

EXPERIMENT 7: BJT AMPLIFIER

Objectives

The objective of this experiment is to obtain and learn the gain characteristic of BJT amplifier circuits practically.

Components Required:

DC Voltage Source

AC Voltage Source

Oscilloscope

Multimeter

Transistor: BC237

Resistors: 220k Ω , 1k Ω , 10k Ω , 33k Ω , 1.2k Ω , 20k Ω

Capacitor: 4.7 μ F (x2), 220 μ F

Preliminary Work:

1. Set up the circuit given in Figure 1 in ORCAD. Use BC237 transistor model.
 - a. Analyze the circuit given in Figure 1 and find I_B , I_C , and V_{CE} . ($\beta_{DC} = 300$)
 - b. Simulate the same circuit in OrCAD. Label base, emitter, and collector terminals of the transistor as B, E, and C, respectively. Perform DC simulation and provide the screenshot of the results. (Use 'Bias Point' analysis)
 - c. Do your simulation results justify the answers in part (a)? (I_B , I_C , and V_{CE})
 - d. Determine in which region the transistor operates.
2. Set up the circuit given in Figure 1 in OrCAD. Use the BC237 transistor model.
 - a. Find frequency response of the BC237 Transistor in ORCAD. Use AC Voltage Source for the input signal. Run AC simulation from 5 Hz to 10 MHz (10 MEG). Plot the AC voltage gain (V_o / V_s). Label the midband frequency gain (in dB) and low and high corner frequencies (the 3-dB frequencies) in the plot before importing it to your homework. What is the midband voltage gain as a ratio (not in dB)?
 - b. Change the input signal with a sinusoidal voltage source that has 220mV V_{pp} at 1kHz. Run transient simulation. Plot the input and output signals. What is the gain based on the transient simulation? Does it agree with the AC gain in part (a)?
3. Set up the circuits given in Figure 1 in TincerCAD and add the results to the report.

Experimental :

- Setup the circuit given in Figure 1 using the BC237 transistor.
 - Set the supply voltage to 20V.
 - Apply a sine wave to the input at a frequency of 1 kHz and Vpp value is 240 mV. Connect the first channel of the oscilloscope to the signal generator (V_s) and the second channel to the output (V_o) of the circuit.
 - Measure the DC node voltages of collector, base, and emitter and write down the measured voltage values (I_C , V_C , V_B & V_E) to Table 1.
 - Calculate the value of V_o/V_s .
- Find the cut-off (corner) frequency points of the BC237 transistor by changing the frequency values of the input signal according to Table 2. Fill in Table 2 according to the values you obtained.

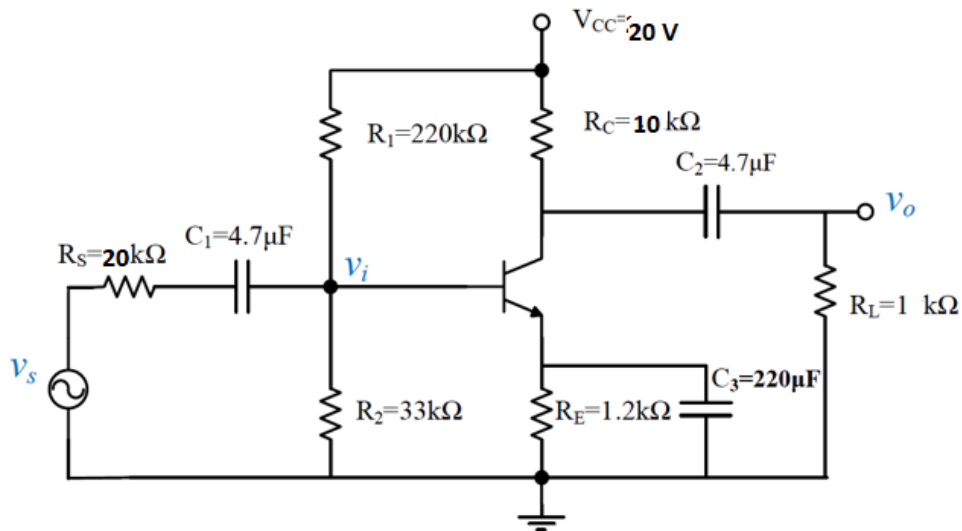


Figure 1

Table 1: DC Values

	Theoretical values	Measured values
V_C		
V_B		
V_E		
I_C		

Table 2 : Frequency Response of the BC237 Transistor

FREQUENCY (f)	V_o	V_o/V_s
5 Hz		
18 Hz		
40 Hz		
60 Hz		
500 Hz		
1 kHz		
5 kHz		
10 kHz		
50 kHz		
100 kHz		
170 kHz		
250 kHz		
500 kHz		