

DO NOT WRITE YOUR NAME OR KAUST ID NUMBER ON THIS PAGE OR ANY OTHER PAGE

PUT YOUR EXAM ID NUMBER ON THIS PAGE AND EVERY OTHER PAGE YOU SUBMIT

WRITE YOUR SOLUTIONS ON ONLY ONE SIDE OF EMPTY SOLUTION SHEETS PROVIDED

PUT PAGE NUMBERS ON ALL SOLUTION PAGES

YOUR SOLUTIONS SHOULD BE ORGANIZED WELL AND WRITTEN CLEARLY – NEAT AND EASY-TO-READ SOLUTIONS WILL HELP YOU IN GRADING

DO NOT WRITE ANY PART OF YOUR SOLUTIONS ON PROBLEM SHEETS – SOLUTIONS ON PROBLEM SHEETS WILL NOT BE GRADED

YOU ARE ALLOWED TO SUBMIT SOLUTIONS TO ONLY FIVE PROBLEMS

EXAM ID NUMBER: _____

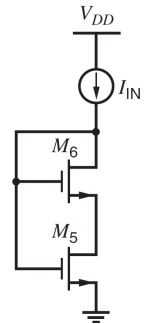
COURSE NUMBER: EE 202

PROBLEM: 1

Problem 1

Ignore body effect in this problem ($\gamma = 0$).

- a) In the circuit of figure 1-a, what is the mode of operation of each transistor (off, triode or active)? Explain your answer. I_{IN} is an ideal current source. (4 points)



The same circuit is used in Sooch cascode current mirror of figure 1-b. All transistors have the same aspect ratio of W/L , except M_5

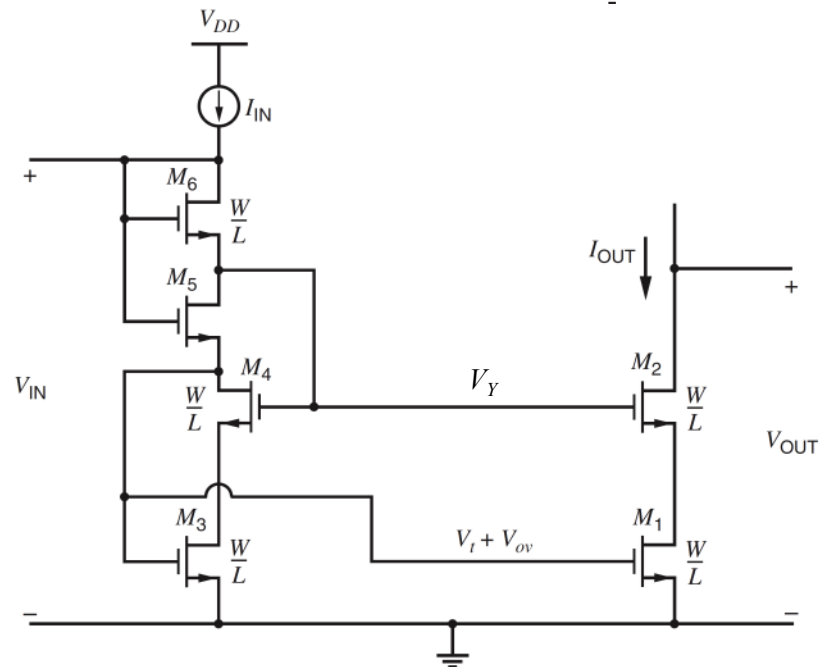


Figure 2-b

- a) Show that if $V_Y = V_t + 2V_{ov}$, the output voltage can go as low as $2V_{ov}$ (**Definition:** $V_{ov} = V_{GS} - V_t$) (3 points)
- b) Explain what will happen if the output voltage is lower than $2V_{ov}$ (3 points)
- c) Show that the condition in part b ($V_Y = V_t + 2V_{ov}$) can be satisfied if the aspect ratio of M_5 is $\frac{W}{3L}$ (4 points)
- d) Find V_{IN} in terms of V_{ov} and V_t (4 points)
- e) Find the output resistance. (2 points)

DO NOT WRITE YOUR NAME OR KAUST ID NUMBER ON THIS PAGE OR ANY OTHER PAGE

PUT YOUR EXAM ID NUMBER ON THIS PAGE AND EVERY OTHER PAGE YOU SUBMIT

WRITE YOUR SOLUTIONS ON ONLY ONE SIDE OF EMPTY SOLUTION SHEETS PROVIDED

PUT PAGE NUMBERS ON ALL SOLUTION PAGES

YOUR SOLUTIONS SHOULD BE ORGANIZED WELL AND WRITTEN CLEARLY – NEAT AND EASY-TO-READ SOLUTIONS WILL HELP YOU IN GRADING

DO NOT WRITE ANY PART OF YOUR SOLUTIONS ON PROBLEM SHEETS – SOLUTIONS ON PROBLEM SHEETS WILL NOT BE GRADED

YOU ARE ALLOWED TO SUBMIT SOLUTIONS TO ONLY FIVE PROBLEMS

EXAM ID NUMBER: _____

COURSE NUMBER: _____ EE 202

PROBLEM: _____ 2

Problem 2

Ignore body effect in this problem ($\gamma=0$). Use any appropriate approximation.

- What is the name and function of the circuit shown in figure 2? (2 points)
- What is the output resistance? (3 points)
- What is the low frequency voltage gain? (3 points)
- Find the poles of the frequency response. Which one is more likely to be the dominant pole? (5 points)
- Suggest a simple way to improve the phase margin. (3 points)
- Assume that the main sources of noise in the circuit are thermal and Flickr noise. Which transistors have a greater contribution toward the input-referred noise? (Explain your answer, but you **do not** need to find the value of the noise) (4 points)

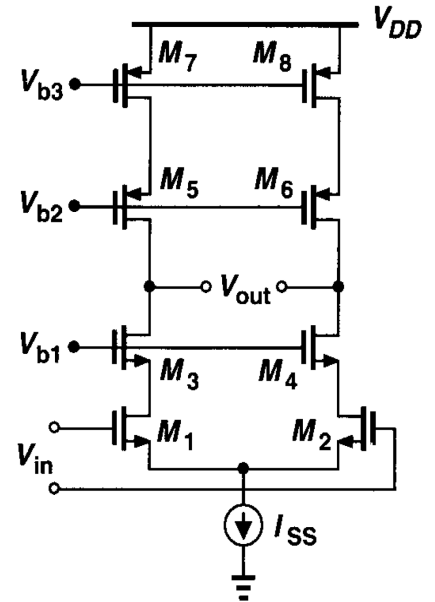


Figure 2