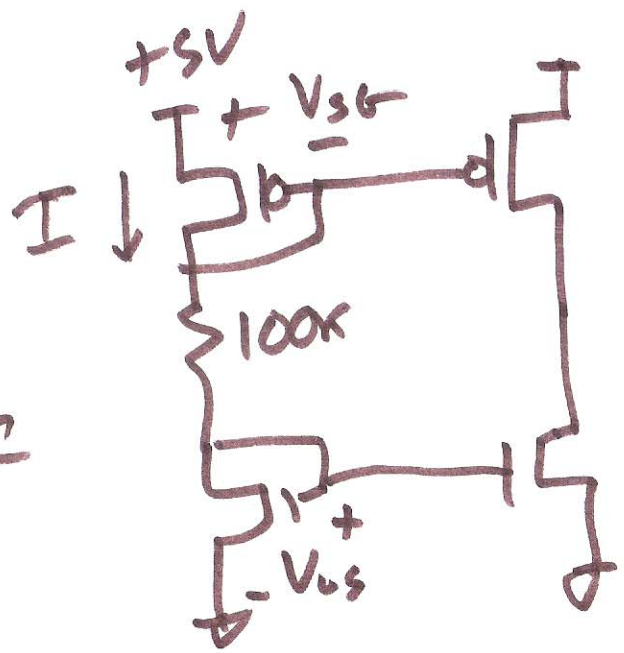


EE 420 / ECG 620

2/12/14

Lecture 6

A20.6



$$S = V_{SG} + I \cdot 100k + V_{DS}$$

$$V_{SG} = \sqrt{\frac{2I}{404 \cdot \frac{20}{2}}} + .9$$

$$V_{GS} = \sqrt{\frac{2I}{1204 \cdot \frac{20}{2}}} + .8$$

$$\frac{dV}{dI} = \frac{I_{BIAS}}{C}$$

