**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.

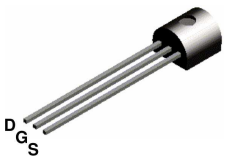


Figure 1:

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 $R_D = 1.5$ k$\Omega$. 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.

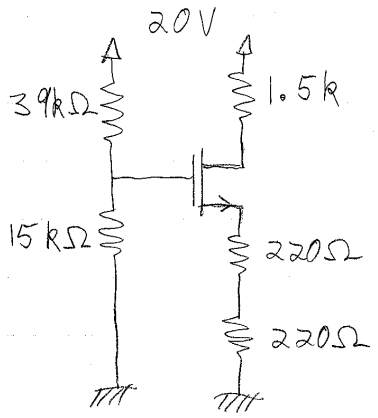


Figure 2:

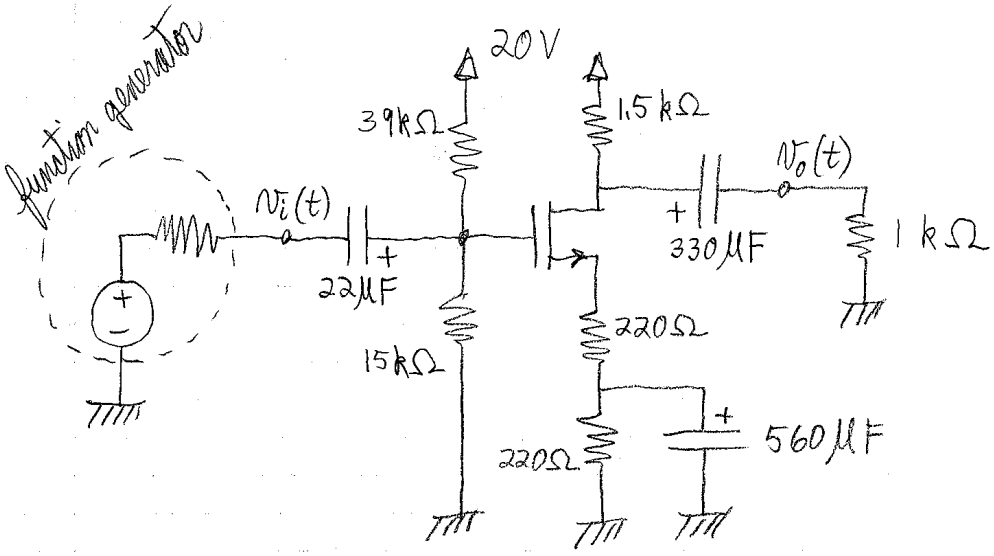


Figure 3:

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 $Z_{out}$.

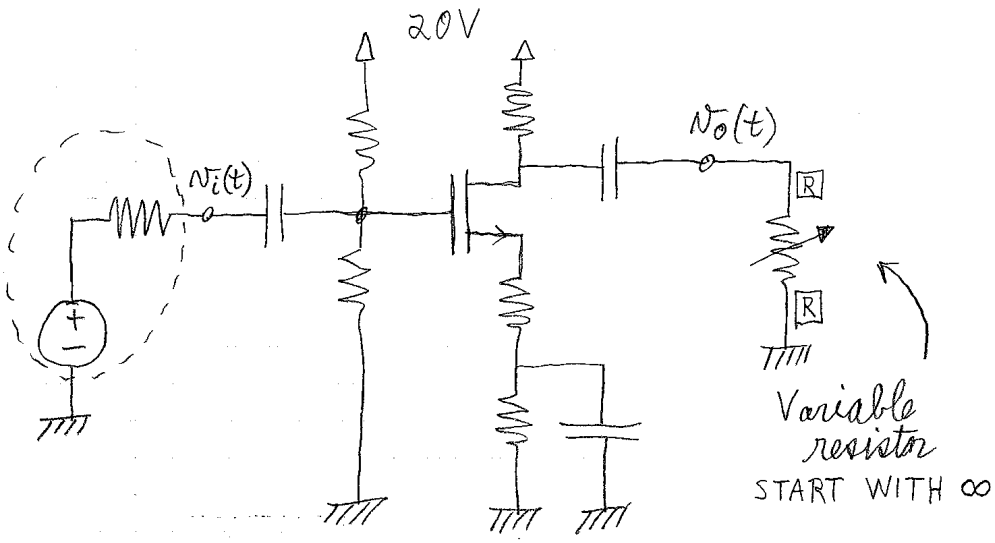


Figure 4:

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 $Z_{in}$.

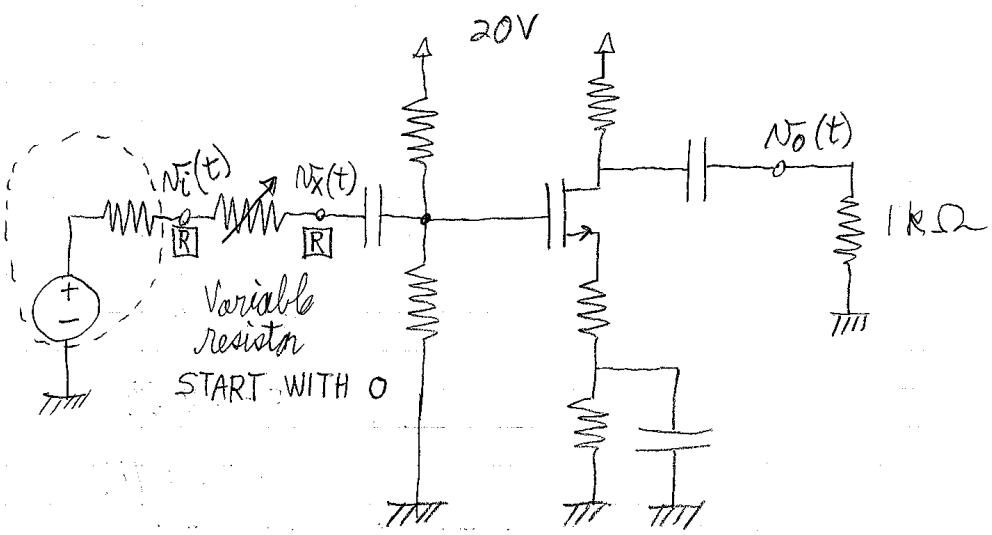


Figure 5:

**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.