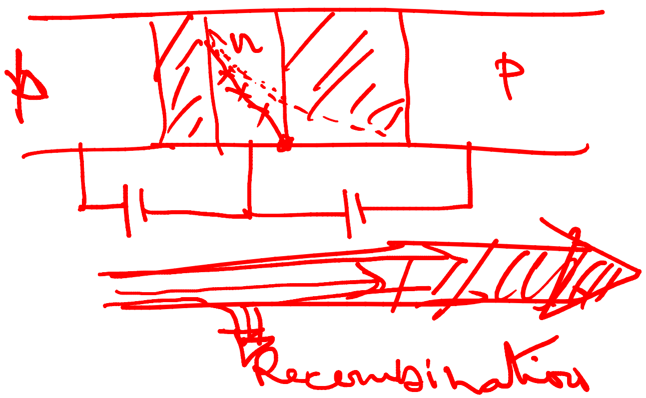
# ESc201, Lecture 17: Bipolar Junction Transistor



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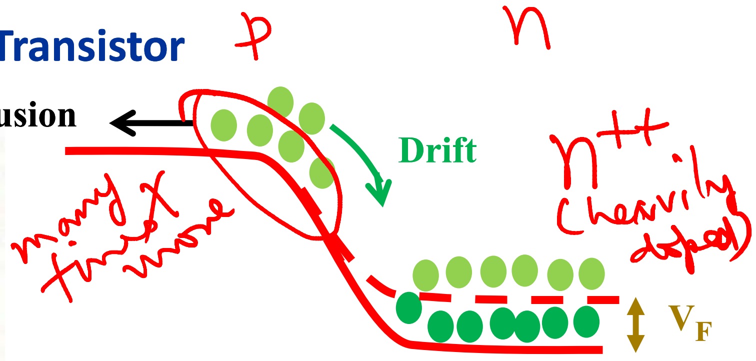


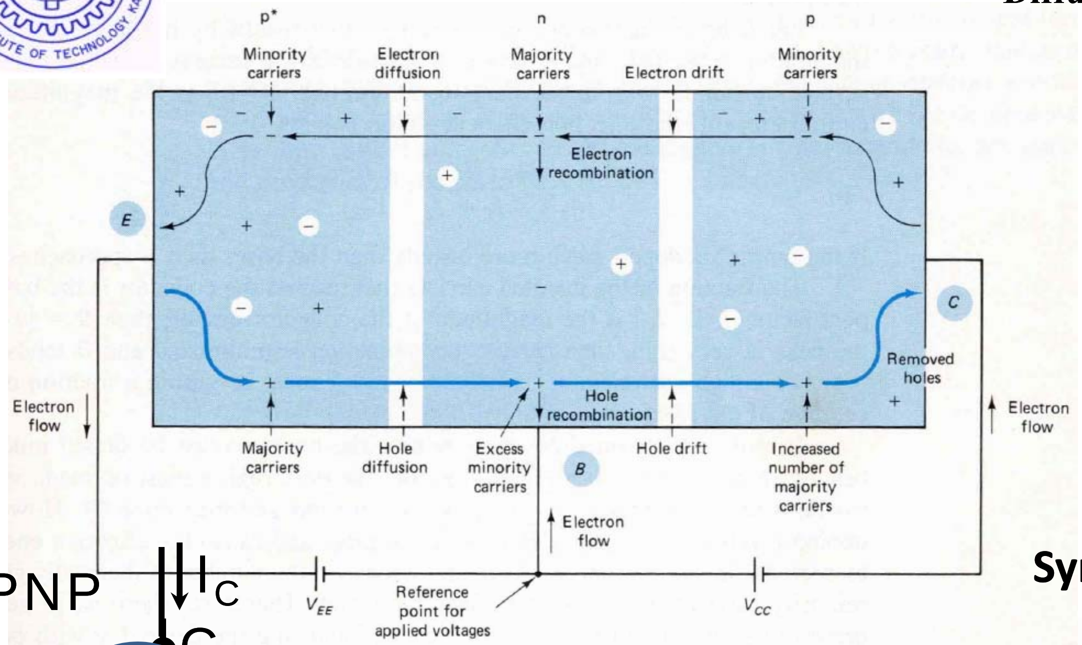


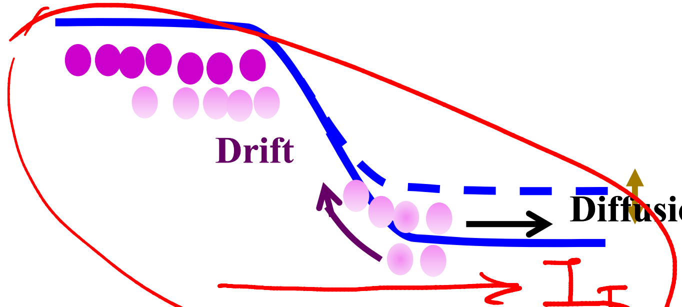


## Symbol and Current Voltage Convention