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BECE101P_SLOT-L5+L6_EXPERIMENT – 07

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Input and Output characteristics of BJT in Common Emitter

AIM: To study the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CE) configuration using LT Spice.

SOFTWARE REQUIRED: LT-Spice

Apparatus required: NPN Transistor-1, Resistor-2, Voltage source-2, wires and grounding.

THEORY:

BJT

Bipolar Junction Transistor

A bipolar junction transistor is a single component made of silicon where both electrons and holes are used as charge carriers. A bipolar junction transistor lets a small current be injected at one of its terminals to control large amounts of current flowing between the other two terminals. This makes the device capable of performing switching or amplification.

Bipolar junction transistor is of two types:

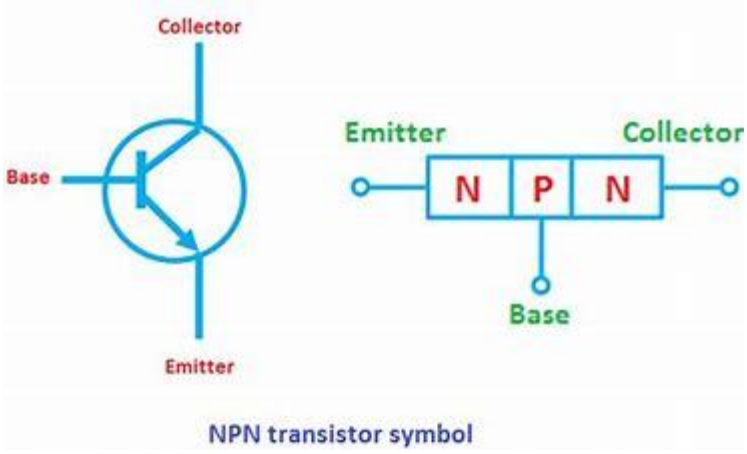
- PNP transistors
- NPN transistors

This bipolar PNP junction transistor is formed with three layers of semiconductor material, with two P-type regions sandwiched between one N-type region.

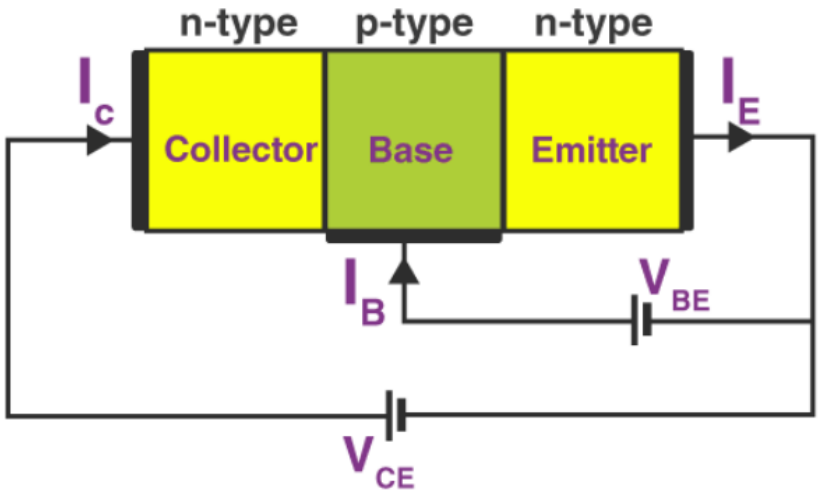
NPN Transistor

The NPN transistor consists of two n-type semiconductors that sandwich a p-type semiconductor. Here, electrons are the majority charge carriers, while holes are the minority charge carriers.

Below is the figure of the NPN Transistor



Working of NPN Transistor



When the emitter-base junction is forward biased, a small voltage VBE is seen. Reverse bias voltage VCE. Due to the forward bias, the majority charge carriers in the emitter are repelled towards the base. The electron-hole recombination is very small in the base region since the base is lightly doped. Most of the electrons cross into the collector region.

