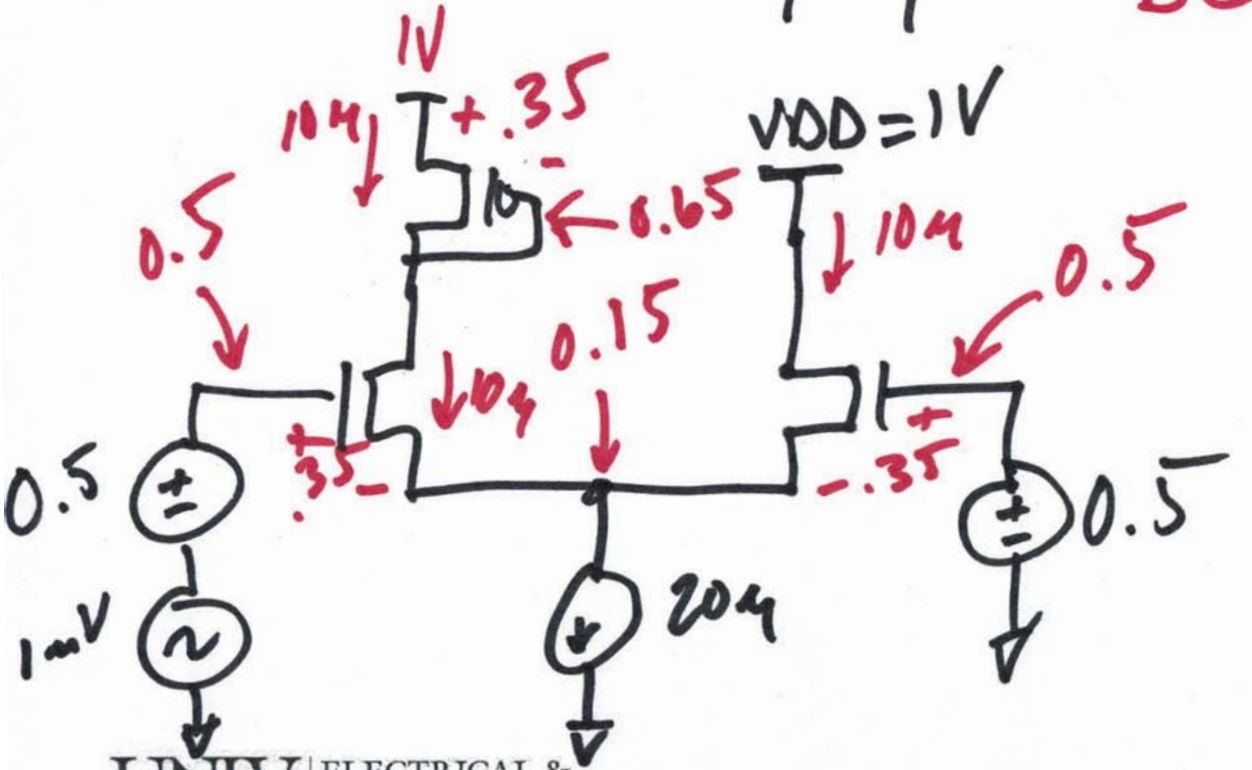
EE 420/ECE 620

Lecture 7

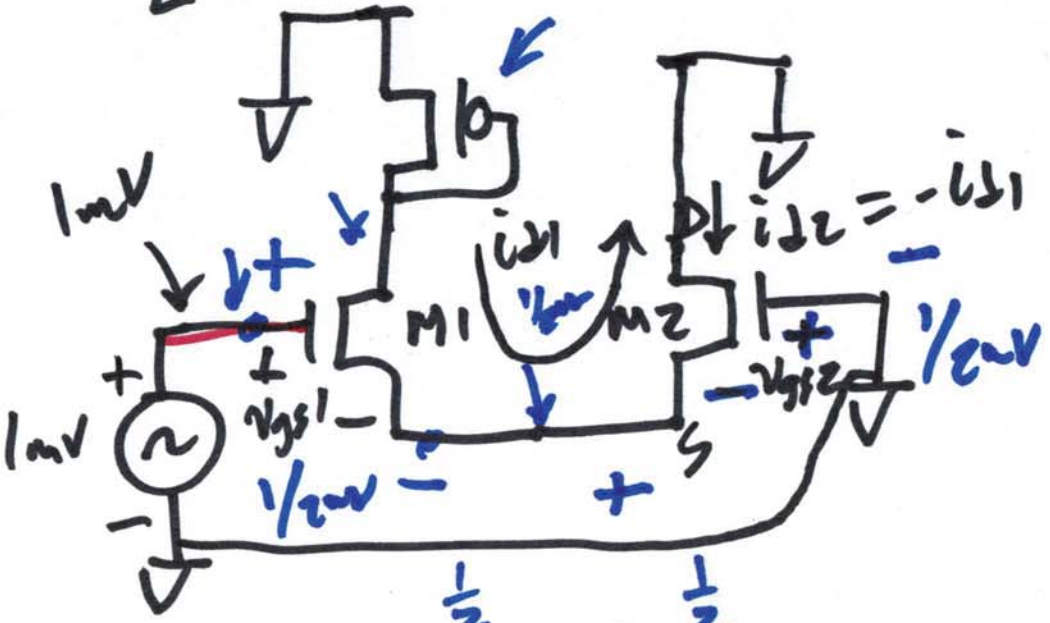
Spring 2016

2/9/16 DC calcs



$g_m = KP\cdot\frac{W}{L}(V_{GS} - V_{THN})$ AC CKT

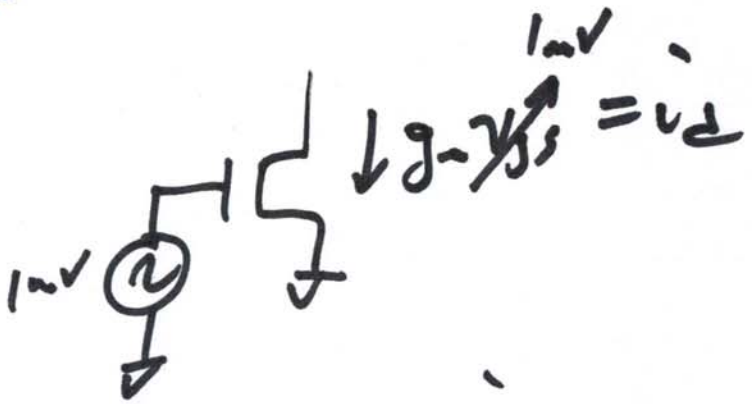
$g_m = \sqrt{2\cdot KP\cdot\frac{W}{L} I_D}$



