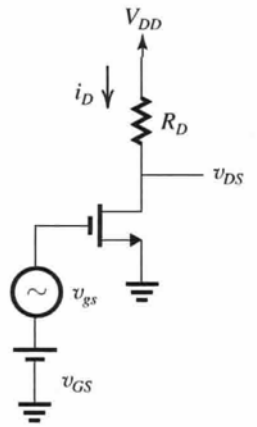
5.71



$V_t = 0.4$ V. $k_n = 4$ mA / V^2

$V_{GS} = 0.65$ V. $V_{DD} = 1.8$ V.

$R_D = 8$ kΩ ($V_{0V} = 0.25$ V.)

(a) $I_D = \frac{1}{2} k_n V_{0V}^2 = 125$ μA

$V_{DS} = V_{DD} - I_D R_D = 0.8$V.

(b) $g_m = k_n V_{0V} = 1$ mS

(c) $A_V = -g_m R_D = -8.0$

(d) *for* $\lambda = 0.1 V^{-1}$

$V_0 \cong \frac{1}{\lambda I_D} = 80$ kΩ

$A_V = -g_m(r_0 \| R_D) = -7.3$

5.72 $|v_o| = 0.5$ V. peak $R_D = 50$ kΩ

$V_{DD} = 1.8$ V. $|A_V| = 5$

$g_m = \frac{A_V}{R_D} = 100$ μS $= k_n V_{0V} = \frac{2I_D}{V_{0V}}$

5.79 $V_t = 1V$, $k_n' = \dfrac{W}{L} = 2\ \text{mA}/V^2$

(a) dc analysis $V_G = \dfrac{5}{15}\ 15\ V, = 5\text{V}$, assume

$I_D = 1\ \text{mA}$

$V_S = 3\ \text{V}$, $V_{GS} = 2\ \text{V}$, $V_{0V} = 1\text{V}$.

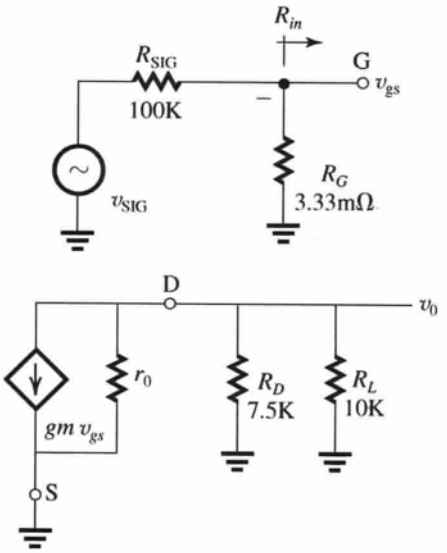
$I_D = \dfrac{1}{2}k'V_{0V}^2 = 1\ \text{mA}$ (check)

$V_D = V_{DD} - I_D R_D = 7.5\text{V}$.

(b) $r_0 = \dfrac{V_A}{I_D} = \dfrac{100\ \text{V}.}{1\ \text{mA}} = 100\ \text{k}\Omega$

$g_m = \sqrt{2k_n I_D} = 2\ \text{mS}$

(c)



(d) $R_{\text{in}} = R_G = 3.33\ \text{M}\Omega$

$\dfrac{v_{gs}}{v_{sig}} = \dfrac{R_{in}}{R_{sig} + R_{in}} = 0.97$

$\dfrac{v_0}{v_{gs}} = -g_m(r_0 \| R_D \| R_L) = -8.2$

$\dfrac{v_0}{v_{sig}} = -8.0$