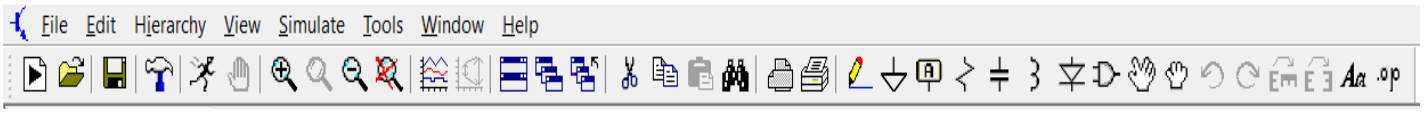
When the emitter is forward biased, electrons move towards the base and create the emitter current IE. Here, the majority charge carriers in the P-type material combine with the holes.

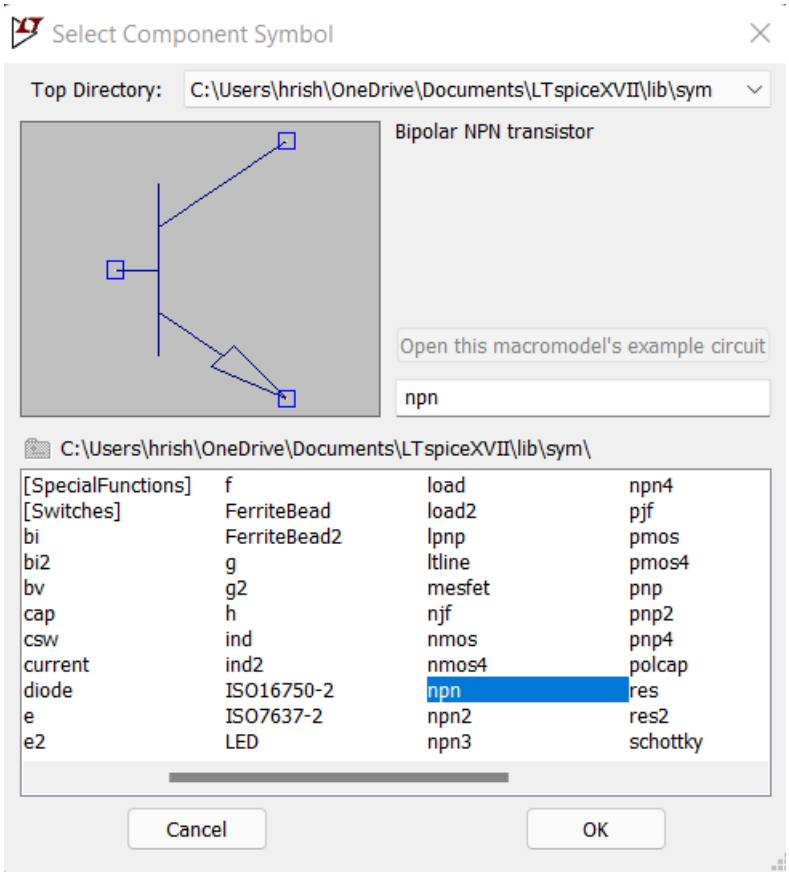
Since the base of the NPN transistor is lightly doped, it lets only a few electrons to combine and the remaining current is known as the base current IB. When the collector region is reverse biased, it applies a greater force on the electrons reaching the collector junction and hence attracts the electrons at the collector.

