1. Design a common source single stage MOSFET amplifier circuit to have a small-signal gain with a magnitude of 5. Bias the circuit so that the dc drain current is 1.3 mA. The small-signal input impedance is specified to be 75 kΩ and the small signal output impedance is 7.5 kΩ. The load resistor is 20 kΩ. The dc power supply voltages are $V^+ = +15 \text{ V}$ and $V^- = -15 \text{ V}$. The parameters of the transistor are: $K$, $\lambda$, $V_{TO}$, $C_{GDO} = 2.5 \text{ nF/m}$, and $C_{GSO} = 2.5 \text{ nF/m}$. Pick $C_1 = C_2 = 0.22 \mu\text{F}$, and $C_3 = 10 \mu\text{F}$. For $K$, $\lambda$, and $V_{TO}$ use the values measured in lab from the data taken from the Keysight curve tracer.

Verify the design with a 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 $-3 \text{ dB}$ frequencies. The SPICE parameters are $K$, $V_{TO}$, $\lambda$, $C_{GDO}$, 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.