$$S = \sqrt{\frac{2I}{404 \cdot \frac{20}{2}}} + .9 + 100kI + \sqrt{\frac{2I}{3 \cdot 404 \cdot \frac{20}{2}}} + .8$$

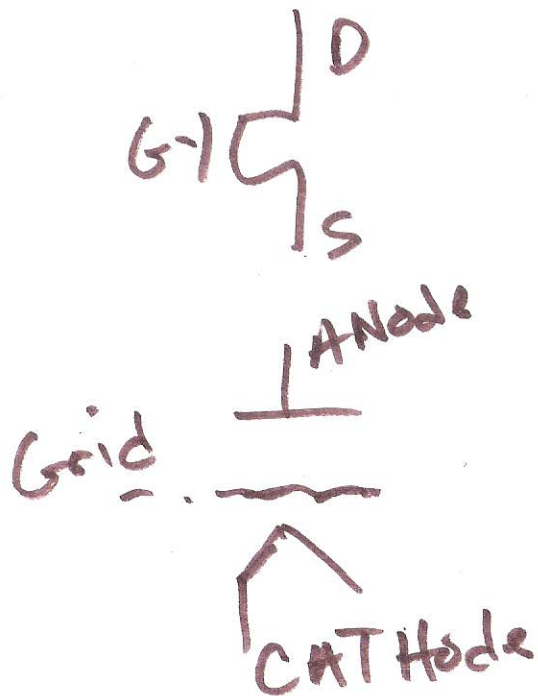
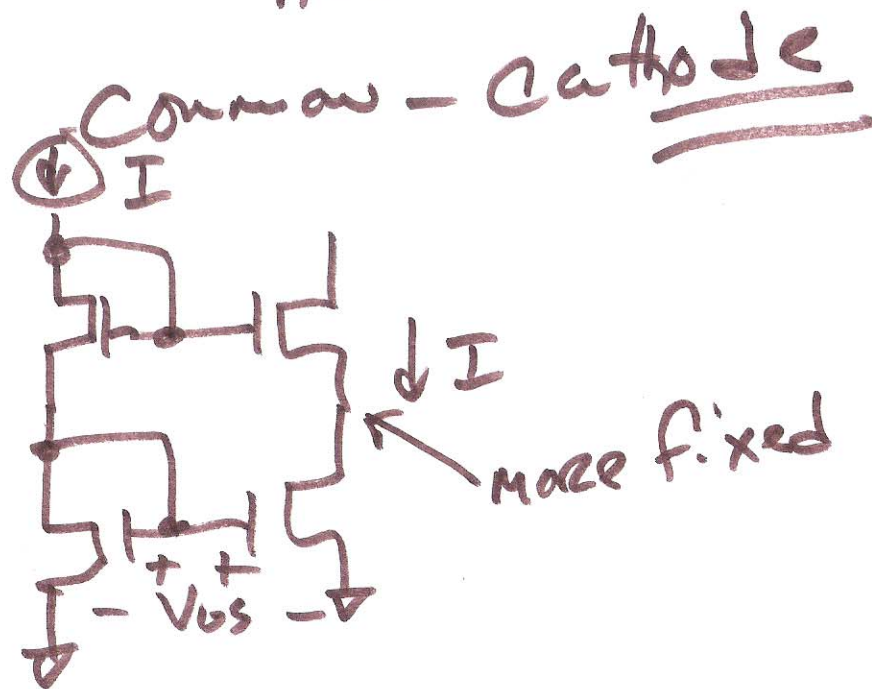
$$3.3 = \sqrt{\frac{2I}{404 \cdot 10}} \left(1 + \frac{1}{\sqrt{3}} \right) + 100kI$$