PROCEDURE

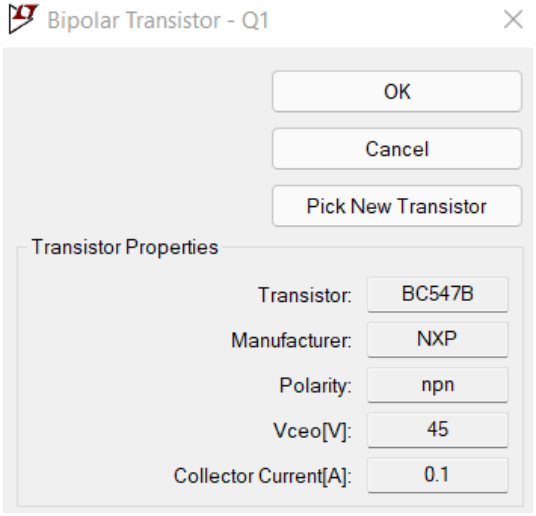
INPUT CHARACTERISTICS OF BJT IN CE

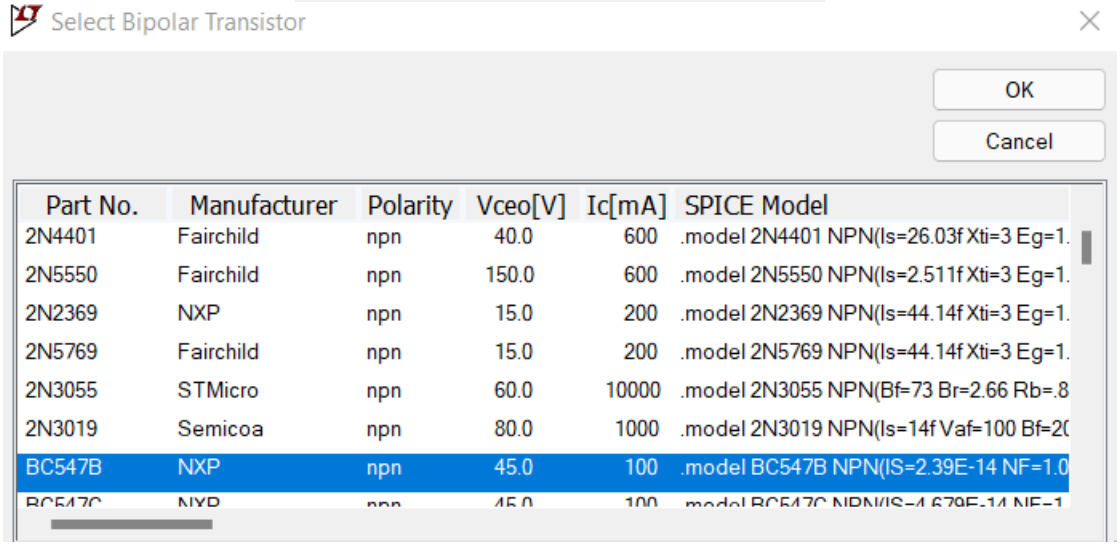
1. Click the component library symbol from the toolbar and select the NPN Transistor from the component library.



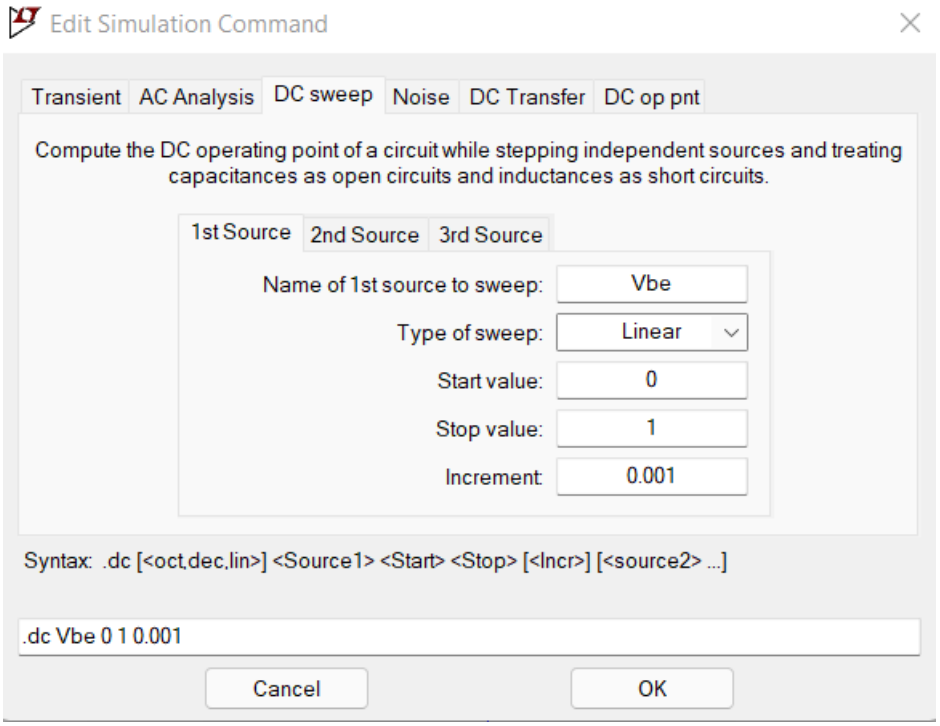


2. Now, right the NPN Transistor and click ‘pick new transistor’ choose the one as shown below.





3. Draw resistors R1(62K ohm) and R2(2K ohm), also put voltage source and rename them as Vbe (0 V) and Vce (1 V) by right click on the voltage sources.
4. Using label name Ic and put the label on the point as shown in the circuit.
5. Also, add grounding to circuit and make the circuit exactly as in the circuit diagram shown later.
6. Now, under run→ edit simulation command→ DC sweep give the setting as shown below in the image.