$1mV = v_{gs1} - v_{gs2}$

$1mV - v_{gs1} + v_{gs2} = 0$

$1mV = v_{gs1} - v_{gs2}$



$= \frac{i_{d1}}{g_{m1}} - \frac{i_{d2}}{g_{m2}}$

$v_{gs1} = \frac{i_{d1}}{g_{m1}}$

$i_{d1} = \frac{1mV \cdot 150\eta}{2}$

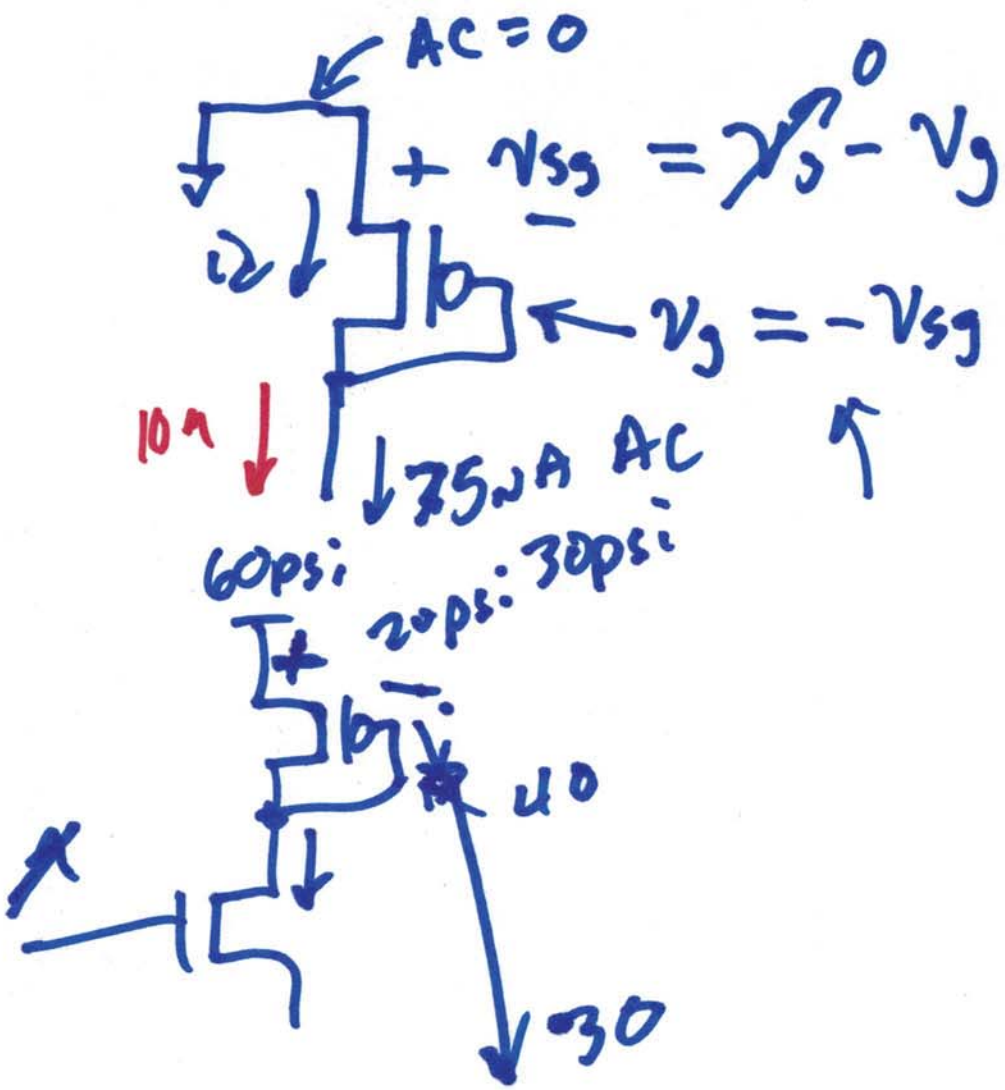
$= 75nA$

$= i_{d1}\left(\frac{1}{g_{m1}} + \frac{1}{g_{m2}}\right)$

$= i_{d1}\cdot\frac{2}{g_{m1}}$

$v_{gs2} = \frac{i_{d2}}{g_{m2}}$

$i_{d1} = -i_{d2}$



$i_d = 75\,\mu A$

$g_m v_{sg} = i_d$

$150\mu \cdot v_{sg} = 75\,\mu A$