let $I = x^2$

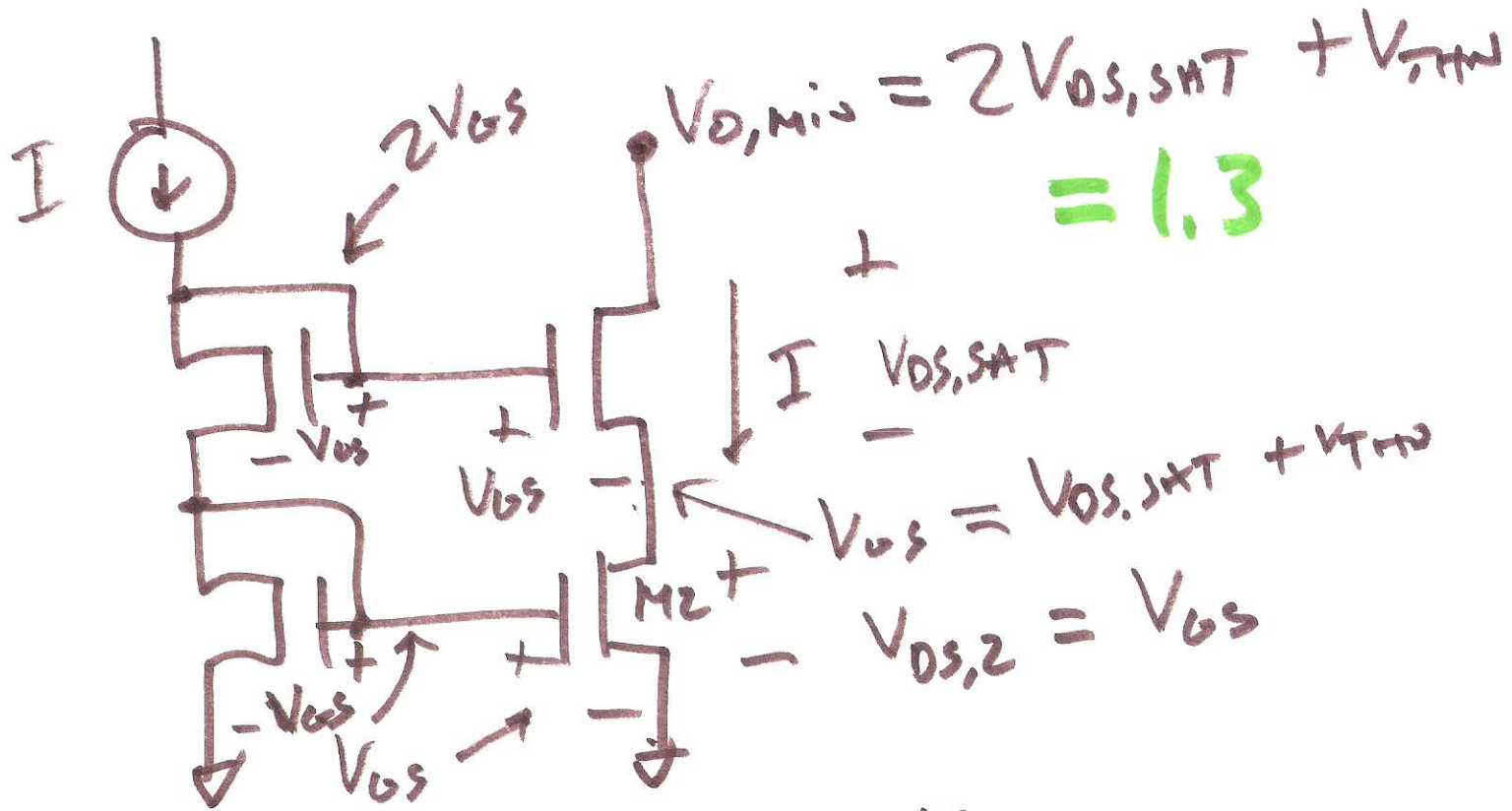
1)

