EEE210: Electronic Circuits and Devices

Lab #6: Common source with unbypassed source resistor amplifier

Experimental work: Use the N-channel enhancement type MOSFET 2N7000 or an equivalent. The pin out of the 2N7000 is presented in figure 1.

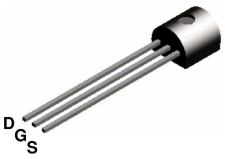

Figure 1:

1. Build the circuit of figure 2. Measure V_{GS} and V_{DS} using a DC voltmeter. Calculate I_D from those noting that:

$$I_D = \frac{V_{DD} - V_{DS}}{R_S + R_D}$$

where $V_{DD} = 20$ V, $R_S = 440\ \Omega$ and $R_D = 1.5$ kΩ. Before going any further, make sure that the MOSFET is biased in the active region.

2. Build the circuit of figure 3. Notice that you only have to add a few components to the circuit of figure 2. Adjust the function generator for $v_i(t)$ to be a 0-DC sinewave of frequency 1 kHz and peak-peak voltage of 1 V.

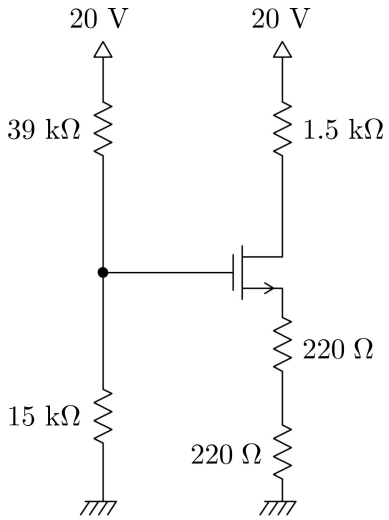

Figure 2:

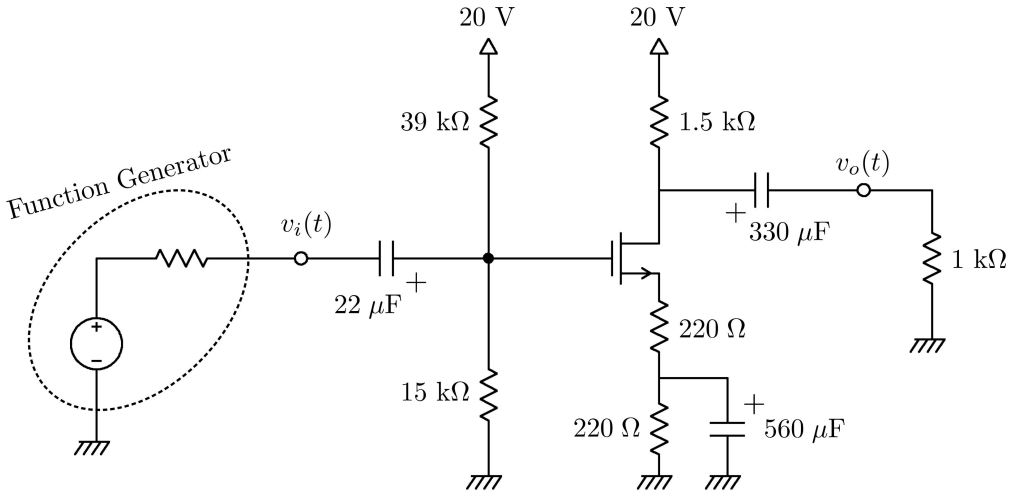

Figure 3:

3. Measure voltage gain

$$A_V = \frac{\text{peak-peak of } v_o(t)}{\text{peak-peak of } v_i(t)}$$

using the oscilloscope.

4. Build the circuit of figure 4 for the measurement of the output impedance Z_{out}. First set $R_L = \infty$ and measure the voltage gain

$$A_{V\infty} = \left.\frac{\text{peak-peak of } v_o(t)}{\text{peak-peak of } v_i(t)}\right|_{R_L=\infty}.$$

Slowly decrease R_L until the voltage gain drops to $A_{V\infty}/2$; the value of R_L is then equal to Z_{out}.

