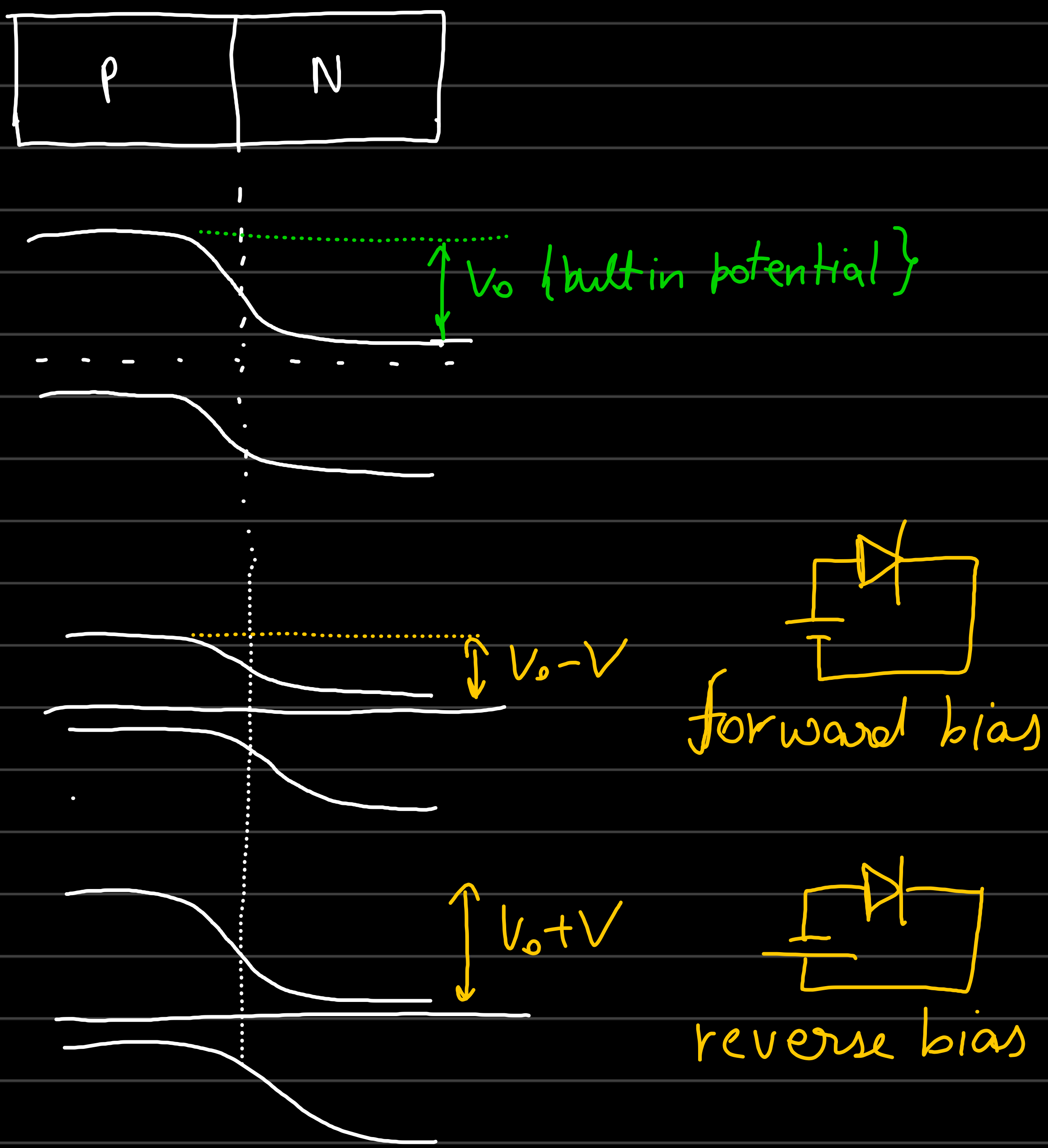
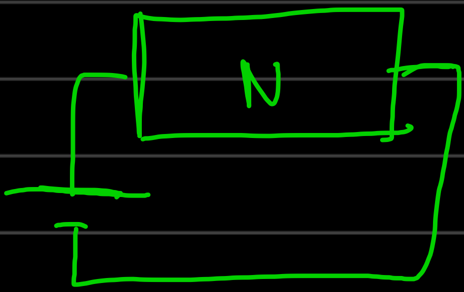
Lecture 21



