NAME and SID

Note: Use the device parameters given in class. Vt=+/-0.5V, unCox=200uA/V2, upCox=100uA/V2, lambda0=0.02 1/V

1. (30pts) Design an amplifier with a low frequency gain of at least 100 and a unity gain frequency of 5 GHz with a 10pF load . Use an NMOS-input common-source amplifier with a PMOS current source load. You may use one resistor in your circuit, and assume a 5V supply, but all other devices must be FETs (no ideal voltage source, current sources, etc.). Try to minimize the size WIDTH of your transistors. All overdrive voltages (Vov or Vdsat) must be between 0.1 and 0.5 volts.
   - ? Calculate the values for gm, ro, Id, and Vdsat that you will use.
   - ? Draw a schematic of your design and clearly label all components (R= …, W/L=…)
   - ? Fill in the table with the data about each of your FETs.

Transistor	W	L	Vdsat	gm	ro

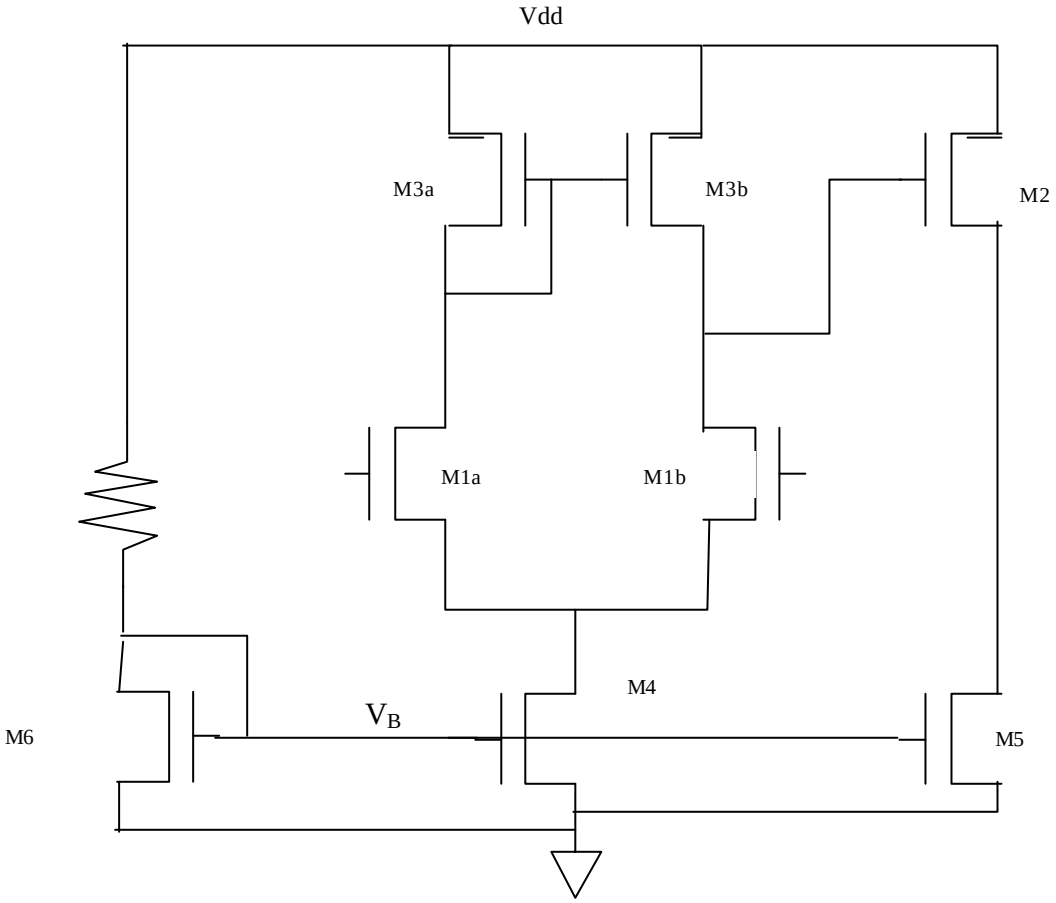
2. (25pts) For the amplifier shown below,

? **Circle and label all differential pairs, current mirrors, gain stages.**

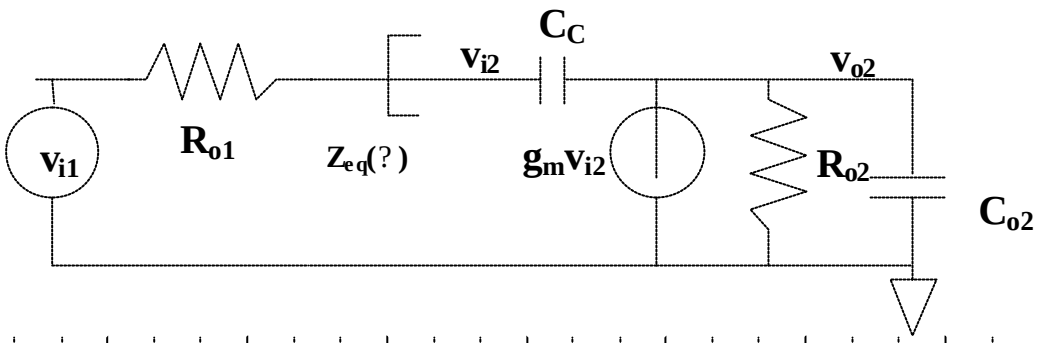
? **Label the input(s) and the output(s)**

? **Which devices make up the bias network:**

? **Which transistors are in the signal path:**



3) (30pts) For the amplifier below assume that **g_m=500microS, R_{o1}=100kOhm, R_{o2}= 200kOhm, C_{o2}= 1pF, C_C = 0.1pF**. In the top plot draw the magnitude of the **impedance** $Z_{eq}(?)$ seen looking into the capacitor at node Vi2, and in the lower plot draw the magnitude of the **first stage gain**, v_{i1} to v_{i2}, and the **total gain,** v_{i1} to v_{o2}**. LABEL AXES, poles, and magnitudes CLEARLY!**



$Z_{eq}(?)$ |

A_{v1} |

$A_{v1} * A_{v2}$|

4. (15 points)

A. You have a single stage MOS amplifier with a low frequency gain of 100, a pole frequency of 5MHz, and an output capacitance of 1pF. Calculate the unity gain frequency, the transconductance gm, and the output resistance Ro.

B. You need to design a single-stage amplifier with a gain of 5 at 10^9 rad/sec, and a DC gain of 50. Calculate the unity gain frequency, the pole frequency, and the gain at 10^7 rad/sec and 10^{10} rad/sec.

C. You have a single-stage amplifier with an output resistance of 10^7 Ohms, a transconductance of 10mS, and a unity gain frequency of 10^9 rad/sec. What is the DC gain, the pole frequency, and the outputcapacitance?