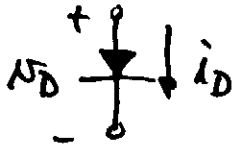
Review of Chapter 3 - Jaeger

1.) Diodes and Diode Circuits

Model -



schematic

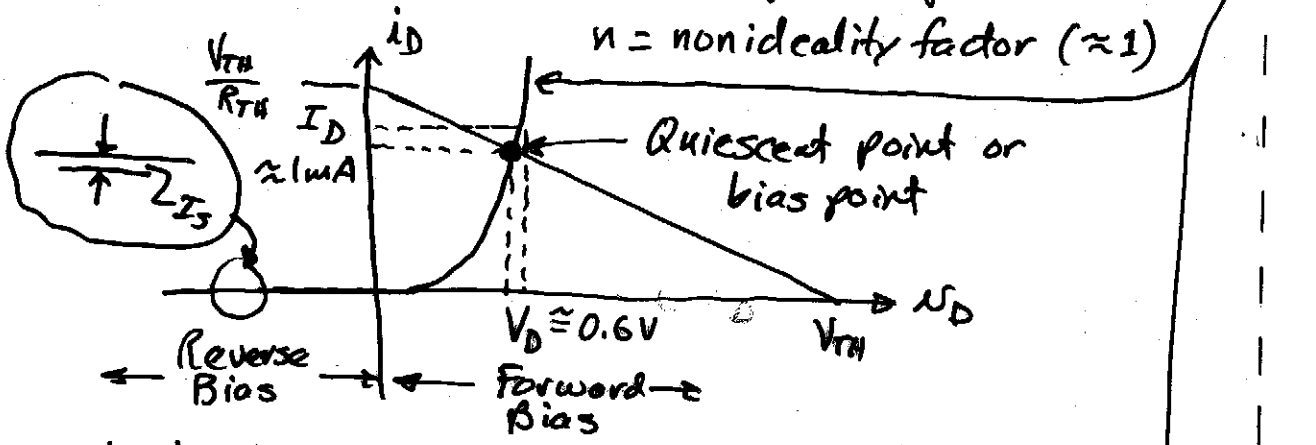
$$i_D = I_S\left[\exp\left(\frac{v_D}{nV_T}\right) - 1\right]$$

Where

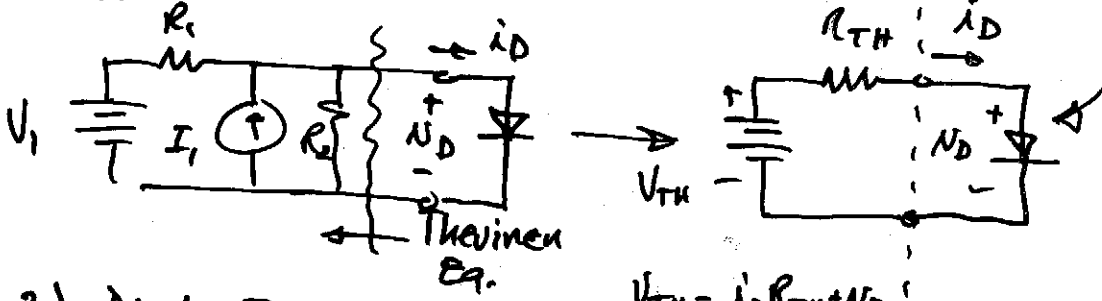
I_S = saturation current $= KT^3 \exp\left(-\frac{V_{GO}}{V_T}\right) \approx 100fA$

V_{GO} = bandgap voltage ($\approx 1.2V$)

n = nonideality factor (≈ 1)



Application of the diode model -



$$V_{TH} = i_D R_{TH} + v_D$$

2.) Diode Temperature Characteristics

a.) Forward bias

$$\frac{dv_D}{dT} = ? = -\frac{V_D + 3V_T + V_{GO}}{T} \approx -2mV/°C$$

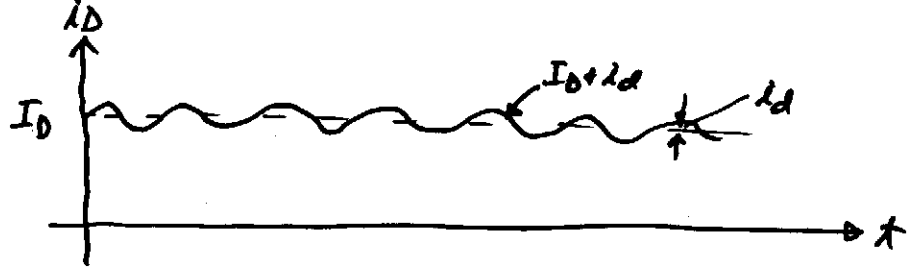
b.) Reverse bias

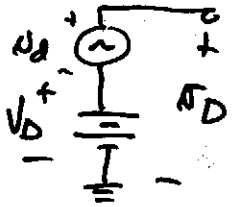
$$\text{Temp. Coeff.} = \frac{1}{I_S}\frac{dI_S}{dT} = \frac{3}{T} + \frac{V_{GO}}{TV_T}$$

