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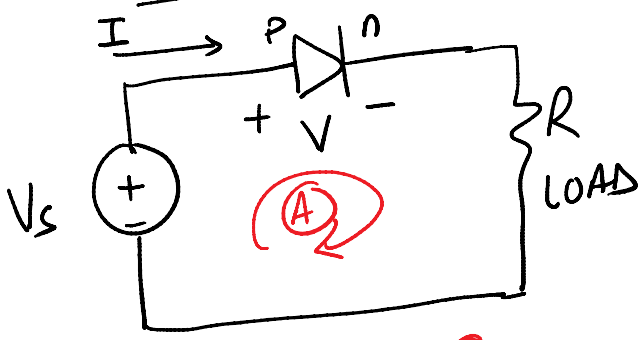
LECTURE -18

BASIC DIODE CIRCUIT



TURN ON VOLTAGE $= V_{to}$

REVERSE SATURATION CURRENT $= -I_o$

KVL LOOP (A)

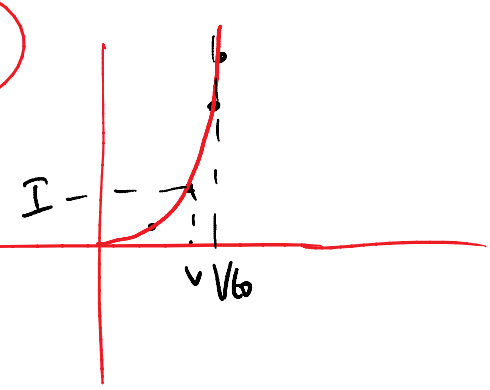
$$-V_s + V + IR = 0$$

$$V = V_s - IR \quad \text{---- (1)}$$

LOAD LINE EQUATION

$$I = I_o\left(e^{qV/KT} - 1\right) \quad \text{---- (2)}$$

SOLVE (1) AND (2) TO FIND THE OPERATING POINT (V, I ?)



Q-POINT

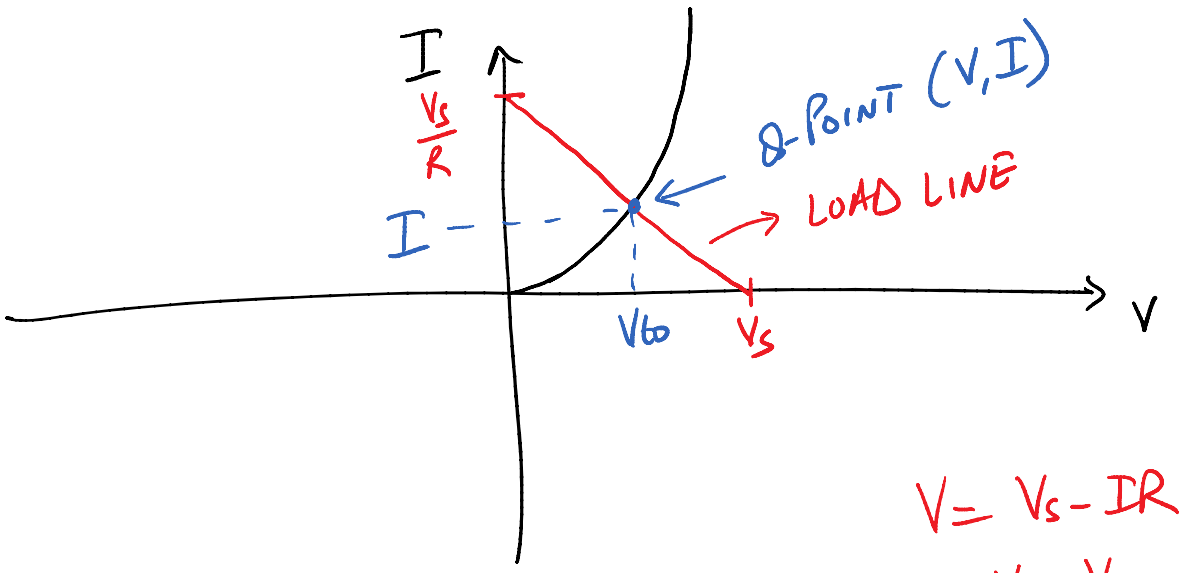
(1) FB $\longrightarrow$ V_s IS POSITIVE

