

Lab-5 Analog Circuits

Bipolar Junction Transistor (BJT): Experiment List

In this session you will perform BJT based practical using components and equipments mentioned below. Based on the class lecture and 3rd lab, perform the following exercises. In your lab-book, remember to write your steps/methods, and the observations/results. The TA's shall sign and grade at the end of each lab. Discuss with your group mates. If you have any difficulty, you may consult TAs.

Components required:

1. BJT BC547
2. Electrolytic Capacitor 10 μF , 100 μF .
3. Resistor 1K Ω , 100K Ω , 20K Ω , 5.6K Ω , 330 Ω .

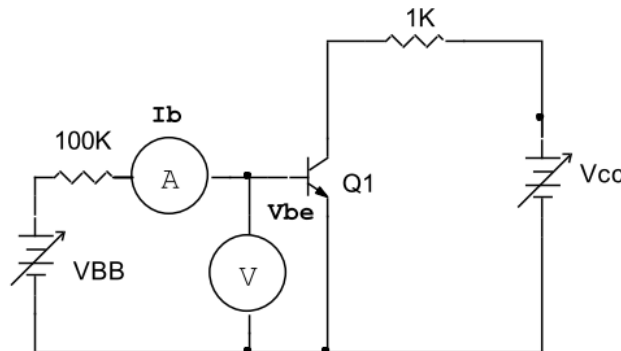
Equipments required:

1. Function generator
2. Oscilloscope
3. Multimeter
4. DC power supply
5. Breadboard

First, test the BJT using digital multimeter.

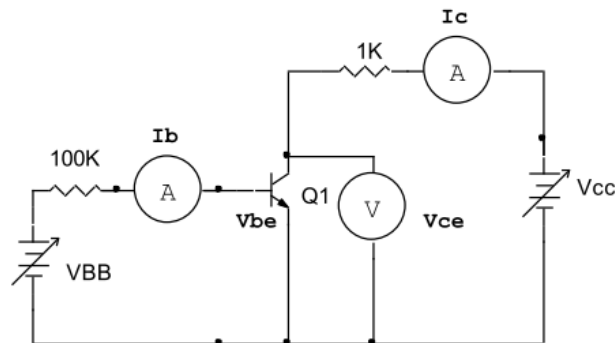
1. Simulate a BJT circuit to get the input and output characteristics curves.

(A) Circuit setup for input characteristics:



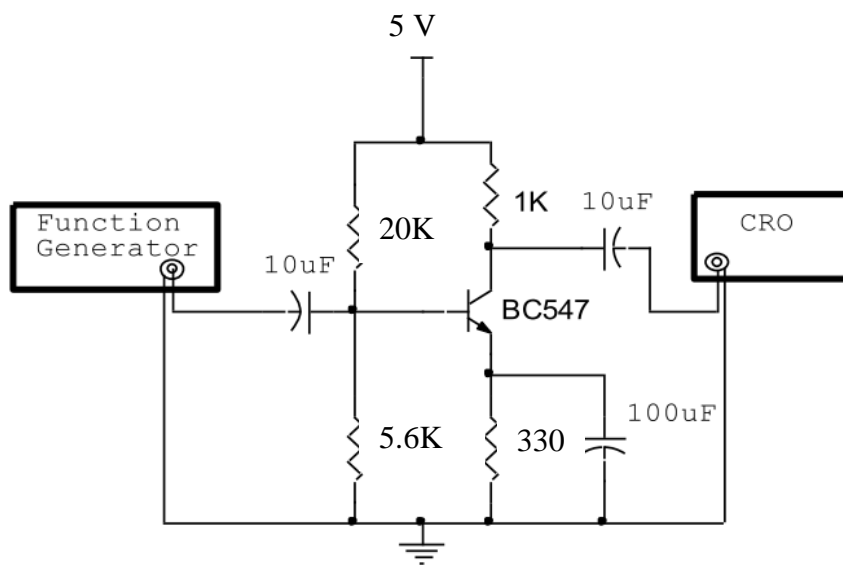
1. Hook up the circuit as shown in the figure above.
2. Keep V_{CC} fix at 0V (Or do not connect V_{CC})
3. Increase V_{BB} from 0V to 20V, note down readings of base current I_b and base to emitter voltage V_{be} in the observation table.
4. Repeat above procedure for $V_{CC} = +5V$ and $V_{CC} = +10V$
5. Draw input characteristics curve. Plot V_{be} on X axis and I_b on Y axis.

(B) Circuit setup for output characteristics:



1. Connect circuit as shown in the circuit diagram.
2. Keep base current fix (Initially 0)
3. Increase V_{CC} from 0V to 20V, note down readings of collector current I_c and collector to emitter voltage V_{ce} in the observation table.
4. Repeat above procedure for base currents $I_b = 5\mu A, 50\mu A, 100\mu A$. Increase base current by increasing V_{BB} .
5. Draw output characteristics curve. Plot V_{ce} on X axis and I_c on Y axis.

2. Built a BJT amplifier.



Common emitter (CE) amplifier

1. Connect function generator at the input of the amplifier circuit.
2. Set input voltage 10 mV and frequency 100 Hz.
3. Connect CRO at the output of the amplifier circuit.
4. Observe amplified signal and measure output voltage.
5. Increase frequency from the function generator and repeat above steps.

(A) What will be the emitter current in the given circuit diagram in absence of input AC signal?

(B) What happens if emitter bypass capacitor is removed from the circuit?

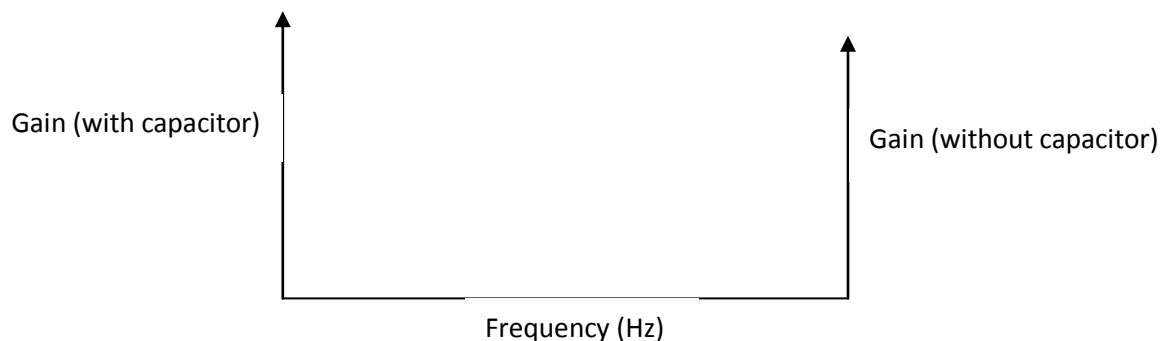
(C) Note down the readings of output voltage in the observation table for frequency range from 10 Hz to 10 MHz. Measure the gain of the amplifier at different frequencies and plot frequency response. Make freq response plot with emitter resistor covered with capacitor and uncovered (emitter degenerated) both. Comment your observation.

To plot frequency characteristic one good way to measure gain is, 1-2-5 points in each decade.

10-20-50 Hz
 100-200-500 Hz
 1-2-5 KHz
 10-20-50 KHz
 100-200-500 KHz
 1-2-5 Mhz

Find 3 dB cutoff points and write down measured bandwidth.

Both the plots for gain vs frequency (with emitter resistor covered with capacitor and uncovered) should appear as under:



(D) What is the effect on gain of amplifier if value of R_c increases?