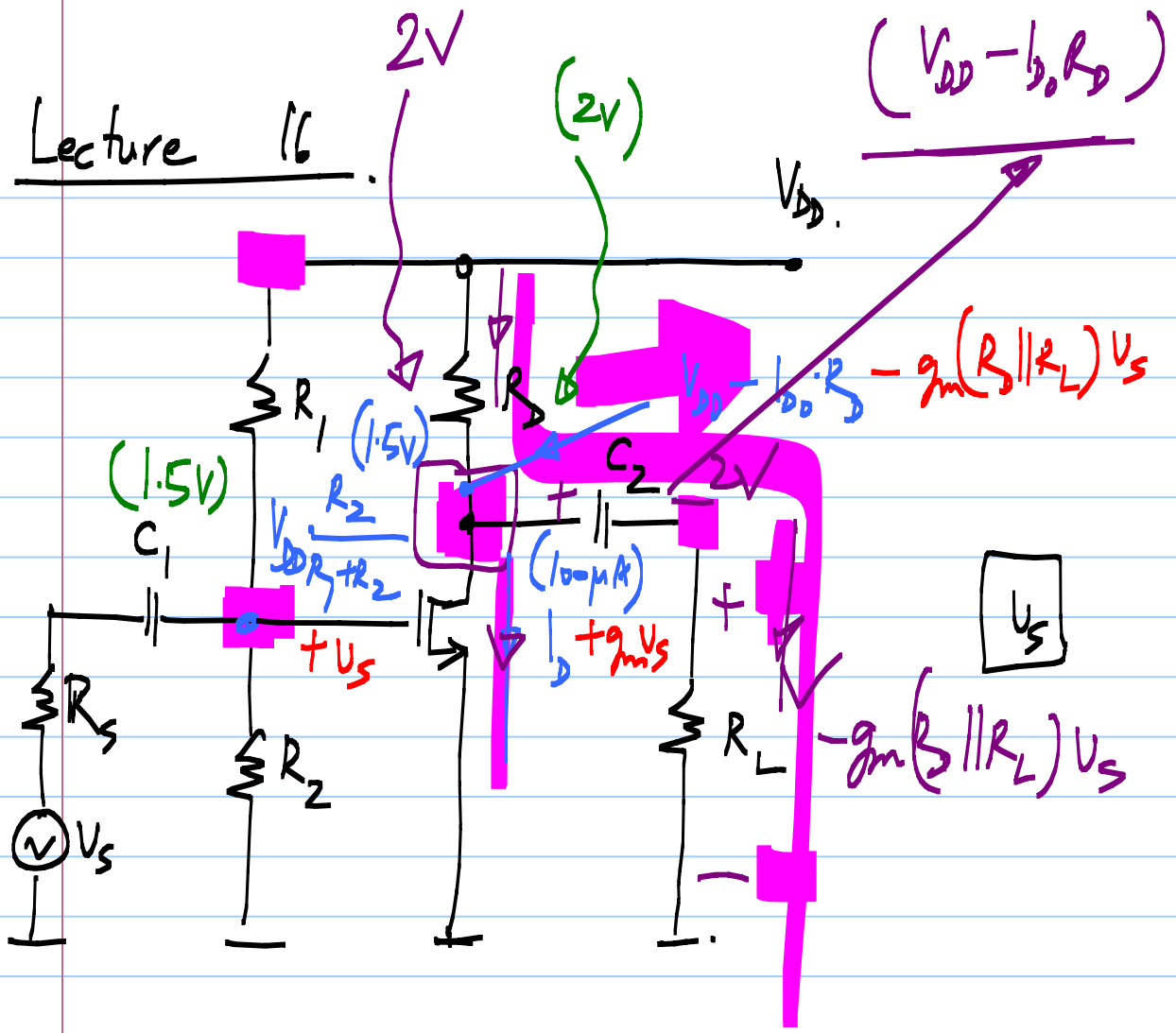
Lecture 16



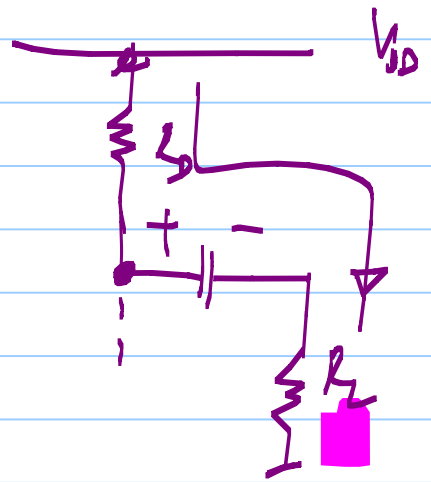
Saturation:

$$V_{DS} \geq V_{GS} - V_T$$

$$V_D - V_S \geq V_G - V_S - V_T$$

$$V_D \geq V_G - V_T$$

$$V_{GD} \leq V_T \; ; \; V_{GS} > V_T$$



$$V_D \geq V_G - V_T$$

$$V_{DD} - I_{D_0} R_D - g_m (R_D \| R_L) \cdot v_s \geq V_{DD} \cdot \frac{R_2}{R_1 + R_2} + v_s - V_T$$