7. Now under run menu click on the 'Run' option.
8. Left click on the R1 resistor to see the Input V-I graph.

OUTPUT CHARACTERISTICS OF BJT IN CE

1. Now, we will modify the circuit that we just made for input characteristics.
2. Right click the Vbe and Vce and give them the values 600mV and 0V respectively.
3. Rest everything, the resistors and their values, the NPN Transistor and all the connection in the circuit remain the same.
4. Now, under run→ edit simulation command→ Under 1st source give the settings as shown below, then go under 2nd source and give the settings as shown below and click OK.

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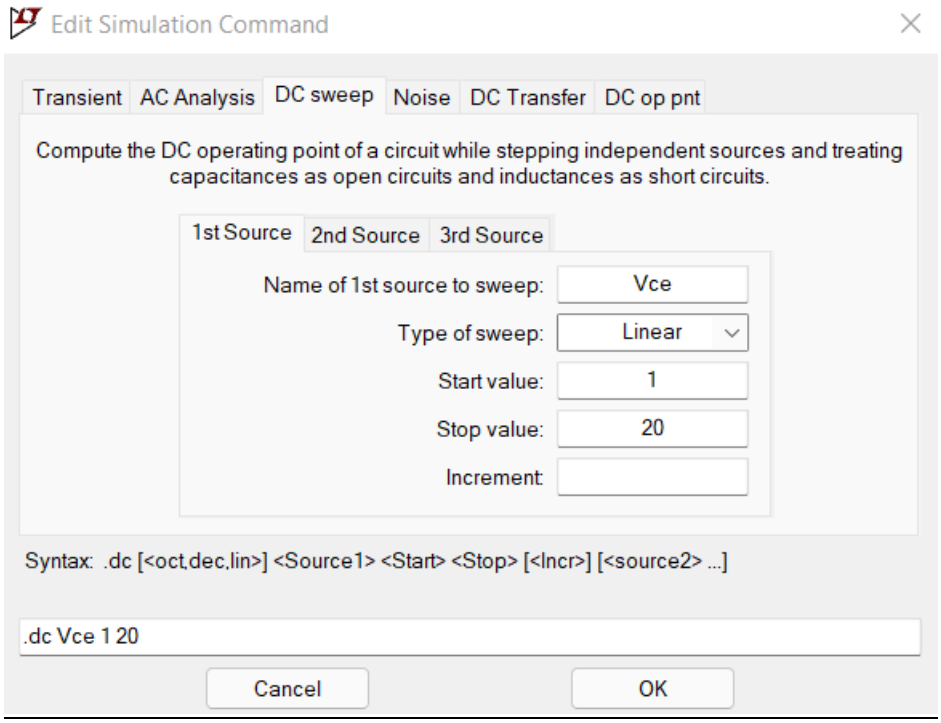
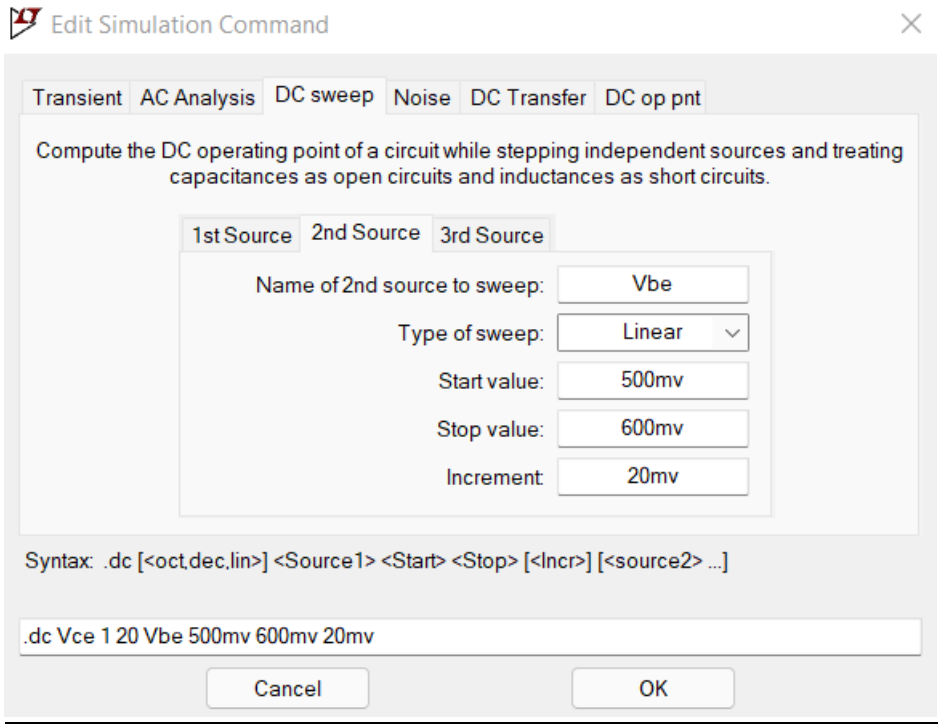
V