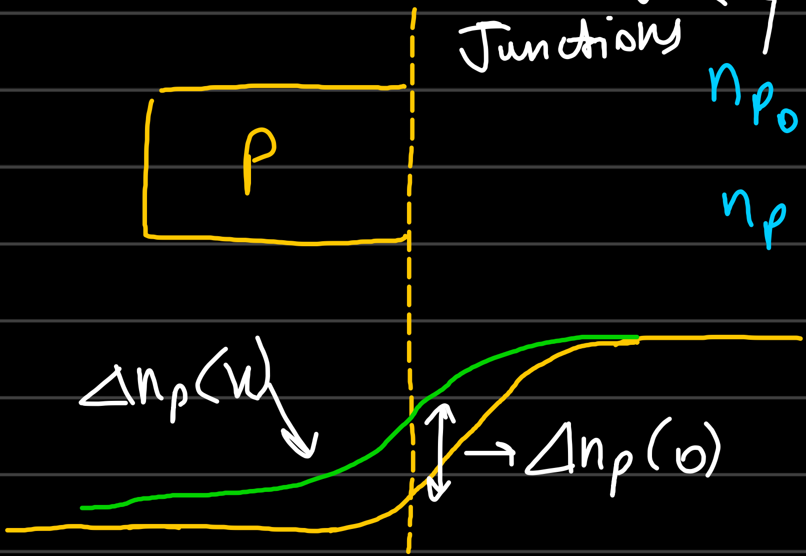
- Current is mostly diffusion!
- Current in PN junction is due to electrons in P type and holes in N-type.



Drift in semiconductor.

↳ drift is absent in PN junc due to depletion width barrier.

