EE 330

Homework 12

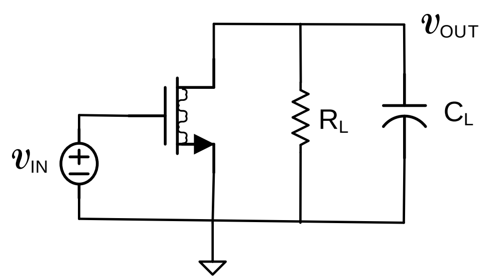
Fall 2020

Due 10:00 p.m. Wednesday Nov. 4

Problem 1

The small-signal equivalent circuit of the standard common-source amplifier biased to operate in the saturation region is shown below where a ***small*** capacitor, C_L, has been placed on the amplifier output.

What is the small-signal gain of the amplifier, $A_V(s) = \dfrac{v_{OUT}(s)}{v_{IN}(s)}$? Your answer should be in terms of the load resistor, R_L, the load capacitor, C_L, and the small signal model parameters of the transistor, g_{o1}, and g_{m1}.

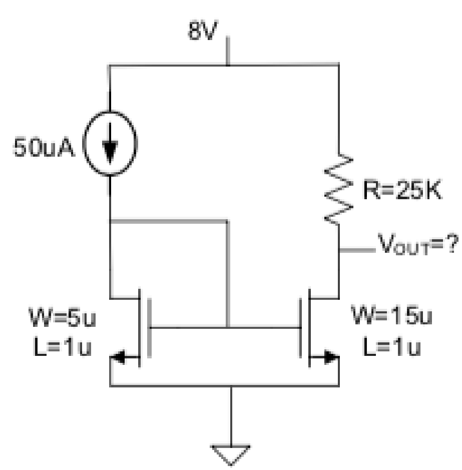


Problem 2

Consider the standard common-source amplifier structure given in Problem 1 where the transistor is biased to operate in the saturation region. Assuming that $C_L = 1nF$, $g_m = 1m\frac{V}{A}$, and $g_o = 10\mu\frac{1}{\Omega}$, determine the magnitude of the amplifier's gain to be at $0Hz$? at $1kHz$? and at $1MHz$?

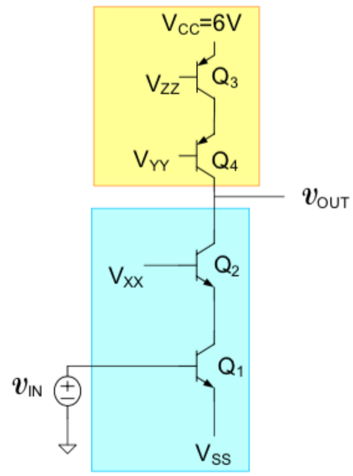
Problem 3

Find V_{OUT} for the circuit below.



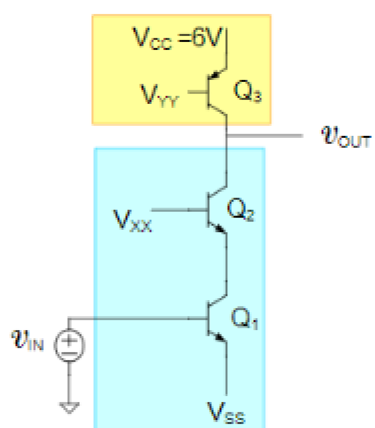
Problem 4

Assume the biasing voltages have been selected so that the quiescent output voltage is $2V$ and that all transisotrs are operating in the forward active region. Determine the small-signal voltage gain if $A_{E1} = A_{E2} = 40\mu^2$ and $A_{E3} = A_{E4} = 60\mu^2$. Assume the transistors all have parameters $\beta = 100$ and $V_{AF} = 100V$.



Problem 5

Assume the quiescent output is 2V and all transistors are in the forward active region of operation. Find the small signal voltage gain if $A_{E1}=A_{E2}=55\mu^2$ and $A_{E3}=75\mu^2$. Assume the transistors all have parameters $\beta = 100$ and $V_{AF} = 100V$.



Problem 6

What is the difference between the two following configurations? What role does that difference play and why?