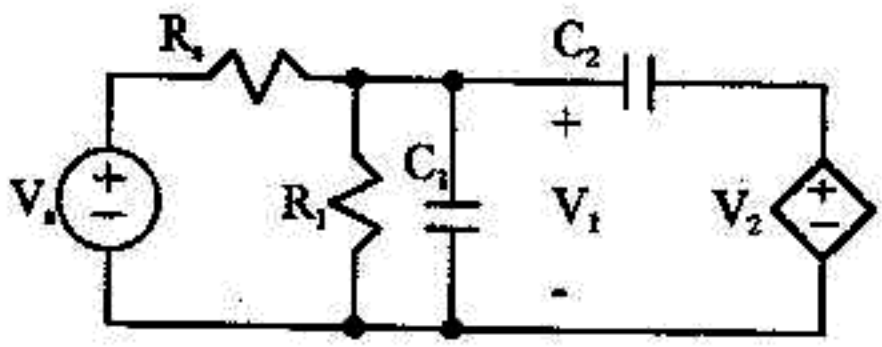
1. A signal source V_s with output resistance R_s is connected in the circuit as shown. It is known that the voltage V_2 is induced by the voltage V_1 such that $V_2=kV_1$.

(1) Derive an expression for the transfer function V_1/V_s.

(2) Find the expression for pole frequency f_H.

(3) If $R_1=R_s=1k\Omega$, $C_1=20pF$, $C_2=2pF$, and $k=-9$, sketch the Bode plot for $|V_1/V_s|$. (15%)

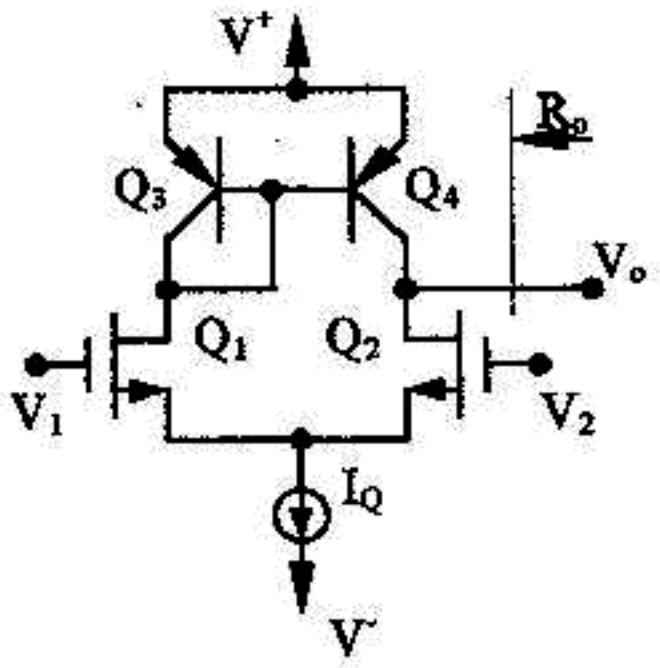


2.(1) Sketch the circuit of a cascode amplifier using two identical BJTs.

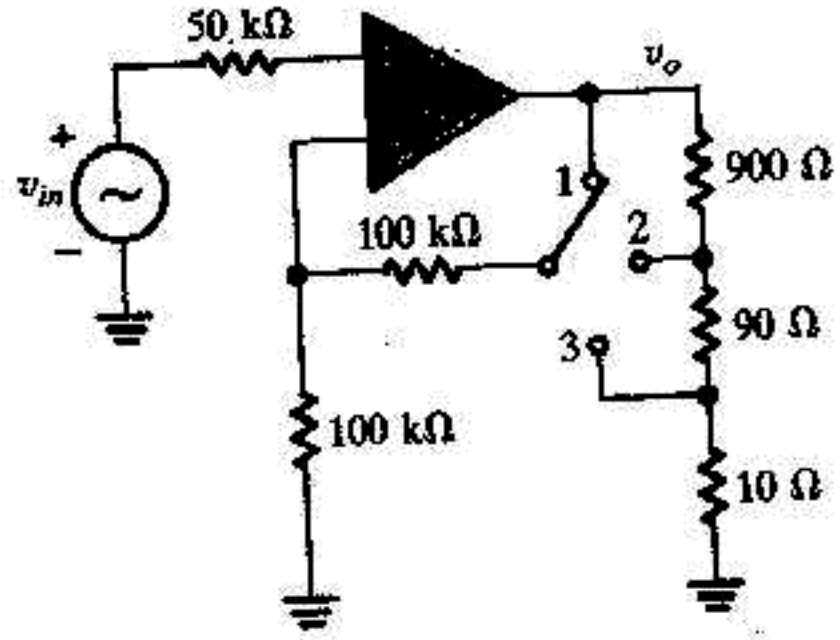
(2) What are the input resistance, output resistance, and voltage gain of your circuit?