CASCODING

→ CASCADE of a
Common-grid
AND



2)



$$V_{D,SAT} = 2V_{D,SAT} + V_{THN} = 1.3$$

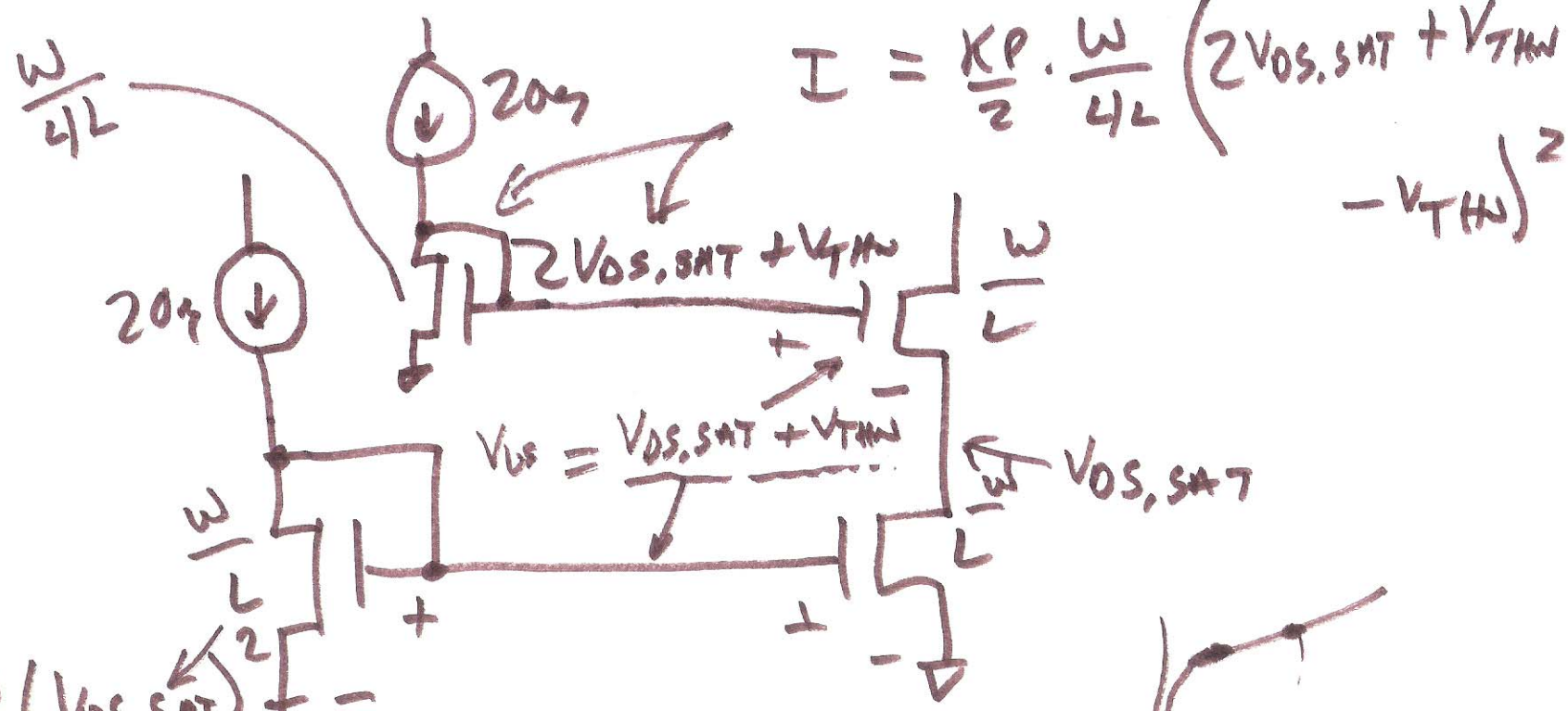
$$V_{GS} = V_{D,SAT} + V_{THN}$$

$$V_{D,S,2} = V_{GS}$$

$$V_{GS} = V_{D,SAT} + V_{THN}$$

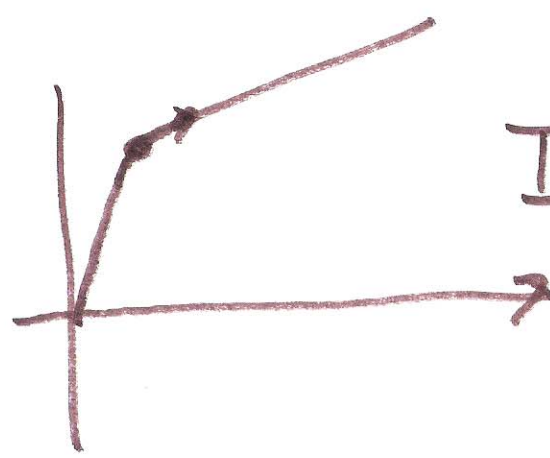
$$1.05 \quad .25 \quad .8$$

3)