$I_S \approx$ doubles every 5°C increase

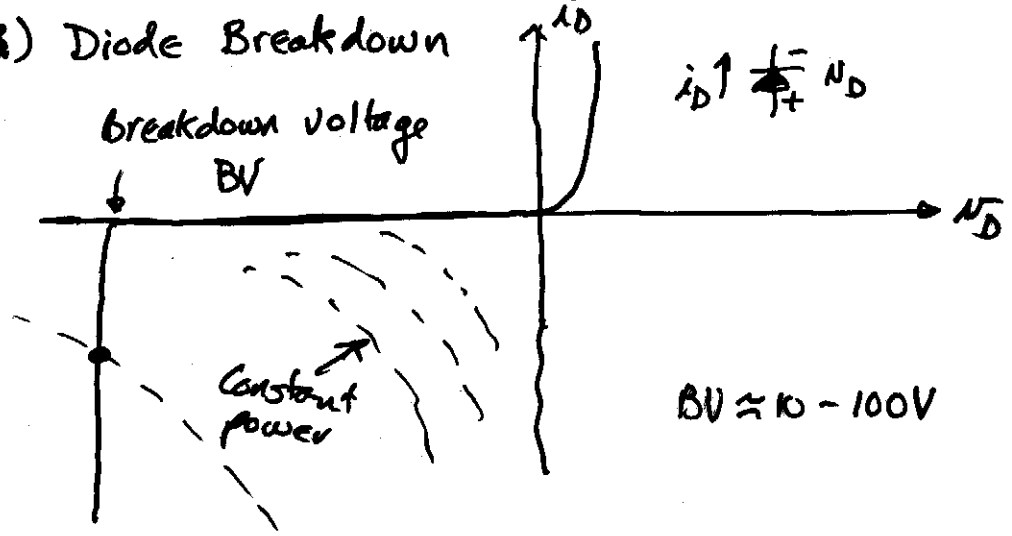
Notation –

$i_D = I_D + i_d$ → total current = dc current + ac current

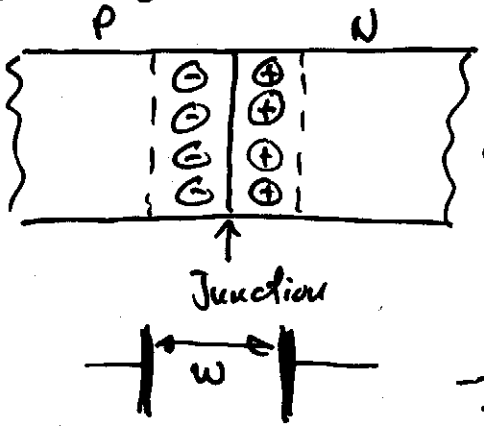




3) Diode Breakdown

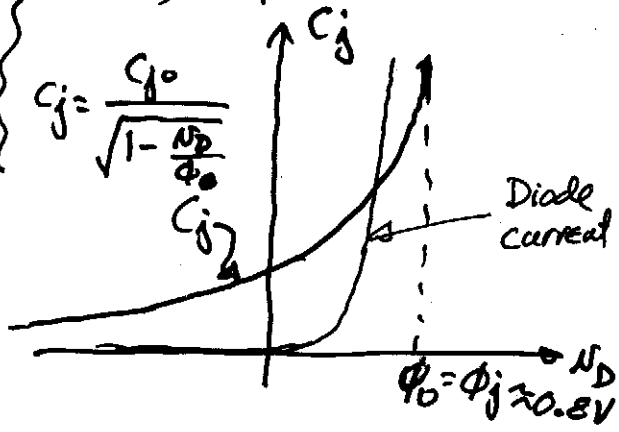


4.) PN junction capacitance



a.) Depletion capacitance

$$C_j = \frac{C_{j0}}{\sqrt{1 - \frac{V_D}{\Phi_0}}}$$

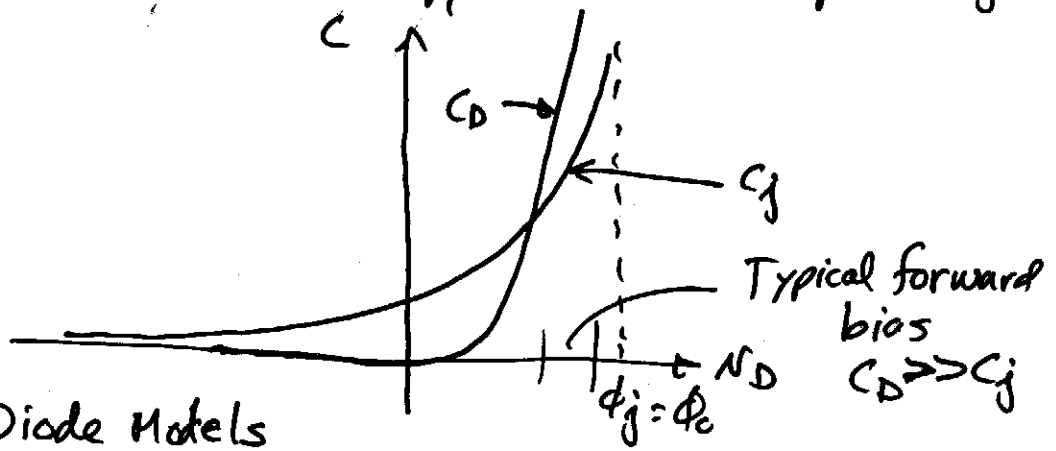


4.) Cont'd

b.) Diffusion capacitance

$$C_D = \frac{dQ_D}{dv_D} = \frac{i_D \tau_F}{V_T} \propto i_D$$

Q_D = charge in depletion region



5.) Diode Models

a.) Short-ckt./Open-ckt.

b.) Constant voltage drop (CVD)

c.) Variable " " (VVD)