Electronics II, EXAM-2, Spring 2018

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May 4, 2018, Prof. Dah-Chung Chang (E1-311)

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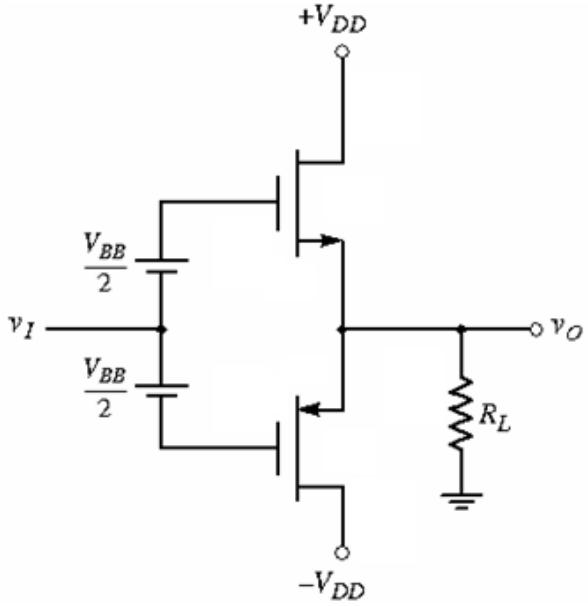
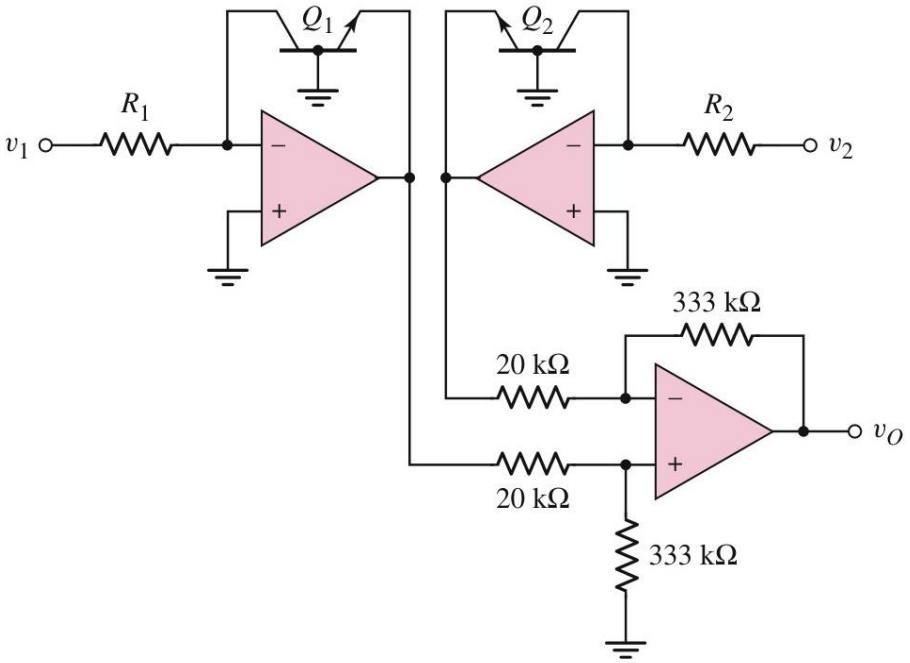
1. (20%) The parameters of the circuit are $V_{DD} = 10V$ and $R_L = 10\Omega$. The transistors are matched, and the parameters are $K = 0.25A/V^2$ and $|V_T| = 1V$. The quiescent drain current is to be 20% of the load current when $v_O = 5V$. Find the input voltage when $v_O = 5V$.

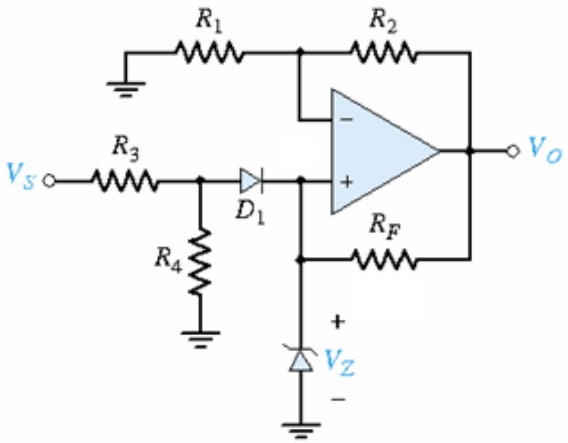


2. (20%) Let the semiconductor parameter for the transistor be $V_T = 0.026V$. Derive the following result

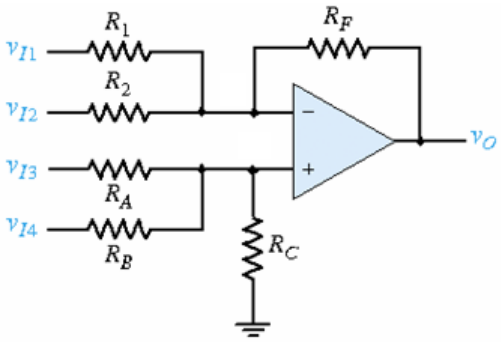
$$v_O = 0.4329 \ln\left(\frac{v_2 R_1}{v_1 R_2}\right).$$



3. (20%) The output of the voltage reference circuit is 10V. Use a Zener diode with a breakdown voltage of 6V. Assume that the Zener diode is biased at the current range of 1 mA to 1.5mA and the PN diode cut-in voltage is 0.6V. The resistor parameters are $R_3 = 10K\Omega$ and $R_4 = 30K\Omega$.
   (a) Find the ratio of R_2 / R_1 and R_F.
   (b) Find the maximum and minimum current values supplied by V_S.



4. (20%) Derive v_O in relation of v_{I1}, v_{I2}, v_{I3}, and v_{I4}.



5. (20%) Consider the following instrumentation amplifier.
   (a) Assume that $R_4 / R_3 = R_6 / R_5$. Find v_O in relation of v_{I1} and v_{I2}. (10%)
   (b) Assume that $R_2 / R_1 = 1$, $R_4 / R_3 = 10$, and $R_6 / R_5 = 12$. Determine CMRR(dB). (20%)