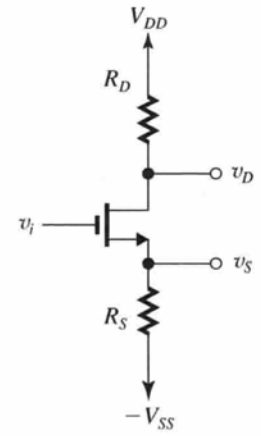
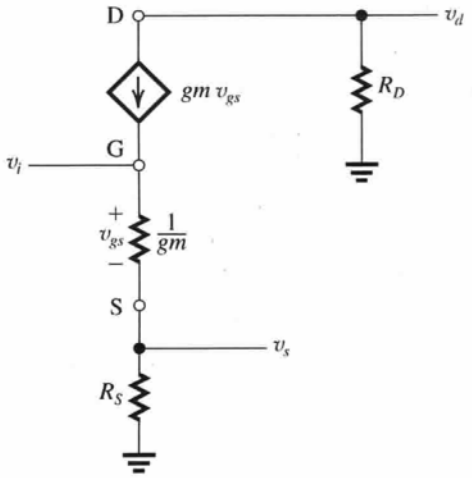
5.76





$$v_i = (g_m v_{gs})\left(\frac{1}{g_m} + R_S\right)$$

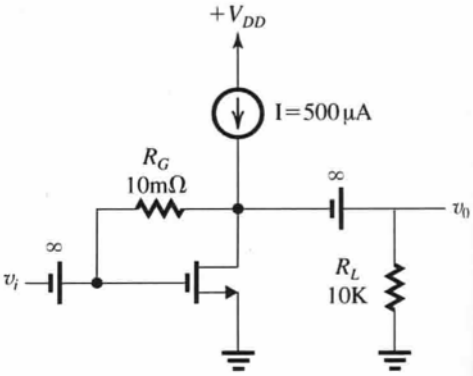
$$v_d = -g_m v_{gs} R_D$$

$$v_S = +g_m v_{gs} R_S$$

$$\therefore \frac{v_S}{v_i} = \frac{R_S}{\frac{1}{g_m} + R_S} = \frac{+g_m R_S}{1 + g_m R_S}$$

$$\frac{v_d}{v_i} = \frac{-R_D}{\frac{1}{g_m} + R_S} = \frac{-g_m R_D}{1 + g_m R_S}$$

5.77



$V_t = 0.5\text{V}.$

$V_A = 50\ \text{V}.$

Given $V_{DS} = V_{GS} = 1\ \text{V}.$

$$V_{0V} = 0.5\text{V}.,\ g_m = \frac{2I_D}{V_{0V}} = 2\ \text{mS}$$

Ex: 5.31

CD (source follower)

$$R_{out} = 200\ \Omega = \frac{1}{g_m} \Rightarrow g_m = 5\ \text{mA / V}$$

$$g_m = k_n' \frac{W}{L} V_{OV} = (0.4\ \text{mA / V}^2)$$

$$\left(\frac{W}{L}\right)(0.25\ \text{V}) \Rightarrow \frac{W}{L} = 50$$

$$I_D = \frac{1}{2} k_n' \frac{W}{L} V_{OV}^2 = 0.625\ \text{mA}$$

$$G_V = \frac{g_m R_L}{1 + g_m R_L}$$

for $K < R_L < 10\ \text{K}$

$0.83 < G_V < 0.98$

Ex: 5.27

$I_D = 0.25$ mA, $V_{OV} = 0.25$ V,

$V_A = 50$ V

$$r_O = \frac{V_A}{I_D} = 200 \text{ k}\Omega$$

$$g_m = \frac{2I_D}{V_{OV}} = 2 \text{ mS}$$

$R_{\text{in}} = \infty$

$A_{vo} = -g_m(R_D \| r_O) \simeq -g_m R_D = -4$

$R_O = R_D \| r_O \simeq R_D \equiv 20 \text{ k}\Omega$

$A_v = G_V = -g_m(R_D \| r_O \| R_L) \simeq$

$-g_m(R_D \| R_L) = -20$ V/V

for $\hat{v}_{gs} = (10\%)\, 2V_{OV} = 0.05$ V.

$\hat{v}_O = (A_V \hat{v}_{gs}| = 1$ V.