VE311 Electronic Circuit Homework 8

Due: **Jul 23rd 11:59a.m.**

Note:

1) Please use A4 size paper or page.

2) Please clearly state your final result for each question.

Question 1. folded cascode

A cascode MOSFET structure can be converted to its equivalent folded cascode topology. The PMOS and current source I_2 replace an NMOS in the simple cascode structure.

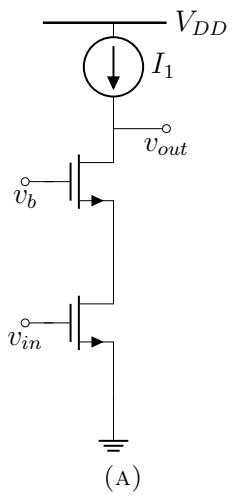


FIGURE 1. Cascode Structure

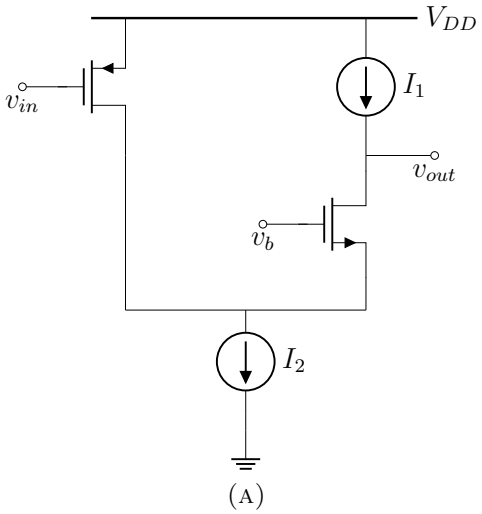
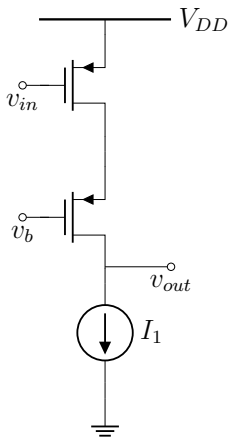


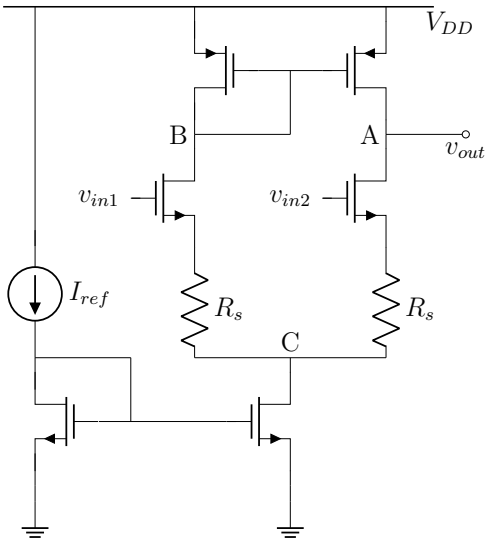
FIGURE 2. folded Cascode Structure

(a) Draw the equivalent folded cascode structure for the PMOS cascode structure.



(b) Find the gain for small-signal and R_{out} of the cascode Figure.1 and folded-cascode Figure.2. Assume that the current sources are ideal.

Question 2. Differential Pairs with Source Degeneration



Assume All MOSFET have identical $\frac{W}{L}$ and $\frac{1}{2}\mu_n C_{ox}\frac{W}{L} = 10mA \cdot V^2$, $\lambda = 0.1V^{-1}$, $V_{TH} = 1V$, $R_s = 10k\Omega$, $I_{ref} = 10\mu A$, $V_{DD} = 5V$

(a). Determine the DC currents and voltages at A and B. Ignore channel length modulation for this question only.

(b). Determine the differential gain for the small signal by using the half circuit. C can be regarded as the ground for AC small signals.

(c). Determine the common mode gain for a common mode small signal input and derive the value of CMRR.