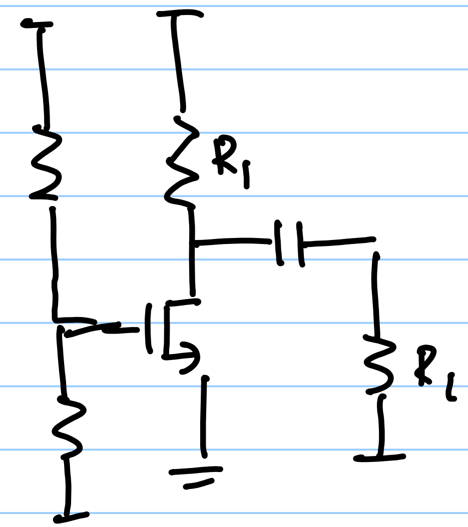
Lecture # 12



$$I_{DS} = \frac{\mu_n C_{ox}}{2}\frac{W}{L}(V_{GS} - V_{tn})^2(1+\lambda V_{DS})$$

$$g_m = \mu_n C_{ox}\frac{W}{L}(V_G - V_S - V_{tn})(1+\lambda V_{DS}) \quad —(1)$$

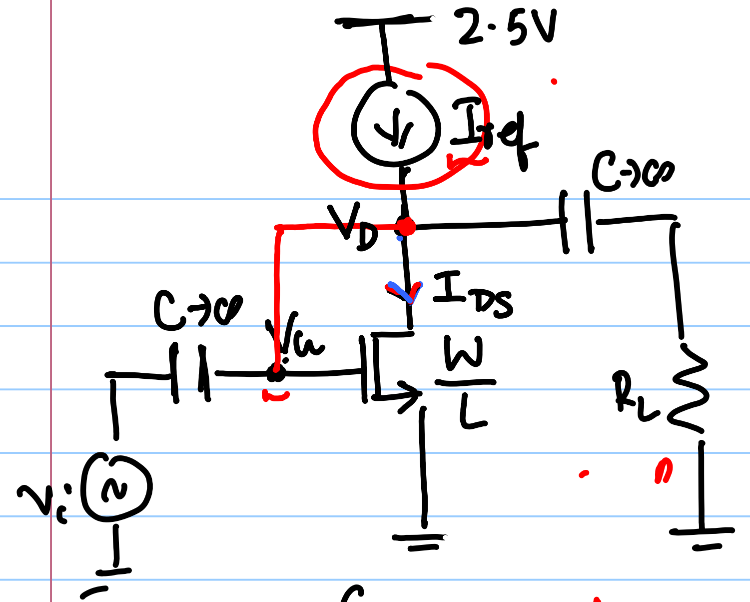
$$= \mu_n C_{ox}\frac{W}{L}(1+\lambda V_{DS})\sqrt{\frac{2 I_{DS}}{\mu_n C_{ox}\frac{W}{L}(1+\lambda V_{DS})}}$$

$$= \sqrt{2 I_{DS} \cdot \mu_n C_{ox}\frac{W}{L}(1+\lambda V_{DS})}$$

$$\approx \sqrt{2 I_{DS}\, \mu_n C_{ox}\frac{W}{L}} \quad —(2)$$

$$\frac{v_o}{v_i} = -g_m (R_1 \| R_L)$$

if MOSFET is biased such that it consumes constant current even when threshold voltage varies, gain doesn't change.



$I_{DS} = I_{ref}$

$$I_{DS} = \frac{\mu_n C_{ox}}{2} \frac{W}{L} (V_{GS} - V_{th})^2 = I_{ref}$$

DC gate voltage, $V_G = 0$

$I_{DS} = 0$

- if $I_{ref} > I_{DS}$ then $V_D = V_G \uparrow$
- if $V_G \uparrow$ then $I_{DS} \uparrow$
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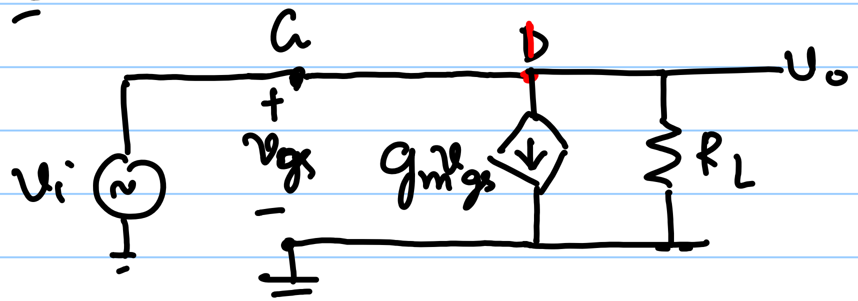

$$\frac{v_o}{v_i} = 1$$

- Inductor is an ideal choice b/w G & D.
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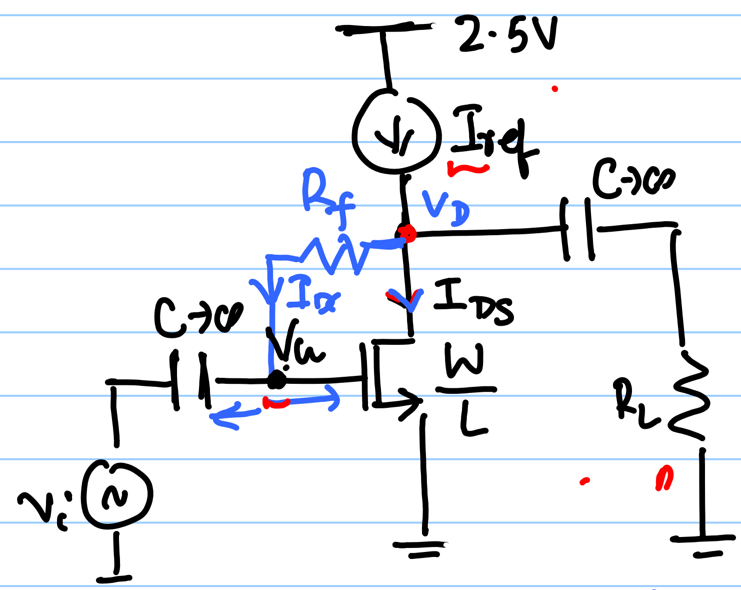
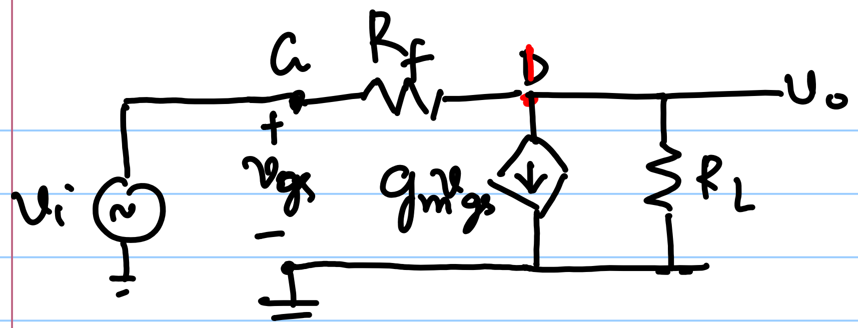


- $V_G = V_D$ at DC, V_G & V_D not connected for ac.



$$\frac{v_o}{v_i} = \left. \frac{\left(\frac{1}{R_f}\right) - g_m}{\left(\frac{1}{R_f}\right) + \frac{1}{R_L}} \right|_{R \to \infty} = -g_m R_L$$