LECTURE-16

SUMMARY OF PN JUNCTIONS

1. PEAK E FIELD IS LOCATED AT JUNCTION

Diagram:

- P region with negative and positive charges indicated.
- N region with negative and positive charges indicated.
- Energies and fields indicated with arrows and symbols:
  - $E_0$ and $x_{p0}$
  - $x_{n0}$

Graphical representation of energy and field distribution across the junction.
2) Potential difference in the energy bands: 

$$ E_{bands} = q(V_0 - V) $$

- $V = V_f \rightarrow FB$
- $V = -V_f \rightarrow RB$

3) Fermi level difference: 

$$ q|V| $$
* Electronic behavior differs for forward bias (FB) and reverse bias (RB)
**I-V Characteristics**

**Ideal Case**

- **ON**: $V > 0$ then $I = 0$ (DC)
- **OFF**: $V < 0$, then $I = 0$ (DC)

Internal Contact Potential $= 0V$

**Diodes Are Non-Ideal**

- **After**: $V > V_o$

Net Potential is $V_o - V$
**DIFFUSION CURRENT**

**CONTACT POTENTIAL**

**TURN ON VOLTAGE** (V<sub>TO</sub>)

**IDEAL CASE**

**NON-IDEAL CASE!**

**FB REGION**

**V.V. IMPORTANT**

**I<sub>0</sub> → REVERSE SATURATION CURRENT**

\[ |I_0| << |I| \]

**REVERSE BIASED CASE!**

\[ I_0 \]

\[ V_{\text{RS}} \]

\[ R_{\text{RS}} \]

**MINORITY CURRENT**

**DRIFT CURRENT**
FB
1) DIFFUSION I
2) FOR $V > V_0$, LARGE CURRENT
3) DRIFT CURRENT $I_0$ IS NEGLIGIBLE

RB
1) DIFFUSION CURRENT $I = 0$
2) DRIFT CURRENT DOMINATES, BUT SMALL!

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$I$ $\rightarrow$ FORWARD SERIES RESISTANCE OF THE DIODE