Ain Shams University
Faculty of Engineering
Mechatronics Eng.

Undergraduate
Electronic Circuits
Spring 2018

ECE 334: Electronic Circuits

LAB 3 – BJT Amplifier

Supervised by: Dr. Maged Ghoneima

1.0 OBJECTIVES

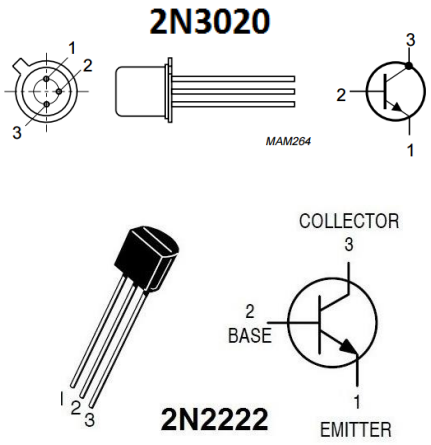
The objective of this lab is to study and characterize BJT amplifier in Common Emitter (CE) configuration. Upon finishing this lab, students should know how to:

1) Measure the voltage gain (Av = Vo / Vi) of the amplifier.
2) Appreciate the effect of shunt capacitor in emitter circuit on amplifier voltage gain.

2.0 REQUIRMENTS

To proceed with this lab, the following components are required:

- Resistor: 1.2 KΩ (2x).
- Resistor: 10 KΩ (1x).
- Resistor: 14.8 K Ω (1x).
- Capacitor: 47 uF (3x)
- BJT NPN: 2N2222 (1x) or 2N3020 (1x).
- Test Board (1x).
- Avometer (2x).
- Wires & crocodile-wiring.



3.0 INTRODUCTION

The common emitter circuit topology is given below:

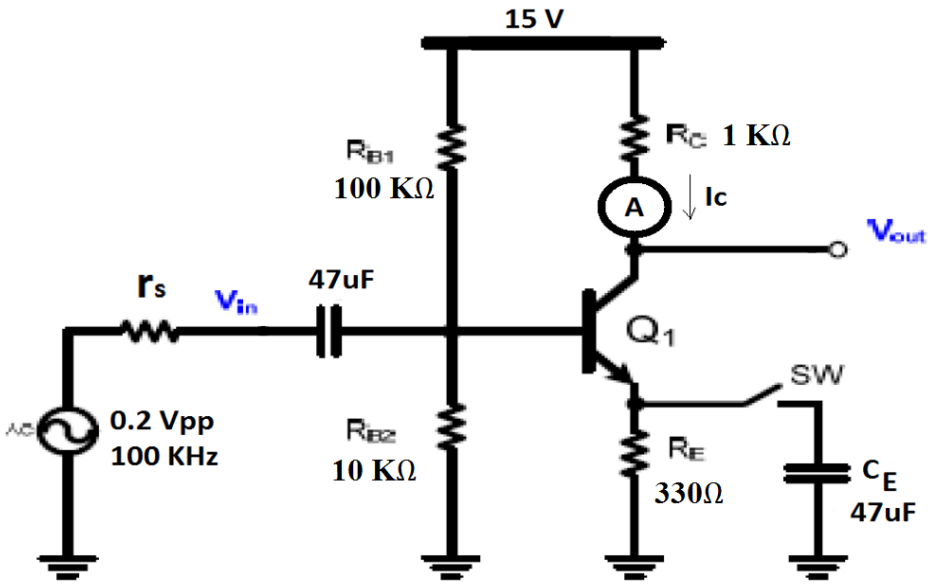


Figure 1: BJT amplifier in common emitter configuration.

After studying BJTs as amplifier, one can easily conclude that the above circuit configuration if common emitter. The symbol A at collector node is an ammeter used to measure the collector current.