$V_D - V_G$ QUIESCENT

$$V_{DD} \cdot \frac{R_1}{R_1 + R_2} - I_{D_0} R_D + V_T$$

$$v_s \leq \frac{}{1 + g_m (R_D \| R_L)}$$

Cutoff limit:

$$V_{GS} = V_{GS,Q} + v_s$$

$$V_{DD} \cdot \frac{R_2}{R_1 + R_2}$$

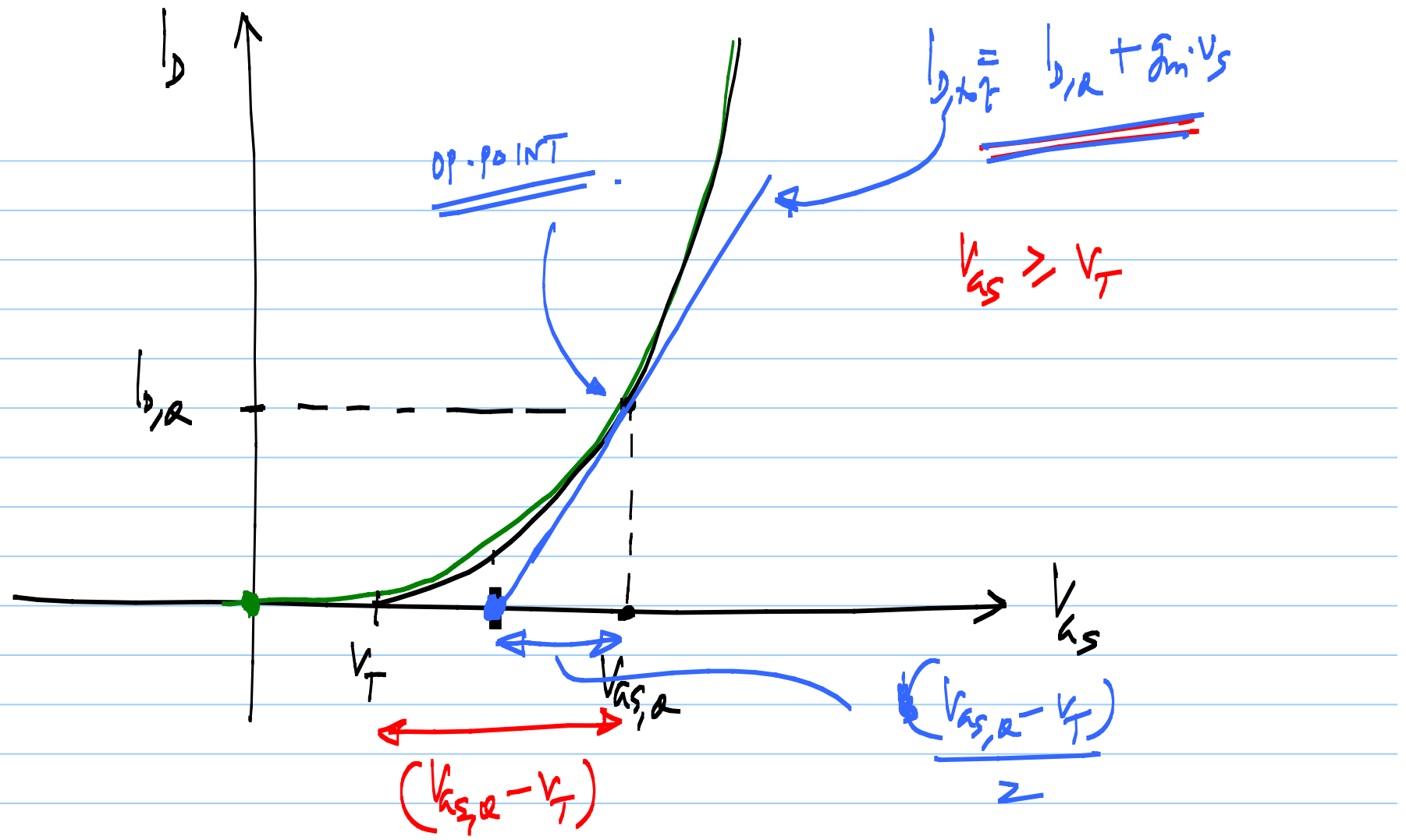
$$V_{GS} \geq V_T$$

$$v_s \geq -(V_{GS,Q} - V_T)$$

$$g_m = \frac{2I_{D,Q}}{V_{GS,Q} - V_T}$$

$$i_D = I_{D,Q} + g_m v_s \geq 0$$

$$v_s \geq -\frac{I_{D,Q}}{g_m} = -\left(\frac{V_{GS,Q} - V_T}{2}\right)$$


I_D
$I_{D,Q}$
V_T
$V_{GS,Q}$
V_{GS}
OP-POINT
$I_{D,tot} = I_{D,Q} + g_m \cdot v_s$
$V_{GS} \geq V_T$
$(V_{GS,Q} - V_T)$
$(V_{GS,Q} - V_T)$
2

$-g_m(R_D \| R_L) \cdot v_s$