LABS

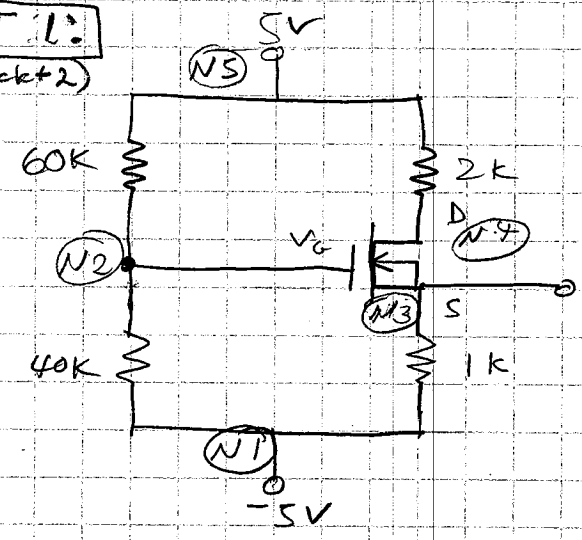
(skip CKT 1)

CKT 1: (Lab ckt 2)

$K'_n = 500\mu A/V^2$

$W/L = 1$

$V_{tn} = 1V$



$V_G = -5 + \left(\frac{40k}{100k}\right)10V = -1V$

$I_{DS} = \frac{V_S - (-5)}{1K} = \frac{V_S + 5}{1K}$

$V_{GS} = -1 - V_S$

$I_{DS}^{(SAT)} = \frac{K'_n}{2}\left(\frac{W}{L}\right)\left[(-1+V_S)-1\right]^2$

$V_S = (-4, 4)$

$V_S \neq 4$ for saturation

$(4 > V_G = -1)$

$\Leftarrow$

$V_S = -4V$

$V_{GS} = -1 - -4 = +3V$

$I_{DS} = \frac{-4+5}{1k} = 1mA$

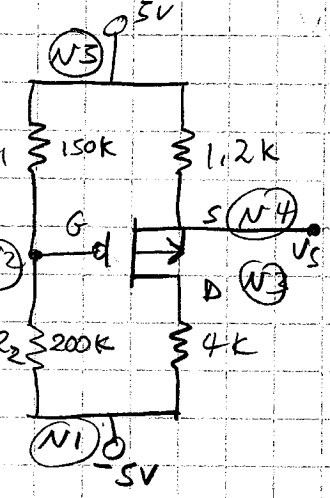
$V_D = 5 - (2k)(1mA) = 3V$

$V_{DS} = 3 - -4 = 7V$

$V_{DS} > V_{GS} - V_T$

$\therefore$ saturation verified

CKT 3 (lab ckt 4)



$K'_p = 250\mu A/V^2$

$W/L = 1$

$V_{tp} = -1$

$V_G = -5 + \left(\frac{200}{350}\right)10V \cong 0.714V$

$I_{DS} = \frac{5 - V_S}{1.2k}$

$V_{GS} = 0.714 - V_S$

$I_{DS}^{(SAT)} = \frac{K'_n}{2}\frac{W}{L}\left[(0.714 - V_S) - -1\right]^2$

$V_S = (-10.43, 4.12677)$

$V_S \neq -10.43 < -5 \Rightarrow V_S = 4.1268$

$V_{GS} = 0.714 - 4.1268 = -3.412$

$I_{DS} = \frac{4.13 - 5}{1.2k} = 727.69\mu A$

$V_D = -5 + (4k)(727\mu A) = -2.089$

$V_{DS} = -2.089 - 4.12677 = -6.216$

$|V_{DS}| > |V_{GS}| - |V_T|$

$\therefore$ saturation verified