1. Design a common source single stage MOSFET amplifier circuit to have a small-signal gain with a magnitude of 3. Bias the circuit so that the dc drain current is 1 mA. The small-signal input impedance is specified to be 50 kΩ and the small signal output impedance is 4.7 kΩ. The load resistor is 10 kΩ. The dc power supply voltages are $V^+ = +15$ V and $V^- = -15$ V. The parameters of the transistor are: $K$, $V_{TO}$, $C_{GDO} = 2.5$ nF/m, $C_{GSO} = 2.5$ nF/m, and $\lambda = 0.014 V^{-1}$. Pick $C_1 = C_2 = 0.22 \mu F$, and $C_3 = 10 \mu F$. For $K$ and $V_{TO}$ use the values measured in lab from the data taken from the Keysight curve tracer.

Verify the design with both a SPICE analysis and experimental measurements. 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 $-3$ dB frequencies. The SPICE parameters are $K^* (2K)$, $V_{TO}$ ($V_{TO}$), $LAMBDA$ ($\lambda$), $CGDO$ ($C_{GDO}$), and $CGSO$ ($C_{GSO}$). 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.