During this experiment procedure, students will connect/disconnect the capacitor C_E & calculate the amplifier gain Av. The deduced gain expressions should agree with the following expressions:

Av (with C_E) ≈ - g_m Rc = $\frac{-\beta R_C}{r_\pi}$

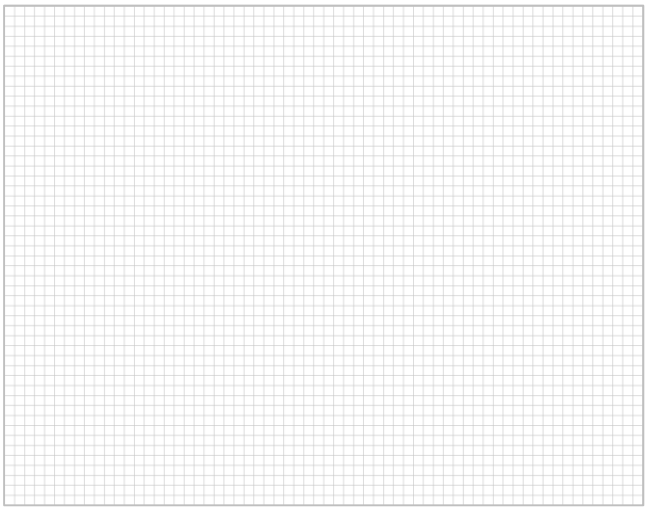
Av (without C_E) = $\frac{-\beta R_C}{r_\pi + (\beta+1)R_E}$

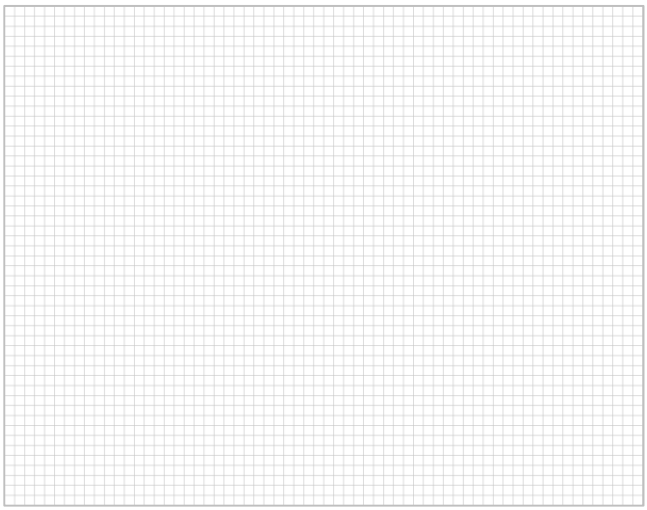
4.0 EXPERIMENT PROCEDURE

Follow these steps to complete the lab:

- Step 1:
  - Construct the circuit as in figure 1 on your board <u>without</u> using the capacitor C_E.
  - Use minimum number of wiring & jumpers.
- Step 2:
  - Make sure the transistor is operating in the forward active mode by measuring the transistor Q-point (V_{CE} & Ic). V_{CE} = ……. Volt, Ic = …… mA .
- Step 3:
  - Set the function generator to 0.2 V_{PP} at 100 KHz.
  - Measure this signal on an oscilloscope to make sure it is correct.
- Step 4:
  - Use both **channel 1** & **channel 2** on the oscilloscope to measure the input & output signal simultaneously.
  - You might see the output signal clipped as the amplifier gain is very large. The output signal will force the BJT to enter either cutoff region or saturation region.
  - Sketch the Input & Output waveforms, & calculate the gain = Vo/ Vi = …… .

- Step 5:
  - Connect the capacitor C_E then the Input & Output waveforms:





  - Calculate the gain:

    Av = Vo/ Vi = …….. .
- Step 6:
  - Comment on you results below:

    ……..
    ……..
    ……..

5.0 Report (Assignment)

Use any circuit simulator (Example: Multisim) & construct the above circuit, then do the following procedure:

1) Construct the circuit as shown in figure 1 on your simulator, then put a screen shot in your report.
2) Set the input signal to 1 mV_{Peak}.
3) Plot the input & output signal when the capacitor C_E is **disconnected**, then put a screen shot with this plot. Calculate the gain Av = Vo / Vi. (You should show the signal magnitude clearly on you report)
4) Plot the input & output signal while **connecting** the capacitor C_E, then put a screen shot with this plot. Calculate the gain Av = Vo / Vi in this case.
5) Compare your simulated results with the lab results.

Note: Reports without cover pages or neat plots will not be marked.

Copied reports will take ZERO MARKs for both students.

Student Sheet:

	Student Name	Group Number	Experiment Mark
1			
2			
3			
4			
5			
6			

ECE334 – Electronic Circuits (Lab 1: BJT Amplifier)

Instructor Sheet

	Student Name	Group Number	Experiment Mark
1			
2			
3			
4			
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