VE311 Electronic Circuit Lab 2 Manual

Due: **Jun 22th 11:59 a.m.**

1 Object

In this lab, you are supposed to have better understanding towards BJT. In this lab, a common-emitter amplifier should be designed by your own and the early effect will also be discussed. The BJT used is 2N3904. You could find the data-sheet of 2N3904 in Canvas.

2 Exercise

2.1 The Early Effect

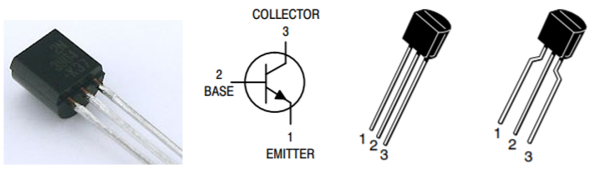

Figure 1: 2N3904 NPN BJT

The figure 1 shows the basic structure of 2N3904 BJT. Build the circuit shown below to measure the early voltage V_A.

1. Build the circuit shown below.

2. Choose $V_{BE} = 0.7V$, change your V_{CE} from 1.2V to 5V and measure the i_C, record the vlaue in the table 1.

3. Choose another V_{BE}, repeat the step above and record the i_C.
   (note: please confirm your value with TA)

4. Plot the table 1 and trying to find the Early voltage V_A

	V_{CE1}	V_{CE2}	V_{CE3}	V_{CE4}	V_{CE5}	V_{CE6}
$V_{BE} =$						
$V_{BE} =$						

Table 1: Measured i_C

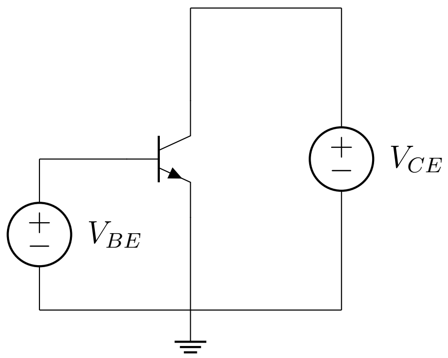

Figure 2: BJT Early Effect Voltage Measurement Circuit

2.2 The Common-Emitter Amplifier

Build the voltage regulator below in Proteus and on the breadboard.

1. Design and build a common-emitter amplifier in Proteus and on the breadboard which has a voltage gain Av $>$ 10, using npn BJT 2N3904. Plot V_{OUT} vs V_{IN}. You could just take $v_{in} = 0$ here. (Hint: First choose an appropriate R_C. Second, perform DC sweep to find out a V_{IN} at which the magnitude of slope is more than 10. At the same time, make sure the BJT is in the forward-active region. If not working, change for another R_C and repeat the DC sweep analysis again.)

2. For $V_{in} = V_{IN} + 0.01\sin(2\pi{\cdot}10^2{\cdot}$ time), plot $V_{out} = V_{OUT} + v_{out}$ vs time. Confirm that the amplitude of v_{out} is equal to $0.01{\times}A_V$.

3. For $V_{in} = V_{IN} + 0.01\sin(2\pi{\cdot}2\cdot 10^6{\cdot}$ time), plot $V_{out} = V_{OUT} + v_{out}$ vs time.Is the amplitude of v_{out} still equal to $0.01{\times}A_V$? If not, explain the possible reasons.

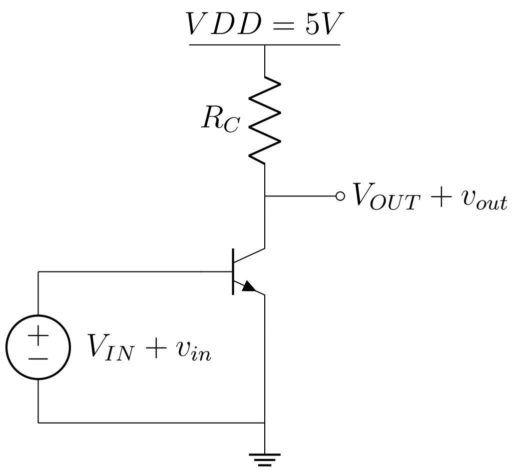

Figure 3: The Common-Emitter Amplifier Circuit

3 Deliverable

- Lab Attendance [10%]

Students are required to attend the lab. Any unexcused absence will result in a grade of zero for the missed lab and the student has the responsibility of contacting the instructor or TA in advance.

- Lab Demonstration [2*10%]

  Students should successfully demonstrate a working circuit of each exercise to TA before their lab session ends or come to the free lab session and send the demonstration video to TA.

- Lab Report [70%]

  A lab report should include objectives, Experimental results (numerical results, figures), Simulation results (also the Proteus file), Error analysis, discussion, and Conclusion. Everyone needs to submit the Proteus file and report individually.