Homework for 7 for Experiment No. 7
Due Week of March 2

1. Shown below is a single stage common source amplifier biased by a current mirror current source. Bias the circuit so that the dc drain current is 1.86 mA, viz pick $R_T$ so that the drain current in each transistor has this value. The small-signal input impedance is specified to be 50 kΩ and the small signal output impedance is 5.1 kΩ (Assume $\lambda = 0$ for this specifications). The load resistor is 10 kΩ. The dc power supply voltages are $V^+ = +15$ V and $V^- = -15$ V. The parameters of the each transistor are: $K = 1 \text{mA}/\text{V}^2$, $V_{TO} = 1$ V, $\lambda = 0.001 \text{V}^{-1}$, $C_{GDO} = 2.5 \text{nF/m}$, and $C_{GSO} = 2.5 \text{nF/m}$. Pick $C_1 = C_2 = 22 \mu F$, and $C_3 = 330 \mu F$.

Verify the design with a SPICE analysis using National Instruments SPICE Multisim.

For the SPICE analysis use a DC analysis to determine the bias. Use an AC analysis to plot the gain versus the frequency. Choose the lower frequency as 1 Hz and the upper frequency 10 GHz. Mark the midband gain and the $-3\,\text{dB}$ frequencies. The SPICE parameters are $K_P$, $V_{TO}$ ($V_{TOD}$), $\Lambda$, $C_{GDO}$, and $C_{GSO}$. If the version of SPICE used requires the width ($W$) and length ($L$) of the channel use 10 μm for each.

Perform a transient analysis to determine the upper and lower clipping levels. (Remember the SPICE parameter $K_P = 2K$.)