Electronics II, Exam-4, Spring 2016

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June 3, 2016, Prof. Dah-Chung Chang (E1-311)

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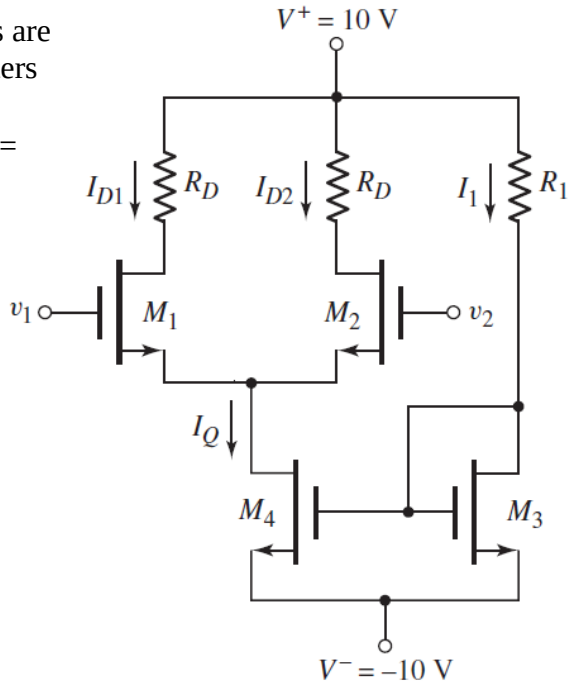
1. (**20%**) For the differential amplifier, the parameters are $R_1 = 50\ \text{k}\Omega$ and $R_D = 24\ \text{k}\Omega$. The transistor parameters are: $K_n = 0.25\ \text{mA/V}^2$, $\lambda = 0$, and $V_{TN} = 2\ \text{V}$.

(a) Determine I_1, I_Q, I_{D1}, V_{DS1}, and V_{DS4} when $v_1 = v_2 = 0$. (**10%**)

(b) What are the maximum and minimum values of the common-mode input voltage? (**10%**)

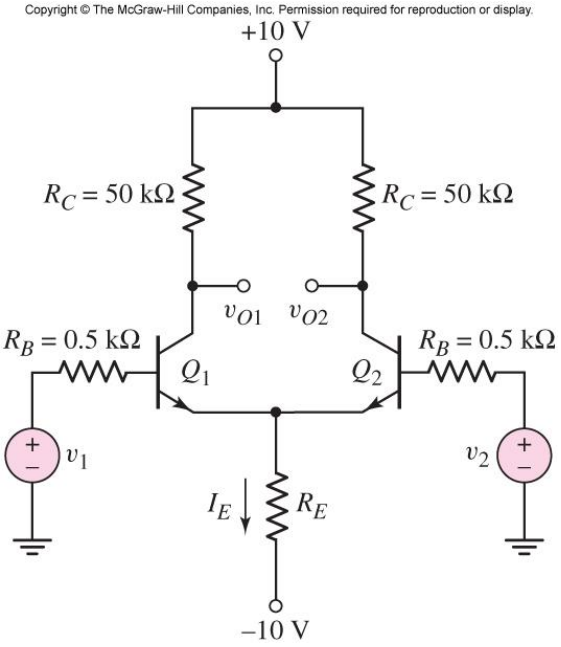


2. (**30%**) The transistor parameters are $\beta = 100, V_{BE}(on) = 0.7V$ and $V_A = \infty$.

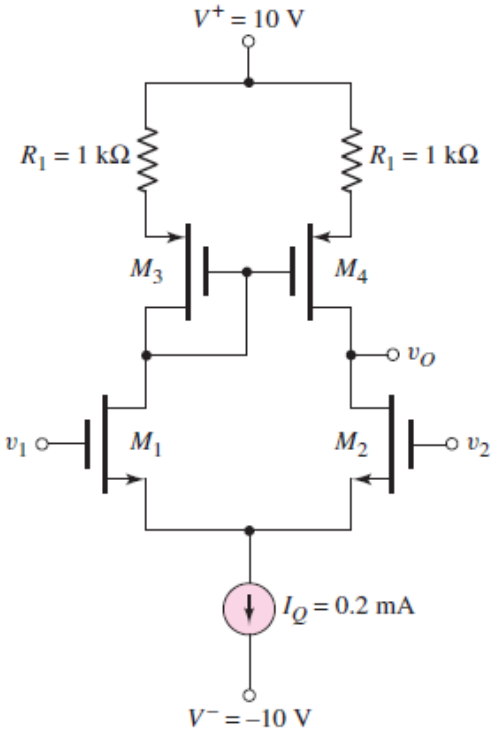
(a) Determine R_E such that $I_E = 150\mu A$. (**5%**)

(b) Derive A_d and A_{cm} for one-sided output at v_{O2}. (**20%**)

(c) Find the value of $CMRR_{dB}$. (**5%**)



3. (**25%**) Consider the diff-amp, the PMOS parameters are: K_p =80 μ A/V^2, λ_p = 0.02 V^{-1}, V_{TP} =−2 V. The NMOS parameters are: K_n = 80 μ A/V^2, λ_n = 0.015 V^{-1}, V_{TN} = +2 V. Determine the open circuit differential-mode voltage gain.



4. (**25%**) The bias currents I_1 and I_2 are such that a zero dc output voltage is established. The transistor parameters are:
$K_p = 0.2mA/V^2, K_n = 0.5mA/V^2, V_{TP} = -0.8V,$
$V_{TN} = 0.8V$ and $\lambda_n = \lambda_p = 0.01V^{-1}$. Determine
(a) the small-signal gain $A_v = v_o / v_{in}$, (**15%**)
(b) the output resistance R_o. (**10%**)