PROBLEM SET #12

Issued: Tuesday, Dec. 3rd, 2013

Due: Wednesday, Dec. 11th, 2013, 8:00 a.m. in the EE 140/240A homework box

1. Using feedback techniques, determine the input and output impedance and current gain (I_{out}/I_{in}) of the circuit in Fig. PS12.1. Leave your answer in terms of variables (g_{m1}, R_1, r_o, etc.) and assume $\gamma = 0$.

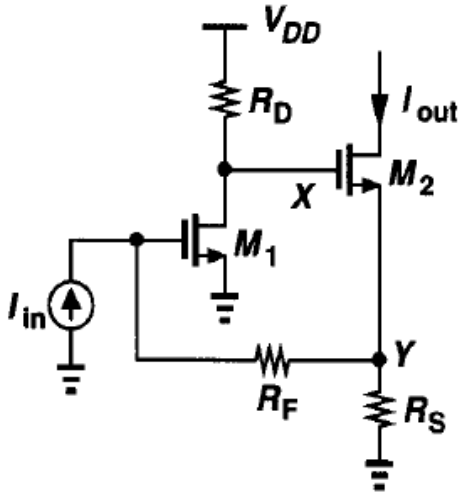

Figure PS12.1

2. Consider the circuit in Fig. PS12.2, where $(W/L)_{1\text{-}4} = 50/0.5$, $|I_{D1\text{-}4}| = 0.5$ mA, $V_{tn} = 0.7$ V, $V_{tp} = -0.8$ V, $k_n' = 134\ \mu A/V^2$, $kp' = 38\ \mu A/V^2$, $\lambda_n = 0.1\ V^{-1}$, $\lambda_p = 0.2\ V^{-1}$, and $R_2 = 3$ kΩ.

a. For what range of R_1 are the above currents established while M_2 remains in saturation? What is the corresponding range of V_{in}?

b. Calculate the closed-loop gain and output impedance for $R_1 = 805\ \Omega$.

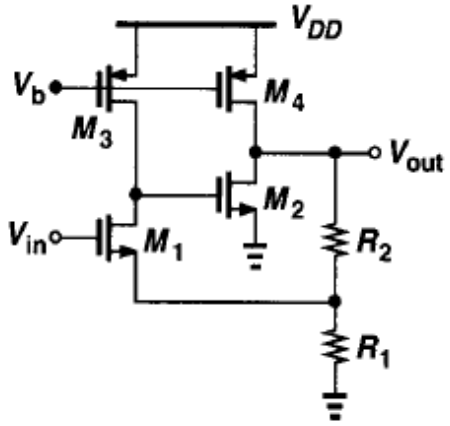

Figure PS12.2

3. A CMOS feedback amplifier is shown in Fig. PS12.3. If the dc input voltage is zero, calculate the overall voltage gain v_o/v_i and the output resistance assuming the following parameters:
$\mu_n C_{ox}$ = 60 μA/V^2, $\mu_p C_{ox}$ = 30 μA/V^2, V_{tn} = 0.8 V,
V_{tp} = -0.8 V, λ_n=$|\lambda_p|$ = 0.03 V^{-1}, and γ_n = γ_p = 0.

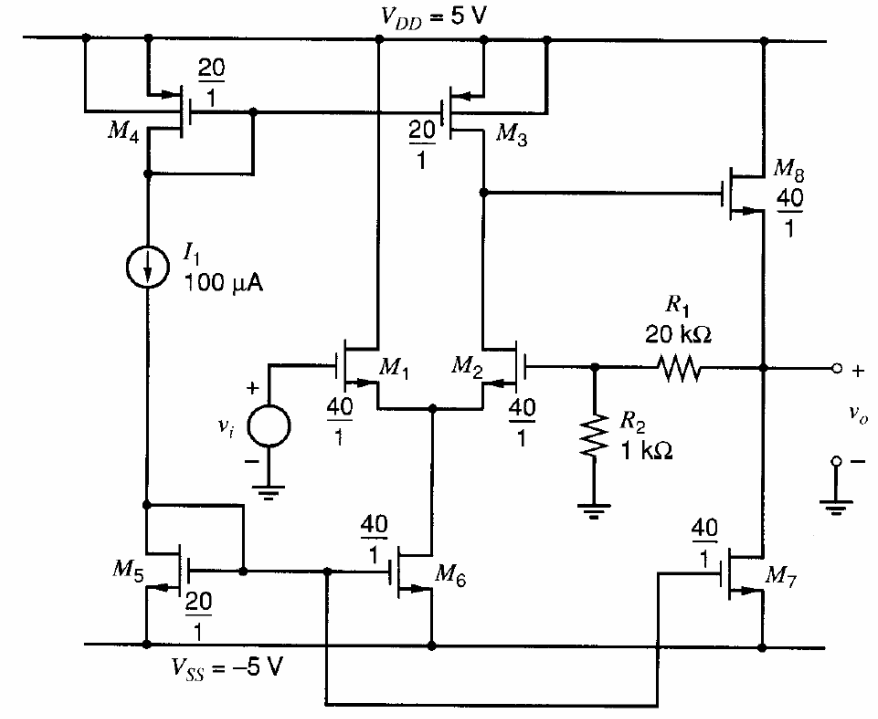

Figure PS12.3