ECE 3050 Analog Electronics Quiz 5
June 17, 2009

Professor Leach   Last Name:_____First Name:_____

Instructions. Print your name in the spaces above. Place a box around any answer. **Honor Code Statement:** *I have neither given nor received help on this quiz.* Initials _____

$$g_m = 2\sqrt{KI_D} \qquad g_{mb} = \chi g_m \qquad r_s = \frac{1}{g_m} \qquad r'_s = \frac{r_s}{1+\chi} \qquad r_0 = \frac{\frac{1}{\lambda} + V_{DS}}{I_D} \qquad r_{id} = r_0\left(1 + g_m R_{ts}\right) + R_{ts}$$

For credit, you must give all equations that you use to calculate your answers. Credit will not be given for any answer without full supporting work.

1. The ac signal circuit of a CS/CD amplifier is shown. For $I_{D1} = I_{D2} = 2\,\text{mA}$, $R_G = 100\,\text{k}\Omega$, $R_S = 600\,\Omega$, $R_D = 22\,\text{k}\Omega$, $K = 5 \times 10^{-4}\,\text{A}/\text{V}^2$, $\chi = 0.25$, and $\lambda = 0$, solve for $A_v = v_o/v_i$, r_{in}, and r_{out}.
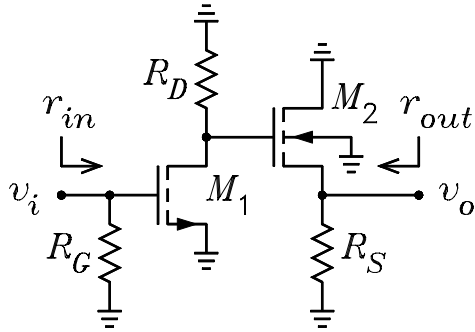
$K := 0.0005 \qquad \chi := 0.25 \qquad I_D := 0.002 \qquad R_G := 100000 \qquad R_S := 600 \qquad R_D := 22000$

$g_m := 2 \cdot \sqrt{K \cdot I_D} \qquad g_m = 2 \bullet 10^{-3} \qquad r_s := g_m^{-1} \qquad r_s = 500$

$r'_s := \dfrac{r_s}{1+\chi} \qquad r'_s = 400 \qquad A_v := g_m \cdot \left(-R_D\right) \cdot \dfrac{1}{1+\chi} \cdot \dfrac{R_S}{r'_s + R_S} \qquad A_v = -21.12$

$r_{in} := R_G \qquad r_{in} = 1 \bullet 10^5 \qquad r_{out} := R_{p2}\left(r'_s, R_S\right) \qquad r_{out} = 240$