EEE210: Electronic Circuits and Devices

Lab #8: Common emitter with unbypassed emitter resistor amplifier

Experimental work: Use the NPN transistor 2N3904 or an equivalent. The pin out of the 2N3904 is presented in figure 1.

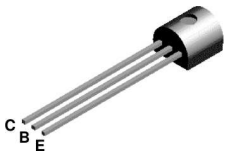

Figure 1:

1. Build the DC biasing circuit of the transistor in figure 2. Measure V_{BE} and V_{CE} using a DC voltmeter. Calculate I_C from those noting that when the transistor is active and $\beta \gg 1$:

$$I_C \approx \frac{V_A - V_{CE}}{R_C + R_E}$$

   where $V_A = 15$ V, $R_E = 291\ \Omega$ and $R_C = 1$ kΩ. Before going any further, make sure that the BJT is biased in the active region.

2. Complete the wiring of the circuit in figure 2. Adjust the `TMAX` simulation parameter to 1 μs using:

```
Simulate > Interactive Simulation Settings
```

   Adjust the function generator for $v_i(t)$ to be a 0-DC sinewave of frequency 10 kHz and peak-peak voltage of 400 mV.

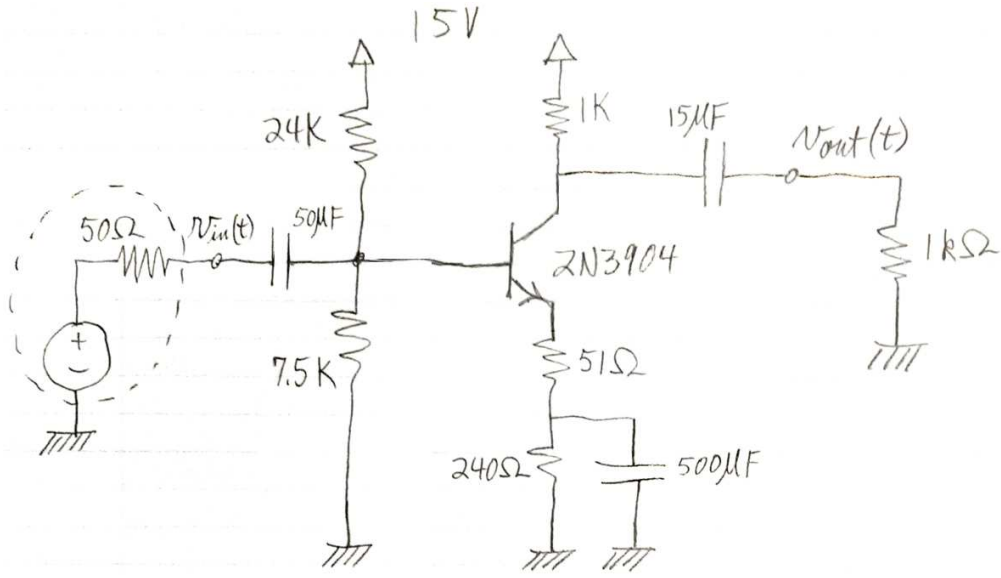

Figure 2:

3. Measure the voltage gain (refer to previous labs for the procedure).
4. Measure the output impedance (refer to previous labs for the procedure).
5. Measure the input impedance (refer to previous labs for the procedure).
6. Measure the input voltage swing using the $X - Y$ deflection mode `B/A` of the oscilloscope.

Report:

1. Using $\beta = 180$, calculate the Q-point of the BJT in the circuit of figure 2 and compare to the measured Q-point.
2. Using $h_{fe} = 180$, $h_{ie} = 1$ kΩ, calculate the voltage gain, the input impedance and the output impedance of the amplifier of figure 2. Compare to the measured values.
3. Calculate the voltage swing of the amplifier and compare to the measured values.