PROBLEM SET #12

Issued: Tuesday, April 26h, 2011
Due: Tuesday, May 3rd, 2011, 5:00 p.m. in the EE 140 homework box in 240 Cory

1. The ac schematic of a shunt-shunt feedback amplifier is shown in Fig. PS12.1. ("ac schematic" means that biasing is not shown, but that you should assume that all devices are biased appropriately.) All transistors have I_D = 1 mA, W/L = 100, k' = 60 μA/V^2, and λ = 1/(50 V).
   a. Calculate the overall gain v_o/i_i, the loop transmission, the input impedance, and the output impedance at low frequencies.
   b. If the circuit is fed from a source resistance of 1 kΩ in parallel with i_i, what is the new output resistance of the circuit?

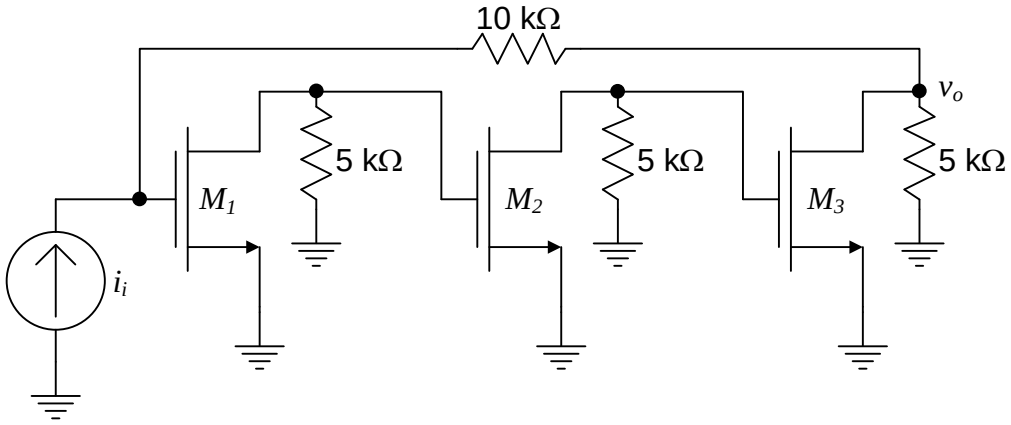

Fig. PS12.1

2. Assume the BiCMOS amplifier of Fig. PS12.2 is fed from a current source. Calculate the low-frequency small-signal transresistance v_o/i_i, the loop gain, and the input and output impedances of the circuit. Use the following parameters in your calculation:
   $I_S = 10^{-16}$A, β_F = 100, r_b = 0, $V_A \rightarrow \infty$, $\mu_n C_{ox}$ = 200 μA/V^2, V_t = 0.6V, and λ = 0.

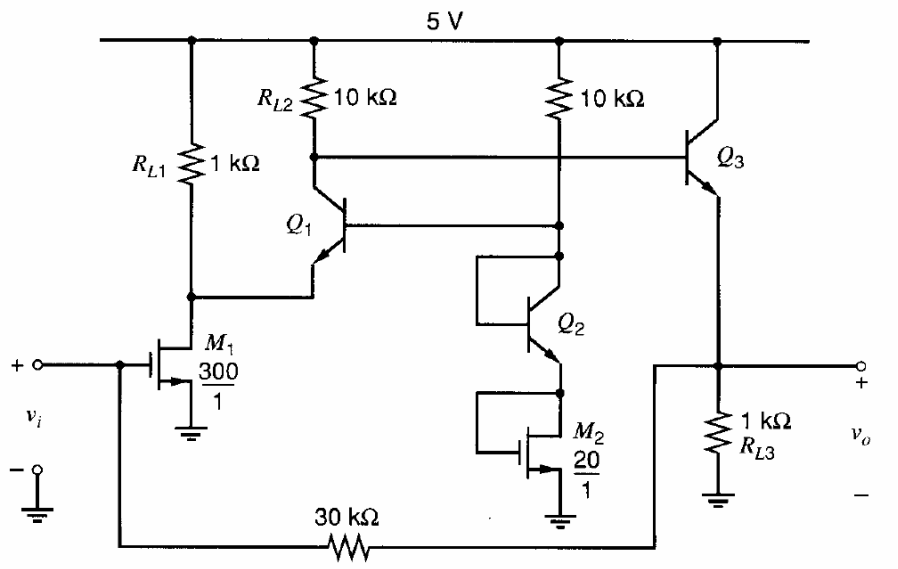

Fig. PS12.2

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. Compare your answer with a SPICE simulation. Use the following:
   $\mu_n C_{ox}$ = 60 μA/V^2, $\mu_p C_{ox}$ = 30 μA/V^2, V_{tn} = 0.8 V,
   V_{tp} = -0.8 V, λ_n=|λ_p| = 0.03 V^{-1}, and γ_n = γ_p = 0.

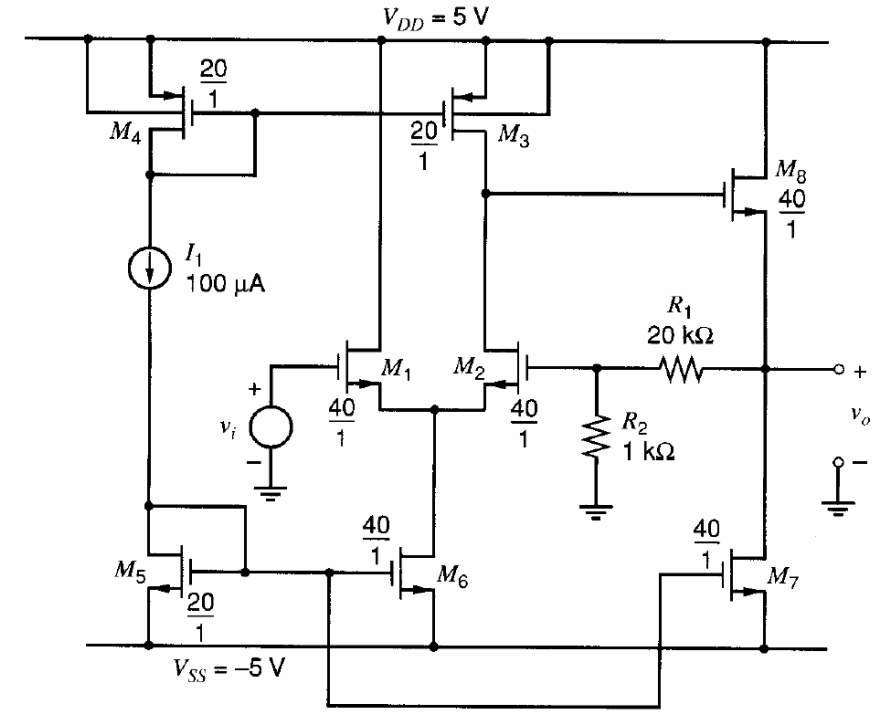

Fig. PS12.3