Common Emitter Amplifier

Equipment

1. Function Generator
2. Oscilloscope
3. DC Power Supply
4. Multimeter

Materials

1. 2N3904 NPN Transistor
2. 470 kΩ Resistor
3. 100 kΩ Resistor
4. 3.9 kΩ Resistor
5. 1 kΩ Resistor
6. 1 µF Capacitor
7. 10 µF Capacitor

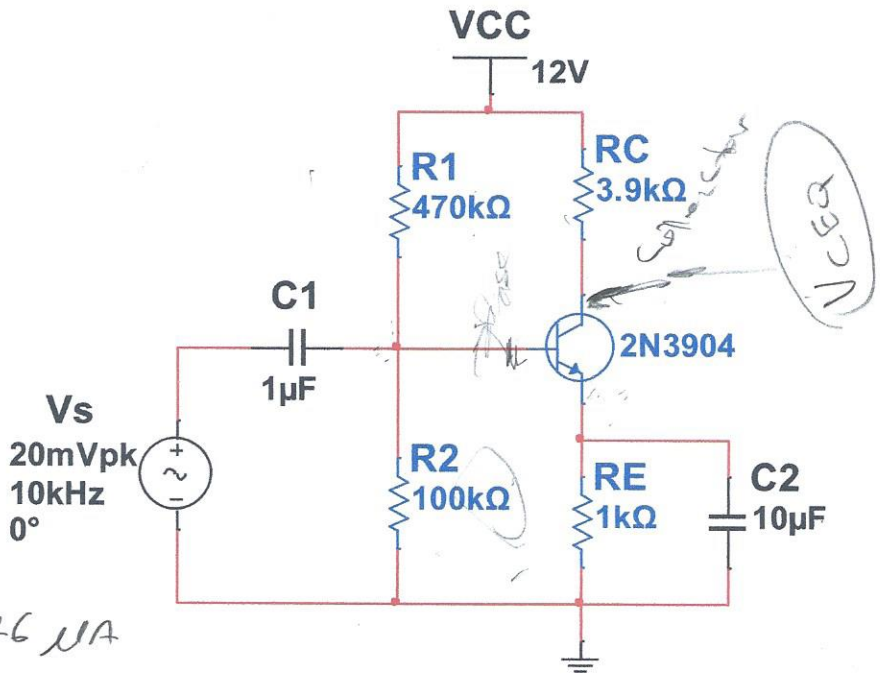

Figure 6 – 1

$I_B = 5.76\ \mu A$

$I_C = 0.9706\ mA$

$V_{CEQ} = 7.304\ V$

Procedure

1. Using the multimeter, measure the resistances of each resistor.

   R_1 = 468.24 kΩ R_2 = 0.9799 kΩ

   R_E = 97.40 kΩ R_C = 3.9099 kΩ

2. On a breadboard, construct the dc circuit shown in ***Figure 6-1*** (for now omit the capacitors and ac source).

3. Measure IB, ICQ and VCEQ of the circuit.

4. Setup the function generator to produce a sinusoidal signal with a high value of 20 mV and low value of -20 mV (do not use the peak-peak Amplitude option), set the frequency at 10 kHz, and an offset value of 0. Add the ac portion to the circuit (capacitors and ac signal).

5. Use ***Channel 1*** of the oscilloscope to measure V_{in} minimum and maximum voltages. Use ***Channel 2*** to measure the minimum and maximum output voltages, V_{out} (V_c).

6. **Take a screenshot including measurements in the following order: (top)** ***Channel 1*** **Min,** ***Channel 1*** **Max,** ***Channel 2*** **Min,** ***Channel 2*** **Max.**
   Question 1: Compare the Vin and Vout signals. How are they different?
   Question 2: What is the measured gain of this circuit?
   Question 3: What is β_{DC} of this circuit using measured currents?
   Question 4: What is the internal emitter resistance, r'_e?

$r'_e = \frac{26mV}{I_C}$ 3: $\frac{I_C}{I_B}$

Submittal: All sections must be completed digitally. (Not hand-written/drawn)

1. **Lab Cover Sheet** (filled in appropriately)
2. **Title Page** (Appropriate information is described in the 'Format of a Technical Report' found on Blackboard)
3. **OBJECTIVE** – This section is in paragraph form comprised of complete sentences stating the purposes for doing the experiment. (What theory was this experiment supposed to verify?)
4. **DATA** section including:
   a. **Circuit**
   b. **Calculations:** Theoretical values for I_{CQ}, V_{CEQ}, r'_e, A_V and V_{out} (use $\beta_{DC} = 130$)
   c. **Screenshots (1)**
   d. **Table 6-1:** This table should include measured and calculated values of all the parameters listed in **step b**. above.
   e. **Answers to the Questions 1 through 4 in Step 6**.
5. **DISCUSSION** – This section is in paragraph form comprised of complete sentences stating specific examples of comparisons of theoretical values to actual/measured values. This need not include a direct comparison of every parameter.
6. **CONCLUSION** – This section is in paragraph form comprised of complete sentences stating whether or not the experiment was successful, how did the student know it was successful, and how successful it was (% error).

Hint: For a successful submittal, make sure your submittal components are presented in the above order. This makes organized and logical sense for an explanation of data. Be sure headings are stated (for example: **DATA**) and all components of the **DATA** section (for example: **TABLE 6-1, CALCULATIONS, Screenshot**) are labeled.