IF OPERATING POINT V AND I ARE AWAY FROM THE KNEE OF THE CURVE

$V \simeq V_{to} \Longrightarrow V = V_{to}$

FROM LOAD LINE EQUATION

$$I = \frac{1}{R}(V_s - V_{to})$$



$V = V_s - IR$

$I = 0 \quad V = V_s$

$V = 0 \quad I = \frac{V_s}{R}$

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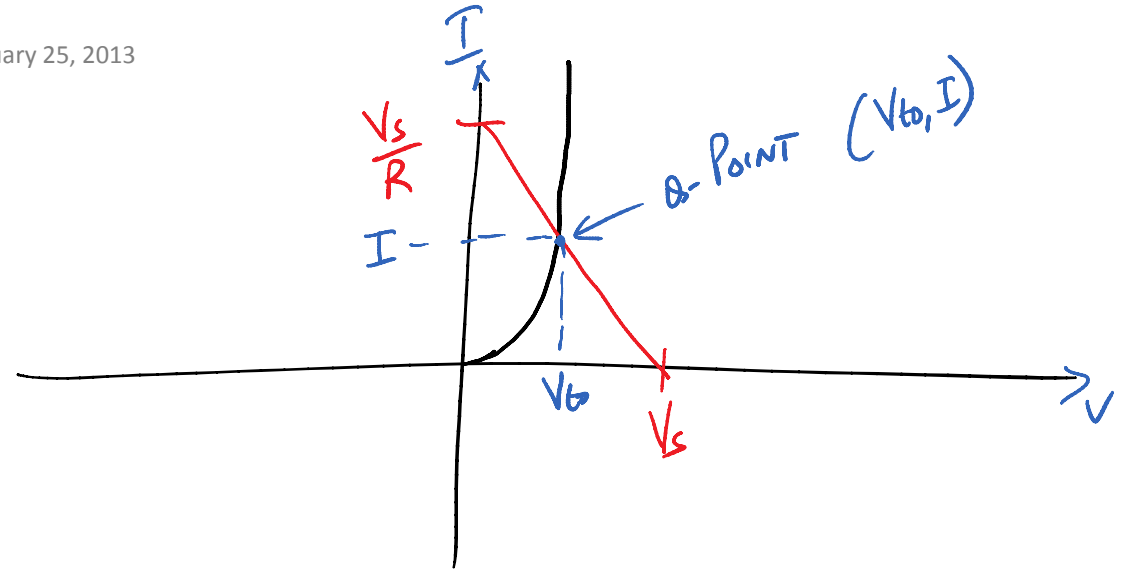

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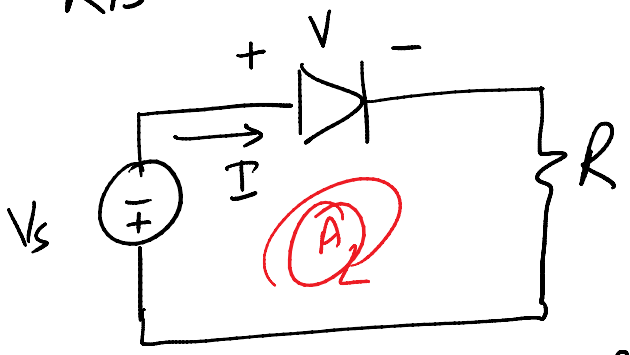
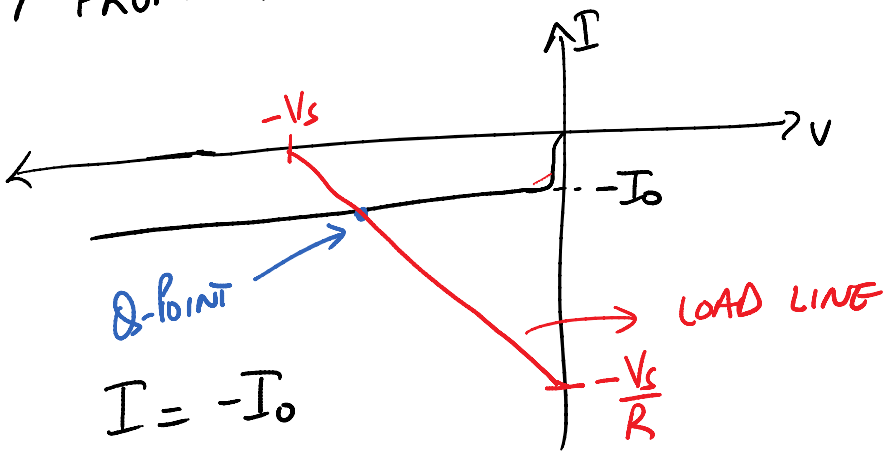
(2) RB CASE → V_s IS NEGATIVE



IF THE ~~ARE~~ OPERATING POINT V AND I ARE AWAY FROM THE KNEE OF THE CURVE



$I = -I_0$

KVL LOOP (A)