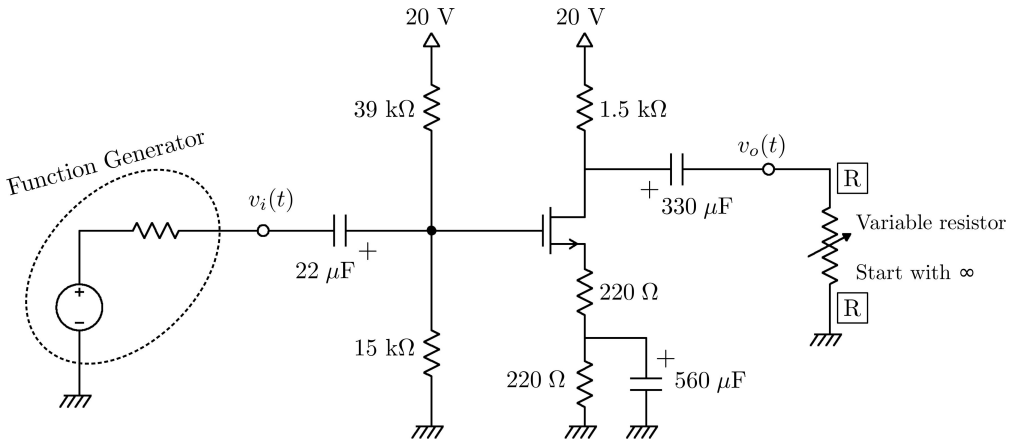

Figure 4:

5. Build the circuit of figure 5 for the measurement of the input impedance Z_{in}. First set $R_X = 0$ and measure $v_i(t)$ and $v_X(t)$ using the oscilloscope; you should have $v_X(t) = v_i(t)$. Slowly increase R_X until $v_X(t) = v_i(t)/2$; the value of R_X is then equal to Z_{in}.

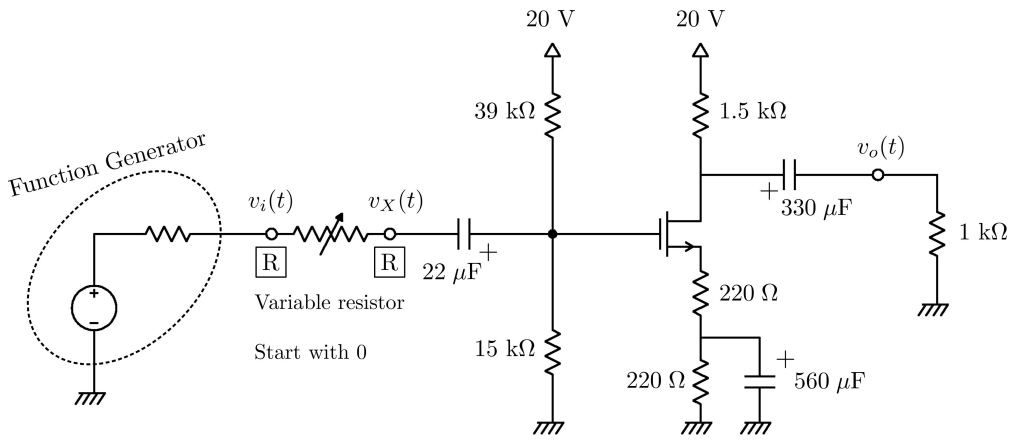

Figure 5:

Report:

1. Using $K = 48$ mA/V^2 and $V_t = 2.1$ V, calculate the Q-point of the MOSFET in the circuit of figure 3 and compare to the measured Q-point.

2. Calculate the voltage gain, the input impedance and the output impedance of the amplifier of figure 3. Compare to the measured values.