(3) What is the advantage of this amplifier as compared to a common emitter amplifier? (10%)

3. In the BiCMOS differential amplifier as shown, $I_Q=0.6mA$, $k_n=0.3mA/V^2$, $\lambda=0.01V^{-1}$ for the MOSFETs; $V_A=80V$ for the BJTs. Find the output resistance R_o, the differential input resistance, and the voltage gain $A_d=v_o/(v_2-v_1)$. (10%)

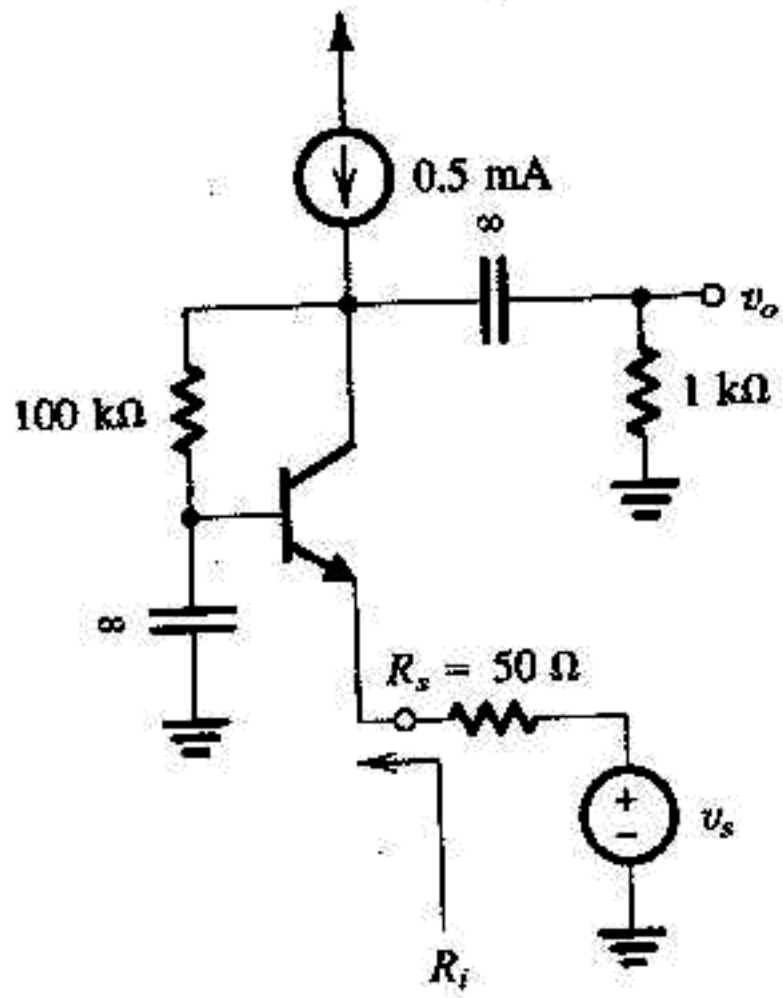


4.Find the voltage gain of the following circuit with the switch in positions 1, 2, and 3. (15%)

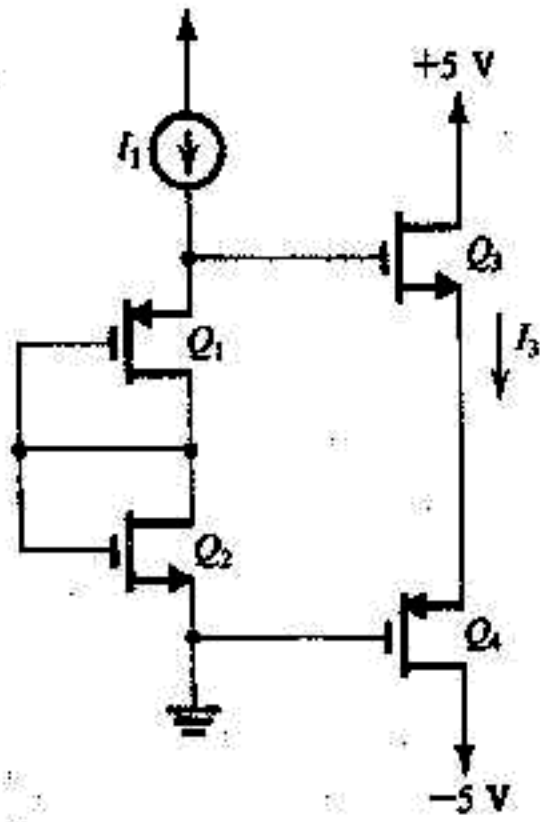


5.An amplifier with inverting circuit intended for very-high-frequency operation, yet characterized by a single-pole roll-off, has f_t=100MHz and A_o=20V/V. For a design in which the actual (rather than the nominal) closed-loop gain is −10V/V, what 3dB frequency results? (10%)

6.For the circuit shown, find the input resistance R_i, and the voltage gain v_o/v_s. Assume that the source provides a small signal v_s and that β is high. Note that a transistor remains in the active region even if the collector voltage falls below that of the base by 0.4V or so. (10%)



7. Assuming the threshold voltage of all devices to be equal in magnitude and k denotes (1/2)($\mu C_{ox}W/L$). If $k_1=k_2$, and $k_3=k_4=16k_1$, find the required value of I_1 such that $I_3=1.6$mA. (15%)



8. Find the transfer function $V_o(s)/V_i(s)$ of the following circuit. Sketch the Bode plot for both gain and phase angle. (15%)