Law of Junctions



$$n_{p_0} = n_{n_0} e^{-\beta V_0}$$

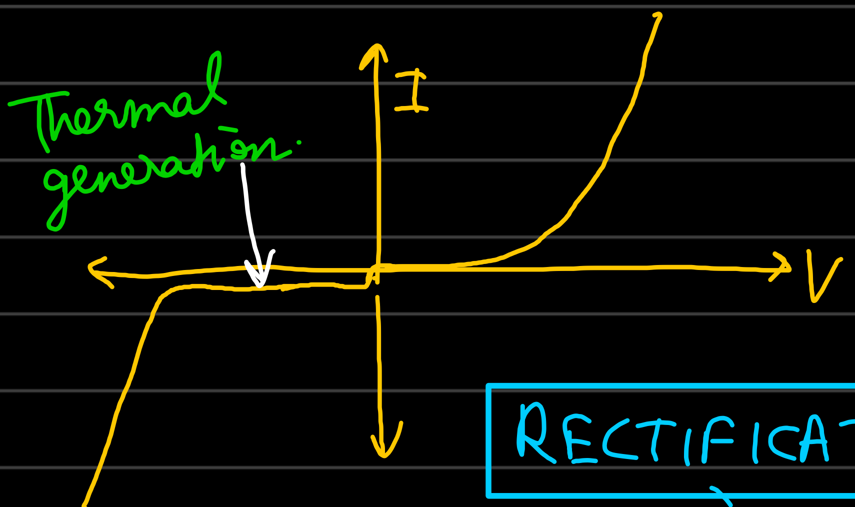
$$n_p = n_{n_0} e^{-\beta(V_0 - V)}$$

$$= n_{p_0} e^{\beta V}$$

$$\Delta n_p(x) = n_p(x) - n_{p_0}$$

* Current in P-N junc: → diffusion of minority charge carriers

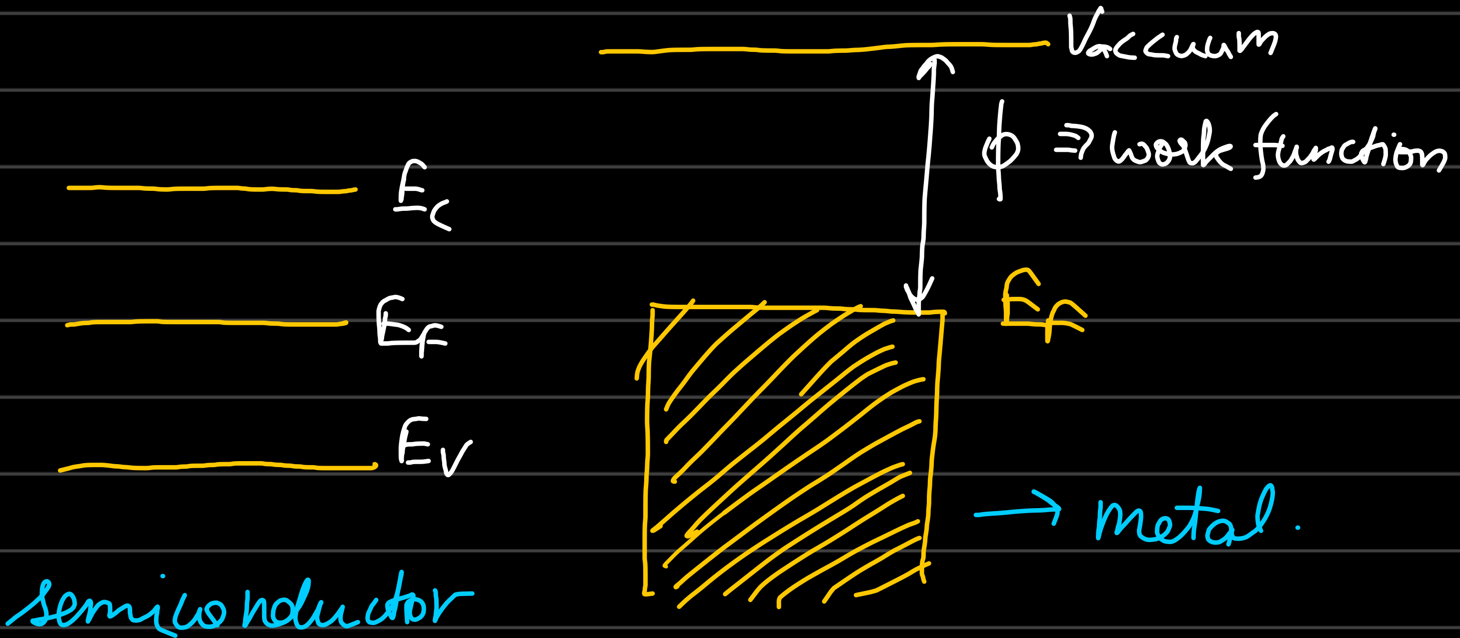
$$\boxed{I = I_0 \left[e^{qV/kT} - 1 \right]}$$

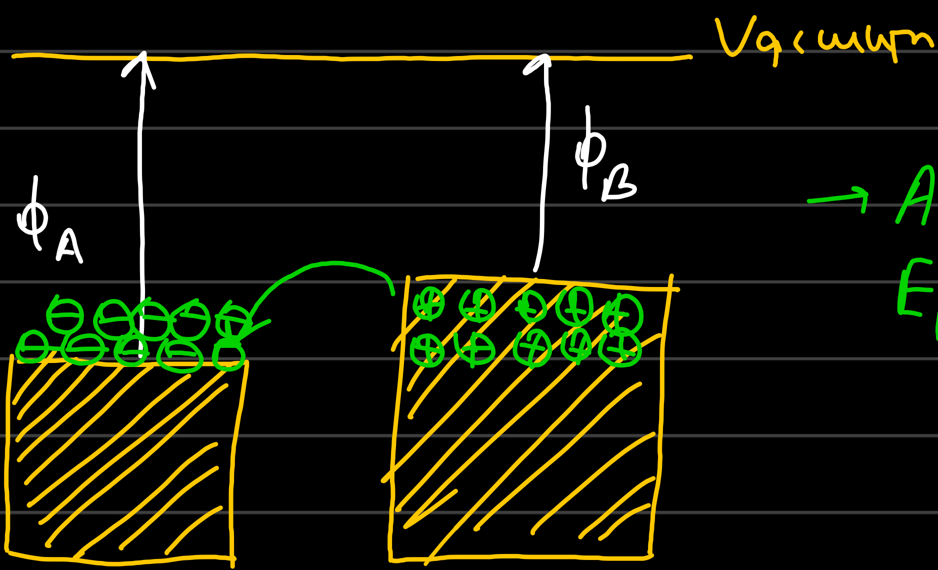


I-V characteristics on p-n junction diode.

RECTIFICATION

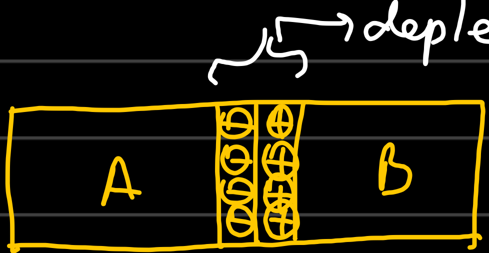
phenomenon by virtue of which junction current changes by change of bias.





→ At equilibrium E_F is flat.

→ depletion width (very small)



↳ will have a built in potential

Semiconductor Devices:

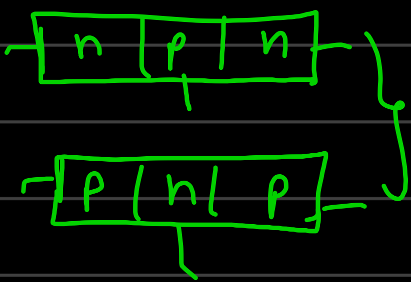
2-terminal devices:
- → PN
- → LED → PiN
- → Solar cells → PiN
- → photodetectors
- → Switches

3-terminal devices: → transistor → BJT, Mosfet, Jfets, Mesfets

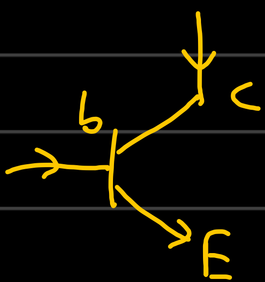
junction transistor

$\underbrace{\text{Jfets, Mesfets}}_{\text{field-effect transistor}}$

field-effect transistor.