$$I = \frac{K_P}{2} \cdot \frac{W}{4L} (2V_{OS,SAT} + V_{THN} - V_{THN})^2$$

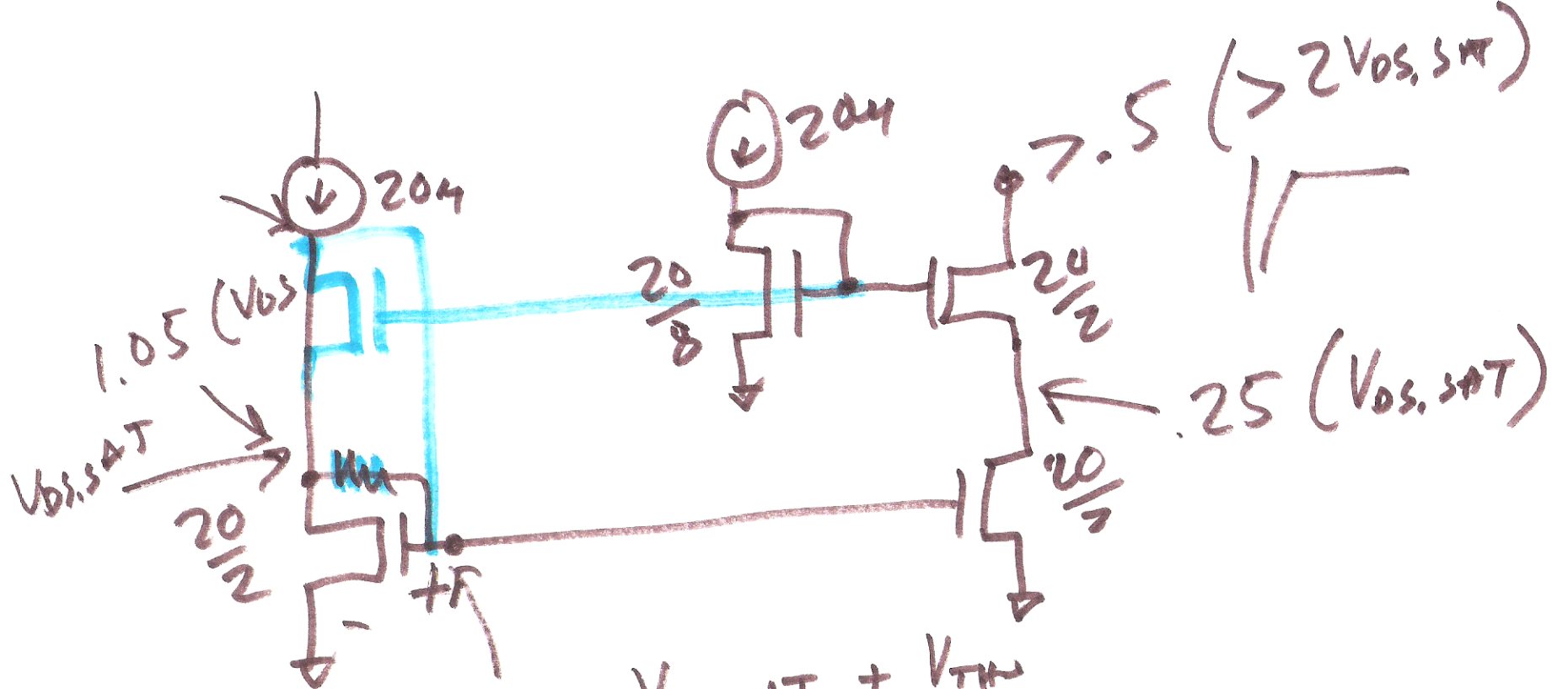
$$I = \frac{K_P}{2} \cdot \frac{W}{L} (V_{OS,SAT})^2$$



$$I = \frac{K_P \cdot W}{2L} (2V_{OS,SAT} + V_{THN} - V_{THN})^2$$

$$= \frac{K_P \cdot W \cdot 4}{2 \cdot \underbrace{(L \cdot 4)}_{MWS}} (V_{OS,SAT})^2$$

