Homework 12

Due: Tuesday, May 6, 2014 at 1pm

This is an individual assignment!

PROBLEM 1 (20pts):

The integrator feedback circuit is shown in Figure 1, with op-amp described by a single-pole transfer function $A_v(s) = A_0/(1+s/\omega_p)$, and output resistance R_{Oa}.

a) Derive the expression for loop-gain $T(s)=af(s)$. Determine the poles and zeros of $T(s)$.

b) Derive the expression for the return-ratio $RR(s)$. Determine the poles and zeros of $RR(s)$.

Sketch the amplitude and phase of $T(s)$ and $RR(s)$ for R_{Oa} = 10 MΩ, A_0 = 1000, ω_p = 25 Mrad/s, C_{IN} = 2 pF, C_F = 20 pF.

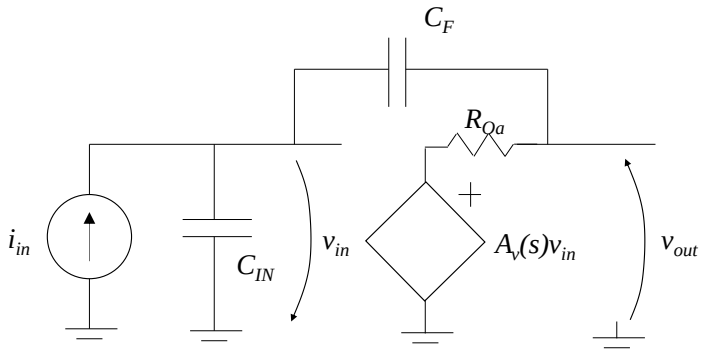

Figure 1

PROBLEM 2 (20pts):

Assume the BiCMOS amplifier of Figure 2 is fed from a current source. Determine the feedback type. Calculate the low-frequency small-signal transresistance v_o/i_i, 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 = 0.6 V, and λ = 0.

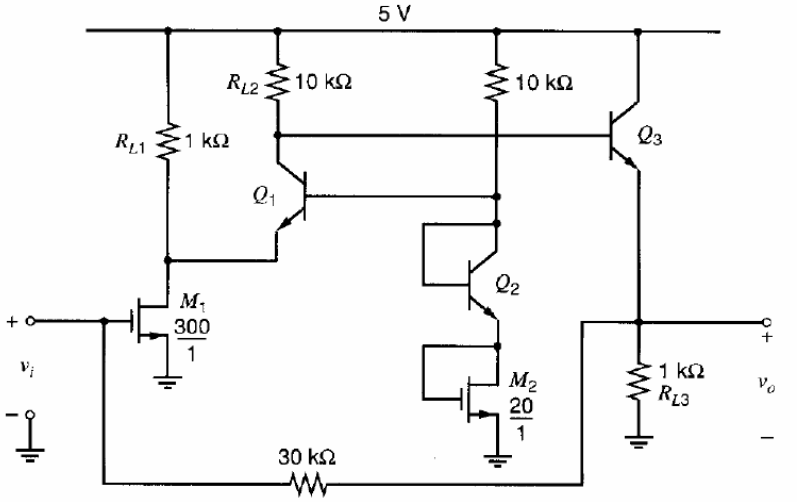

Figure 2

EXTRA PROBLEM FOR EE 240A STUDENTS:
PROBLEM 3 (20pts):
A balanced monolithic amplifier is shown in Figure 3.
(a) Determine the feedback-type.
(b) If the common-mode input voltage is zero, calculate the bias current in each device. Assume that β_F is large.
(b) Calculate the voltage gain, input impedance, and output impedance of the circuit at low frequencies using the following data:
$\beta = 100$, $r_b = 0$, $V_A = \infty$, and $V_{BE}(on) = 0.7$ V.

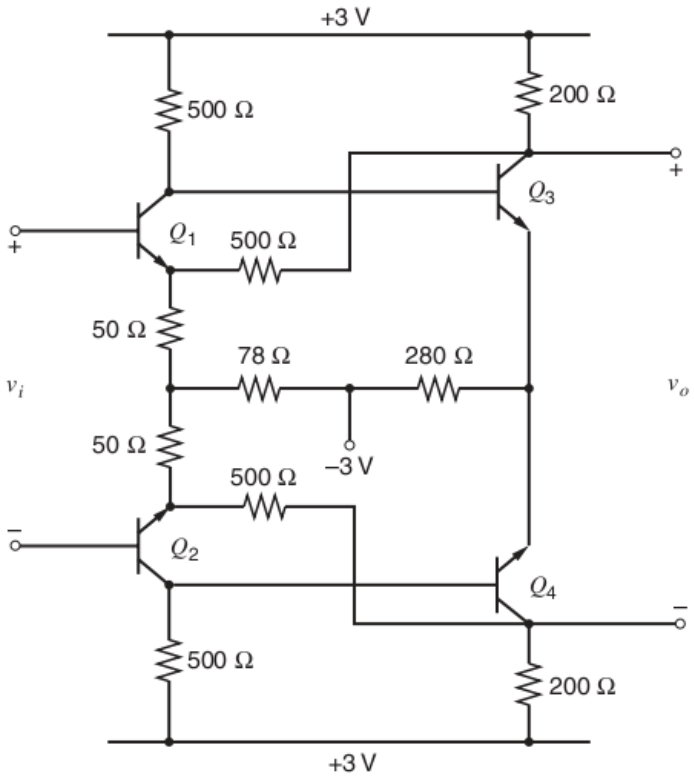

Figure 3