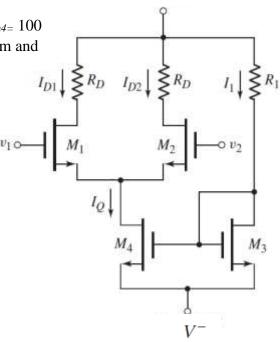
Electronics II, Exam-4, Spring 2018

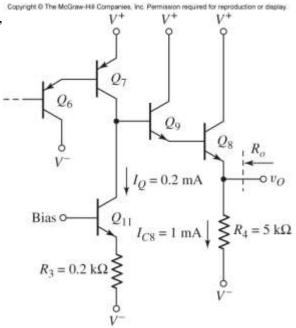
Department of Communication Engineering, National Central University June 15, 2018, Prof. Dah-Chung Chang (E1-311)

Note: Exam time is 10:00AM-12:00PM, 2018/6/15. The total is 120 points.

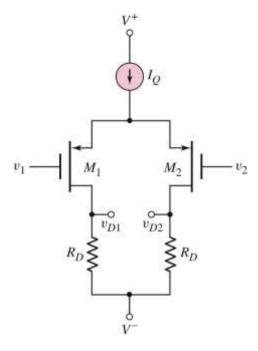
1. **(20 pts)** For the differential amplifier, the parameters are V^+ =5V, V^- =-5V, R_1 =80 k Ω and R_D =40 k Ω . The transistor parameters are: $K_{n1} = K_{n2}$ =50 μ A/V², $K_{n3} = K_{n4}$ =100 μ A/V², λ = 0, and V_{TN} =0.8 V. Determine the maximum and minimum values of the common-mode input voltage?



2. (30 pts) Assume $\beta = 120$ for all npn transistors and $\beta = 90$ for all pnp transistors. Let $V_{A7} = 60V$ for Q_7 , $V_{A11} = 120V$ for Q_{11} , and $V_A = \infty$ for all other transistors. Determine the output resistance R_o .



3. (30 pts) The circuit and transistor parameters are $V^+ = 3V, V^- = -3V, R_D = 360k\Omega, I_Q = 12\mu A,$ $V_{TP} = -0.4V, K_p = 30\mu A/V^2, \text{ and } \lambda = 0.$ The output resistance of the current source is $R_o = 4M\Omega$. (a) Determine V_{SD} of the transistors for $v_1 = v_2 = 0$ (b) Determine the differential-mode and common-mode voltage gains for $v_O = v_{D2}$.



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- 4. (40 pts) Given that $V_{BE(on)}=0.7V$, $\beta=150$, $V_A=\infty$, and $R_2=R_3$. If $I_Q=0.4mA$, determine
 - (a) R_2 (10 pts)
 - (b) I_{R4} , I_{R6} , and I_{R7} (10 pts)
 - (c) R_{i2} and R_{i3} (10 pts)
 - (d) $A_{d1} = v_{O2} / (v_1 v_2)$ and $A_2 = v_{O3} / v_{O2}$. (10 pts)

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