$\rightarrow V_{OS} - V_{THN}$



$$V_{bs} = V_{os,sat} + V_{THN}$$

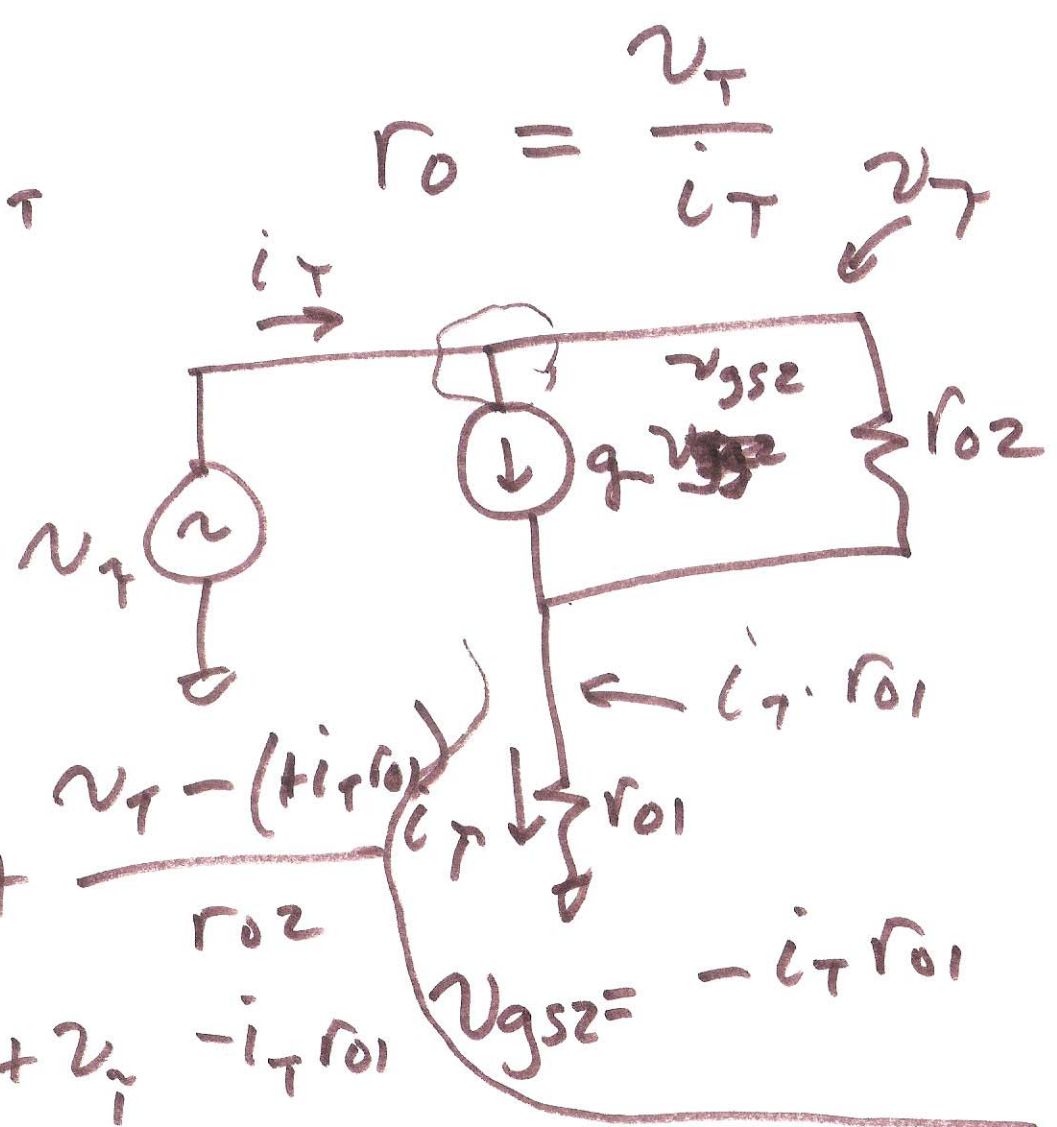
$$V_{os} \geq V_{bs} - V_{THN}$$

$$V_{os,sat} \geq V_{os,sat} + V_{THN} - V_{THN}$$

$$0 \geq 0$$

?

5)



