Homework 11

Due: Monday, April 28, 2014 at 1pm

This is an individual assignment!

PROBLEM 1 (10pts):

Using feedback techniques, determine the type of feedback, the input and output impedance and current gain (i_{out}/i_{in}) of the circuit in Figure 1 using the two-port feedback analysis technique. Leave your answer in terms of variables (g_{m1}, R_D, r_{o1}, etc.) and assume $\gamma = 0$.

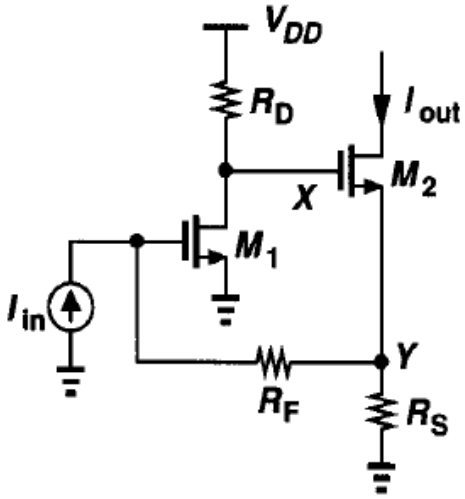

Figure 1

PROBLEM 2 (10pts):

Consider the circuit in Figure 2, where $(W/L)_{1-4} = 50/0.5$, $|I_{D1-4}| = 0.5$ mA, $V_{tn} = 0.7$ V, $V_{tp} = -0.8$ V, $k_n' = 134\ \mu A/V^2$, $k_p' = 38\ \mu A/V^2$, $\lambda_n = 0.1\ V^{-1}$, $\lambda_p = 0.2\ V^{-1}$, $R_1 = 805\ \Omega$ and $R_2 = 3\ k\Omega$.

Calculate the loop-gain T=af and compare to the value of the Return Ratio.

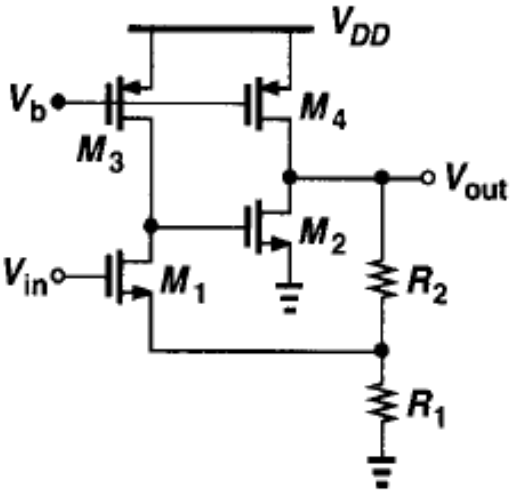

Figure 2

PROBLEM 3 (15pts):

A voltage-follower feedback circuit is shown in Figure 3. For the MOS transistor, I_D =0.5 mA, k'= 180 μA/V^2, $r_o = \infty$, W/L = 100, and $\gamma = 0$. For the op-amp, assume that R_i = 1 MΩ, R_o = 10 kΩ, and a_v =1,000. Calculate input resistance, output resistance, loop transmission, and closed-loop gain:

(a) Using the formulas from two-port analysis.

(b) Using the formulas from return-ratio analysis.

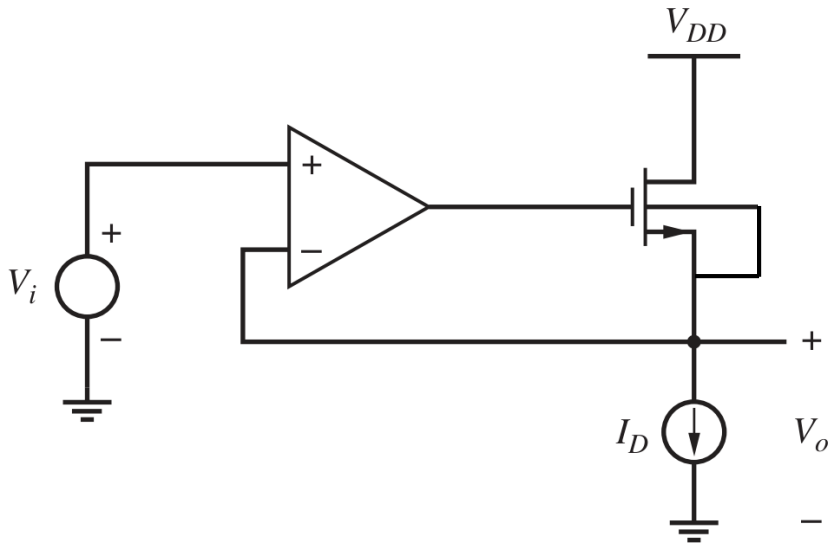

Figure 3

EXTRA PROBLEM FOR EE 240A STUDENTS:
PROBLEM 4 (15pts):

In the circuit of Figure 4, suppose all resistors are equal to 2 kΩ and $gm1 = gm2 = 5$ mS. Assuming $\lambda = \gamma = 0$, calculate the closed-loop gain and output impedance.

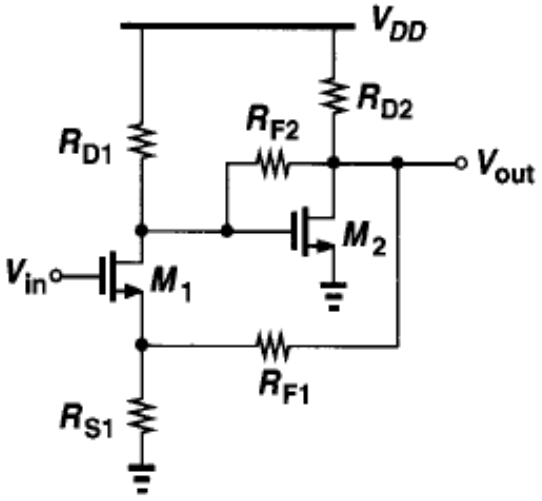

Figure 4