$V_s + V + IR = 0$

$$V = -V_s - IR$$ → LOAD LINE EQUATION

$V = 0$ $\quad V_s = -IR$

$\Rightarrow I = -\frac{V_s}{R}$

$I = 0$ $\quad V = -V_s$

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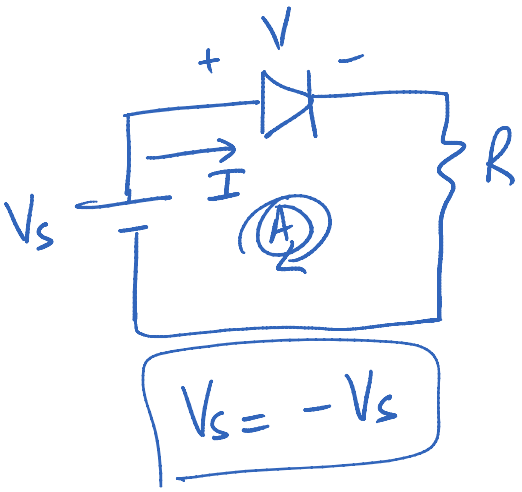

$V_s = -V_s$

$I = -I_0$

$-V_s + V + IR = 0$

$V_s = V + IR$

$V = 0$ $\quad V_s = IR$

$\Rightarrow I = \frac{V_s}{R}$ $\quad V_s = -V_s$

$= -\frac{V_s}{R}$

$I = 0$ $\quad V = V_s = -V_s$

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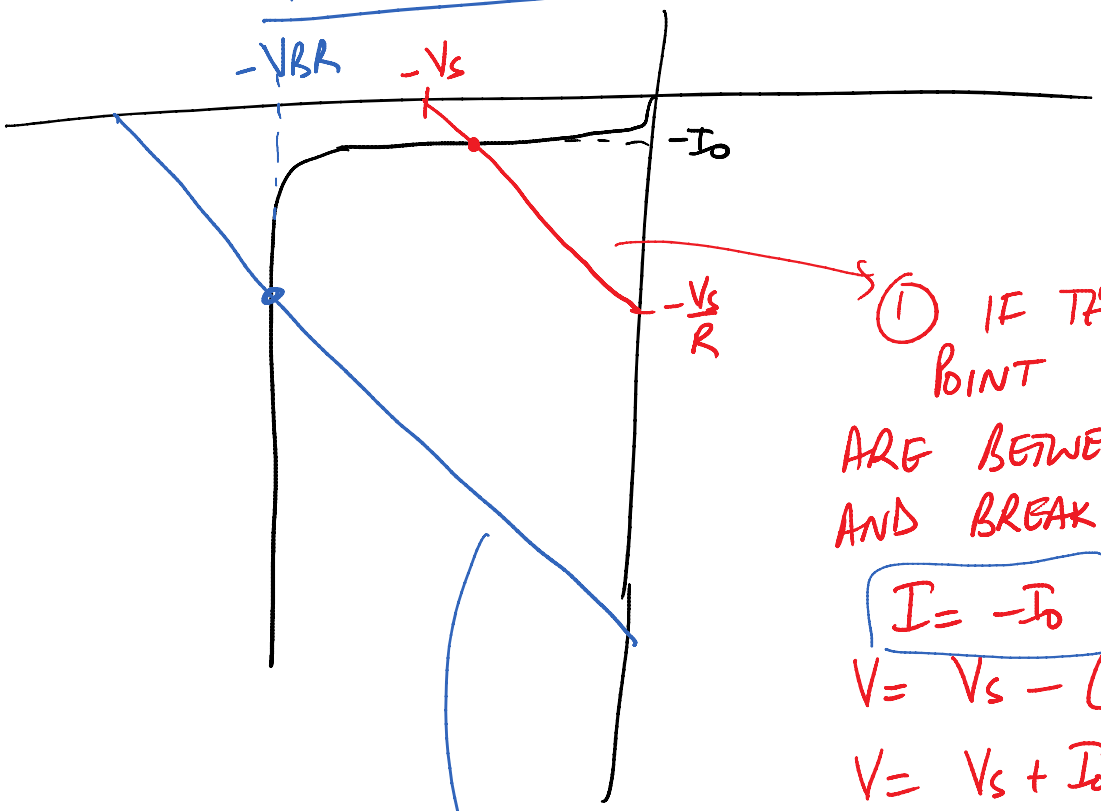
RB → BUT WITH BREAKDOWN! → 2 CASES!



① IF THE OPERATING POINT V AND I ARE BETWEEN THE KNEE AND BREAKDOWN

$I = -I_o$

$V = V_s - (-I_o R)$

$V = V_s + I_o R$

↳ NEGATIVE

② IF OPERATING V AND I ARE IN THE BREAKDOWN REGION

$V = -V_{BR}$

$I = \frac{1}{R}(V_s - (-V_{BR}))$