$$r_o = \frac{v_T}{i_T}$$

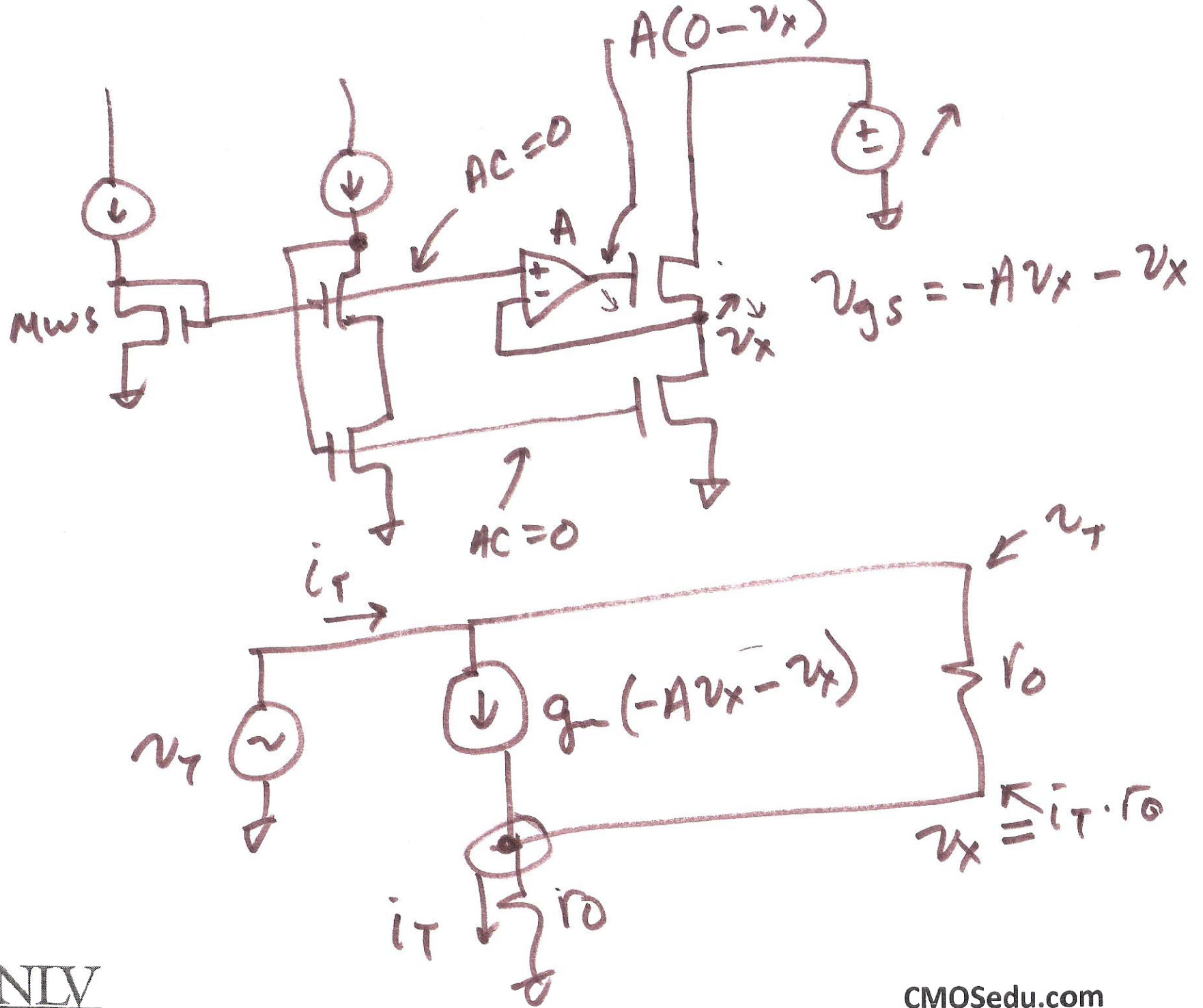
$$i_T = g_m(-i_T r_{o1}) + \frac{v_T - (i_T r_{o1})}{r_{o2}}$$

$$i_T r_{o2} = -g_m i_T r_{o1} r_{o2} + v_T - i_T r_{o1}$$

$$i_T (r_{o2} + g_m r_{o1} r_{o2} + r_{o1}) = v_T$$

$$r_o = \frac{v_T}{i_T} = r_{o2} (1 + g_m r_{o1}) + r_{o1} \approx g_m r_{o1} r_{o2}$$

6)



$$i_T = g_m(-Av_x - v_x) + \frac{v_T - i_T r_o}{r_o}$$

$$v_x = i_T r_o$$

$$i_T(1 + g_m r_o(A+1) + 1) = \frac{v_T}{r_o} \quad \downarrow \quad \frac{v_T}{r_o} - i_T$$

$$\frac{v_T}{i_T} = r_o(1 + 1 + g_m r_o(A+1))$$

$$\approx \underline{\underline{g_m r_o^2 A}}$$