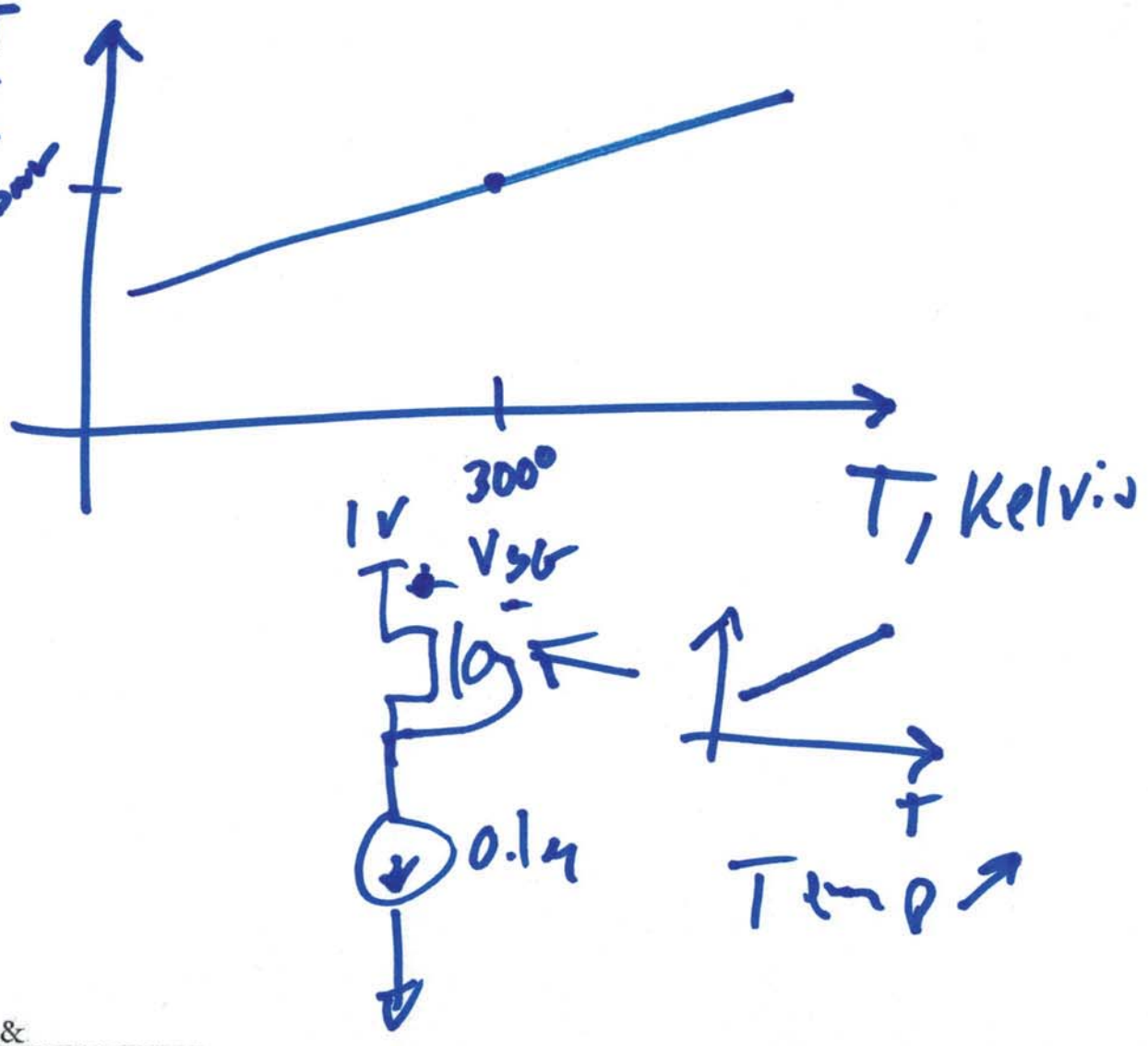
$$\boxed{v_{sg} = \frac{1}{2}\,mV}$$

$$v_g = -\frac{1}{2}\,mV$$

Temp Behavior

$V_T = \frac{kT}{q}$

26mV



$I_D \uparrow \quad g_m r_o \downarrow$

$g_m = \sqrt{2 K_P \cdot \frac{W}{L} I_D}$

opamp gain

$r_o = \frac{1}{\lambda I_D}$

$(V_{GS} - V_{THN}) = V_N$

$g_m r_o \propto \frac{1}{\sqrt{I_D}}$

$f_T \quad I_D \uparrow \; f_T \uparrow$

$V_{GS} \uparrow \; f_T \uparrow$

$I_D \uparrow \; g_m r_o \downarrow$

$V_N \uparrow \; f_T \uparrow$

5)