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 $V^+ = +15$ V and $V^- = -15$ V. The parameters of the transistor are: $K$, $V_{TO}$, $C_{GDO} = 2.5 \text{nF/m}$, $C_{GSO} = 2.5 \text{nF/m}$, and $\lambda = 0.014 \text{V}^{-1}$. Pick $C_1 = C_2 = 0.22 \mu\text{F}$, and $C_3 = 10 \mu\text{F}$. 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 $K$ ($2K$), $V_{TO}$ ($V_{TO}$), $\lambda$ ($\lambda$), $C_{GDO}$ ($C_{GDO}$), and $C_{GSO}$ ($C_{GSO}$). If the version of SPICE used requires the width ($W$) and length ($L$) of the channel use 10 $\mu$m for each. Perform a transient analysis to determine the upper and lower clipping levels.