5. Now, click the ‘Run’ button under simulate tab.
6. Click the R1 resistor to get output V-I graph.

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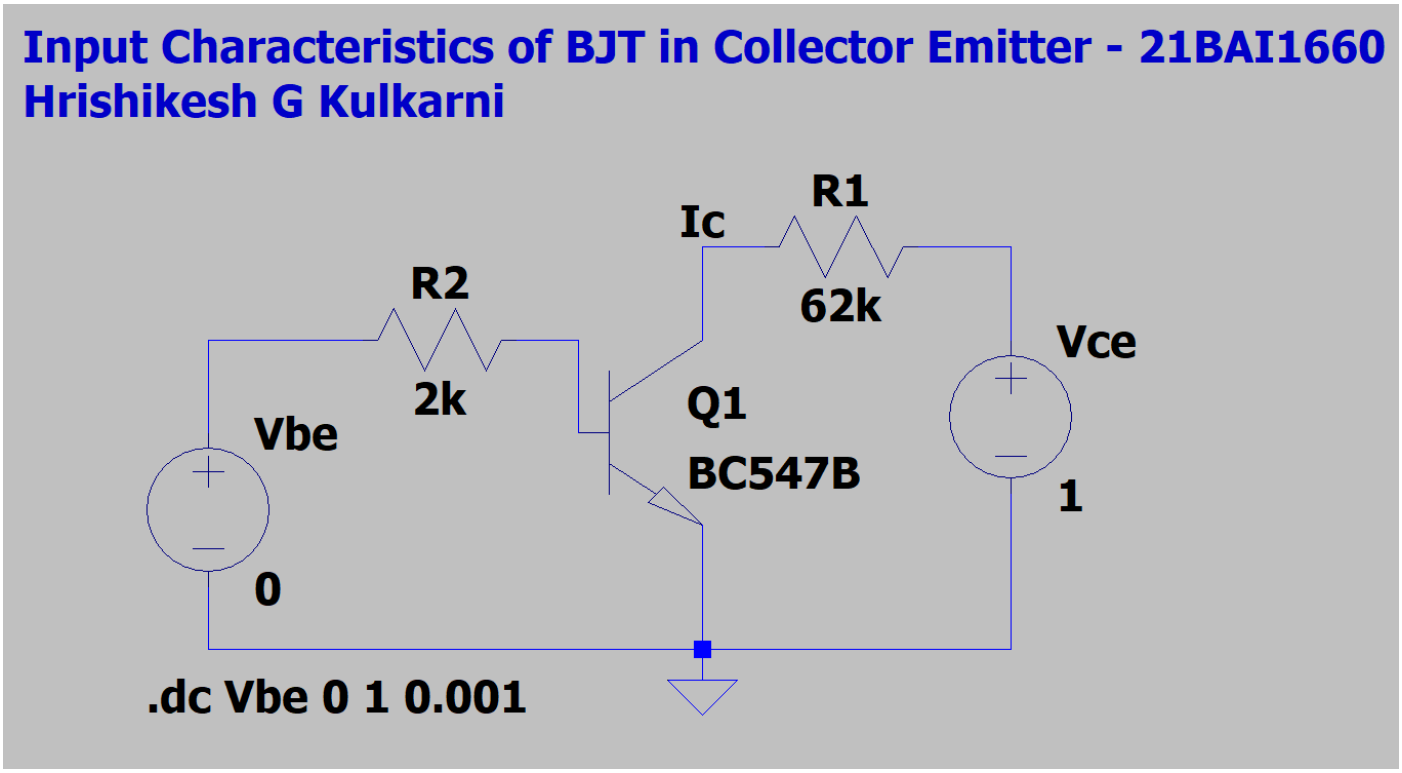
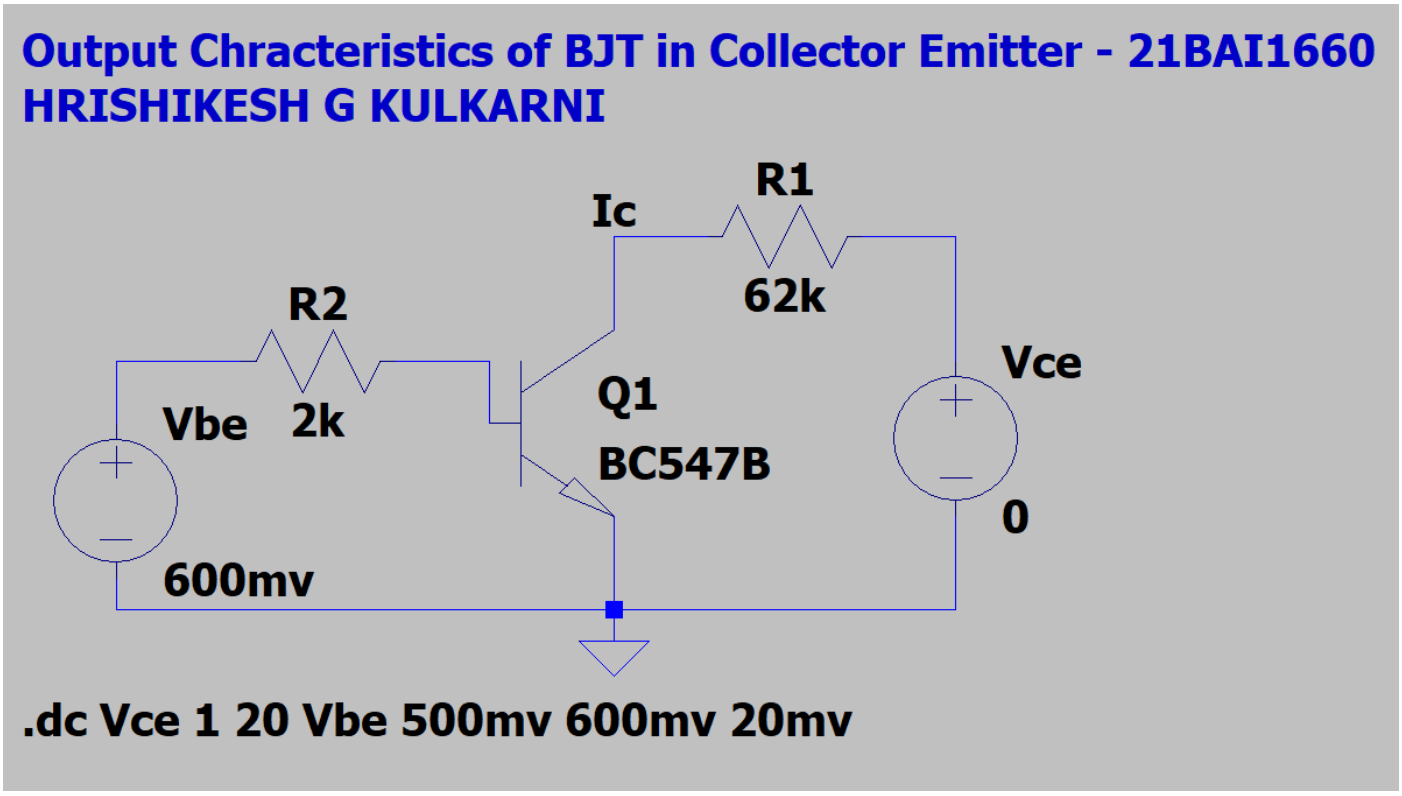
V

