الجامعة الألمانية الأردنية
German Jordanian University

Electronics 1 Lab (CME 2410)

School of Informatics & Computing
German Jordanian University

Laboratory Experiment (8)

The Bipolar Junction Transistor (BJT)
AC Amplifier

1. Objective:

1. Verify the operation modalities and the characteristics of various BJT amplifier configurations.
2. Analyze which factors influence the gain.

2. Equipment & Instruments

Module No. : DL 3155E14

2 Digital Multimeters.

Function Generator.

Oscilloscope.

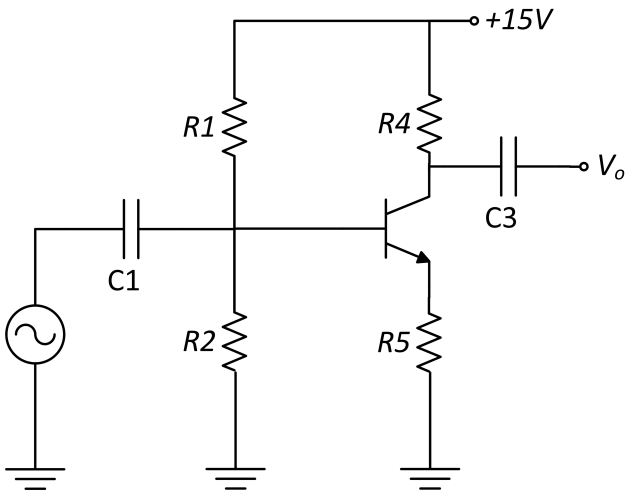
3. Components List:

R1 = 120kΩ, R2=10kΩ, R4=15kΩ, R5=1kΩ, R6=15kΩ, C1=47μF, C3=10μF, V1=2N2219A.

Experiment Part 1 (Using the Kit)

4. Procedure

1) Connect the circuit as shown:



2) Connect an oscilloscope to observe the input to the common-emitter amplifier (base of the transistor) and the output of the amplifier.

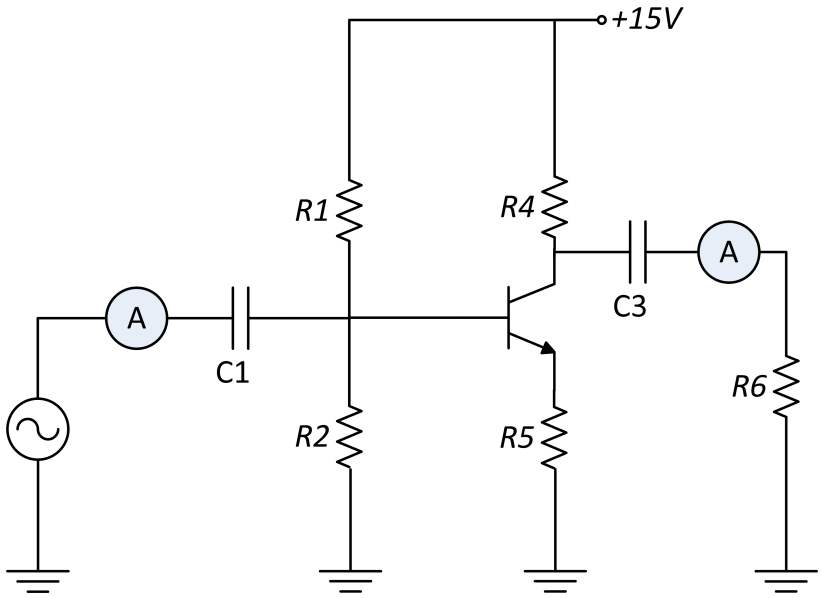
3) Adjust the output of the signal generator to a sinusoidal voltage of 1V peak-to-peak, 10kHz at the input of the common-emitter circuit.

4) Observe and draw the output signal. Compare with the input signal.

5) Measure the peak-to-peak output voltage and gain of the amplifier.

6) Connect load resistance R6 to the output and measure the output signal. Compare with the input signal and previous output signal (without R6) in terms of peak-to-peak voltage and gain.

7) Connect another circuit as shown:



8) Adjust the signal generator to 1V peak-to-peak, 1kHz.

9) Measure the input and output currents and calculate the current gain.

10) Calculate input power and output power from the measured voltages and currents. Then calculate the power gain. Compare this gain with the product of the power and current gains.

11) Reconnect the 1st circuit with load resistance R6, and signal generator at 1kHz.

12) Measure with a multimeter the voltage across R2. Divide this by the measure input current to obtain the input resistance of the amplifier. Compare this with the calculated value $R_{in} = (r_b^{'} + \beta R5) \,||\, R1 \,||\, R2$ where $\beta = 100$, $r_b^{'} = 5.1k\Omega$

13) Calculate the gain as:

$$A_v = \frac{R4 \,||\, R6}{R5 + r_b^{'} / \beta}$$

14) Compare with the measured value

15) Calculate the measure output resistance as:

$$R_{out} = \frac{V_{o(withoutR6)} - V_{o(withR6)}}{V_{o(withR6)}} \bullet R6$$

Explain how this equation is derived and compare result with calculated R_{out}=R4

Modification M1 (Changes R1 from 120k to 10k)

16) Adjust the output of the function generator to 1Vpp, 10kHz.

17) Set the 1st dipswitch M1 to ON position (covered dot) and observe the output.

18) Increase the amplitude of the input signal and observe the output. Explain what is happening.

19) Set M1 back to the OFF position.

Modification M2 (Changes R4 from 15k to 2.7k)

20) Set the amplitude of the input signal to 1Vpp.

21) Set the 2nd dipswitch M2 to ON position (covered dot) and observe the output.

22) Remove and put again the load R6 and observe the output.

23) Set M2 back to the OFF position.

Modification M3 (Changes R2 from 10k to 3.3k)

24) Set the 3rd dipswitch M3 to ON position (covered dot) and observe the output.

25) Observe the signal at the various test points in the circuit.

26) Set M3 back to the OFF position.

Experiment Part 2 (Using the breadboard)

1. Design a common emitter amplifier with a gain of 20.
2. Build it using the individual components on the breadboard.
3. insert an input signal and measure the output to check your amplifier.