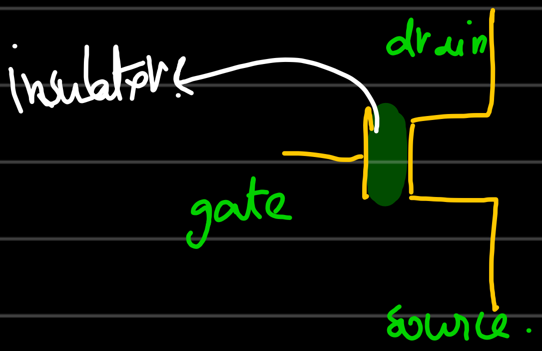
relative potentials determine behaviour.



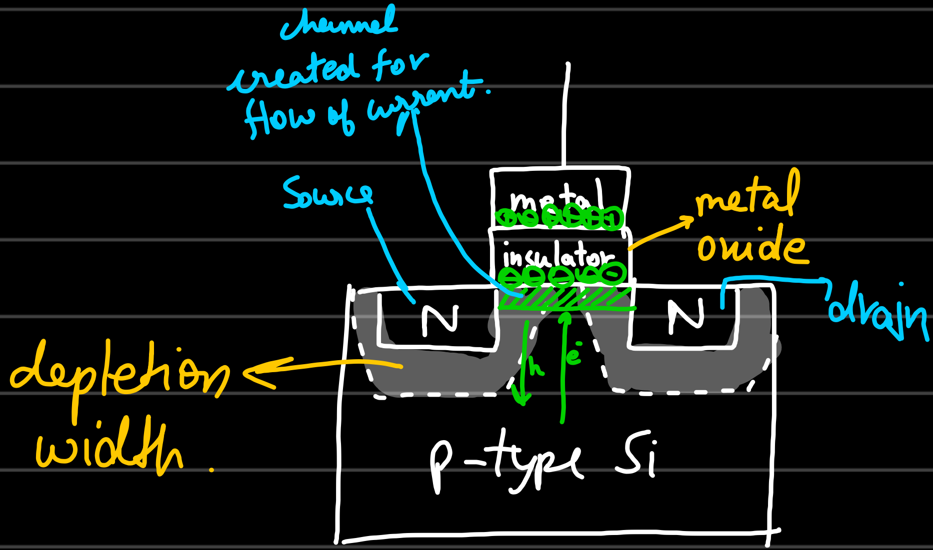
$\beta = \frac{I_c}{I_b}$ {gain}

{common-emitter amplifier}

Field-Effect Transistors:

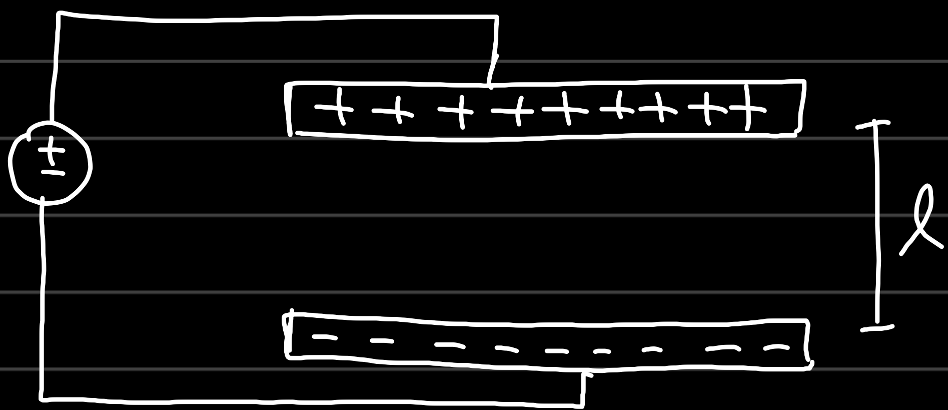


$\{I_b = 0\}$ gain $\beta \to \infty$



Metal-Oxide Semiconductor Field Emission Transistor {MOSFET}

Dielectrics:



Q → what is charge density on plate)

$Q = C \cdot V$

$C = \frac{A\varepsilon}{d}$ {derived from Gauss Law}

charge density / area ← $q = \frac{Q}{A} = \frac{\varepsilon V}{d}$

Q' ⇒ when dielectrics are changed.

$\xi \rightarrow$ polarizability