CIRCUIT DIAGRAMS

INPUT CHARACTERISTICS OF BJT IN CE

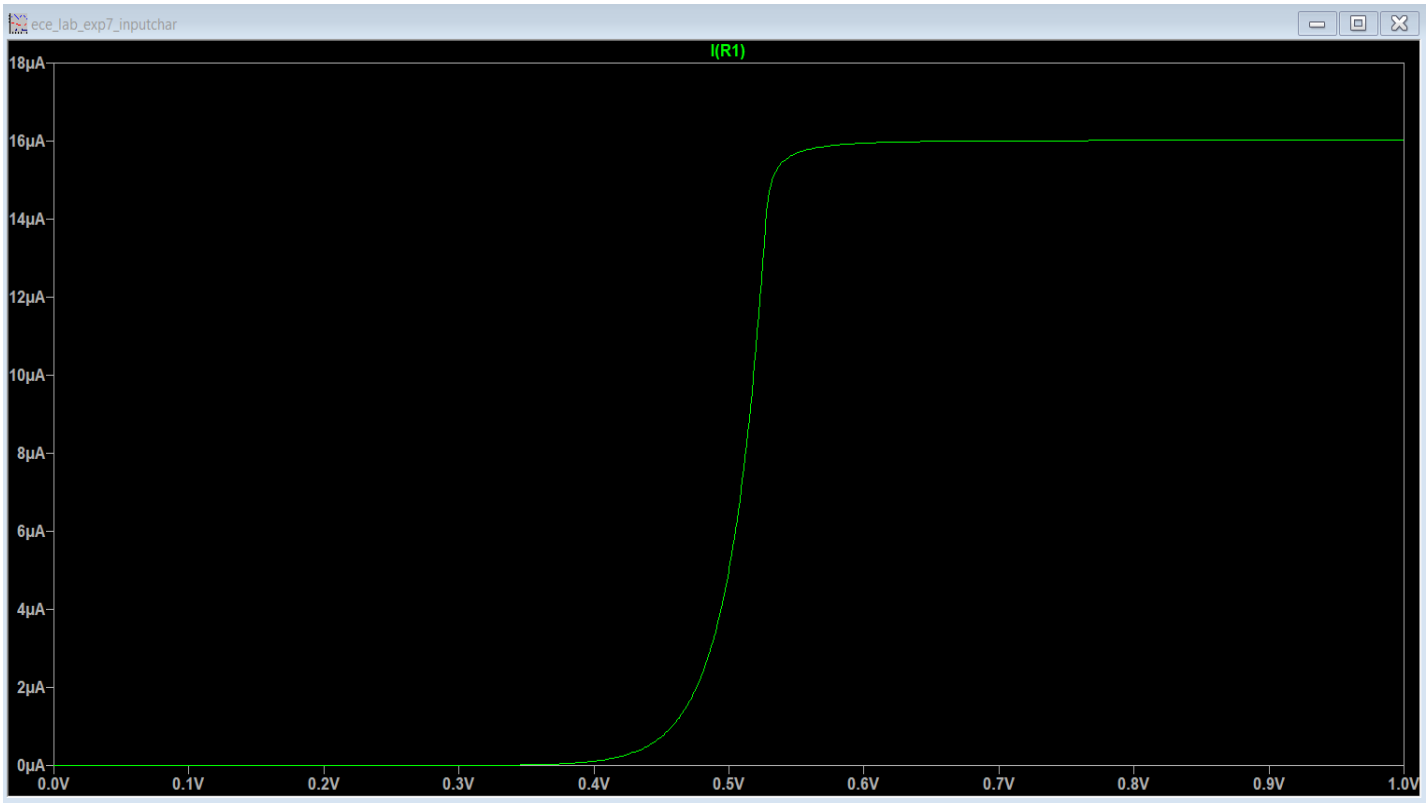


OUTPUT CHARACTERISTICS OF BJT IN CE

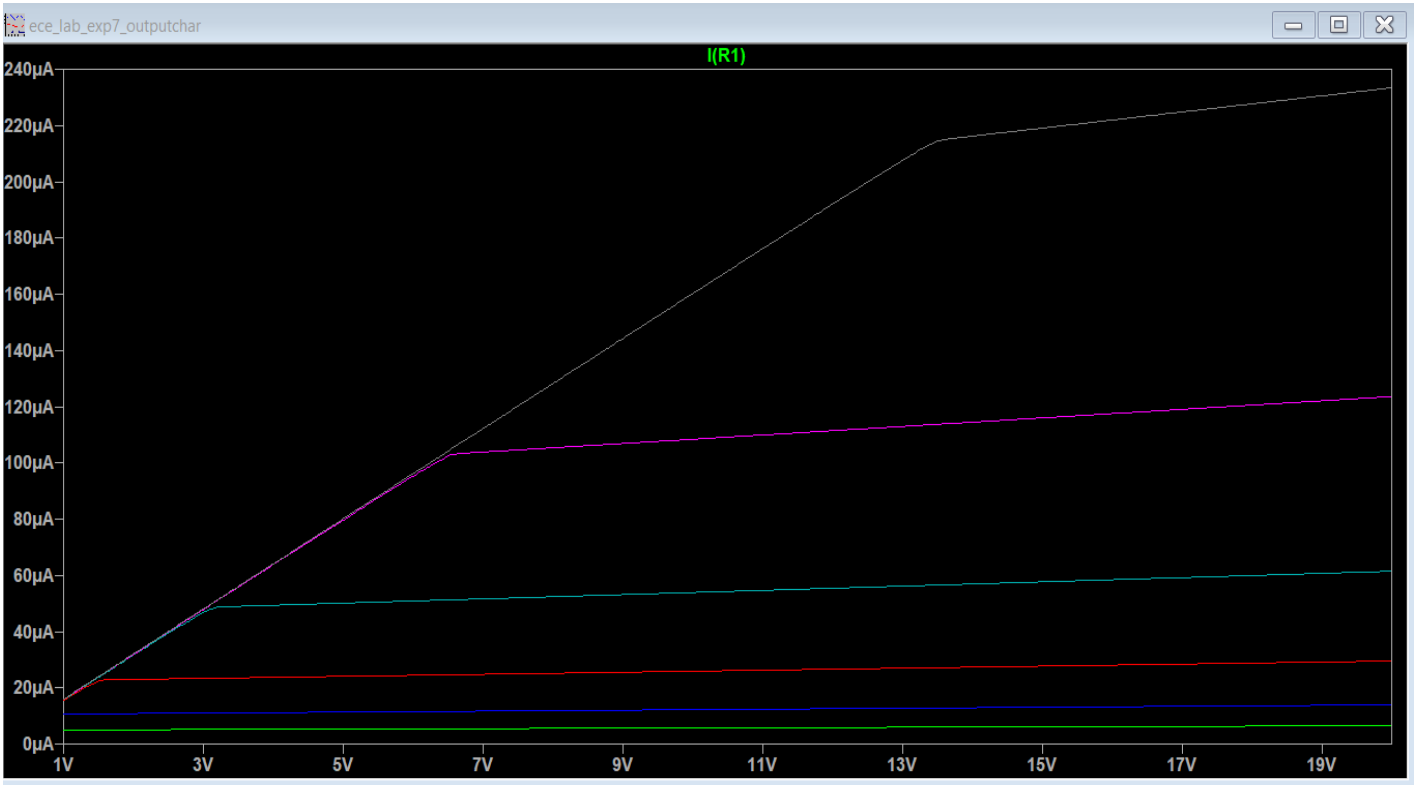


OUTPUT GRAPHS

INPUT CHARACTERISTICS OF BJT IN CE



OUTPUT CHARACTERISTICS OF BJT IN CE



RESULT AND INFERENCE

From the above simulation, we observe the input and output characteristics of a Bipolar Junction NPN Transistor in common emitter configuration.

=====THE END=====