Experiment No.9 **Date:**

V-I Characteristics of Bipolar Junction Transistor (BJT) In Common Emitter (CE) Configuration

Aim:

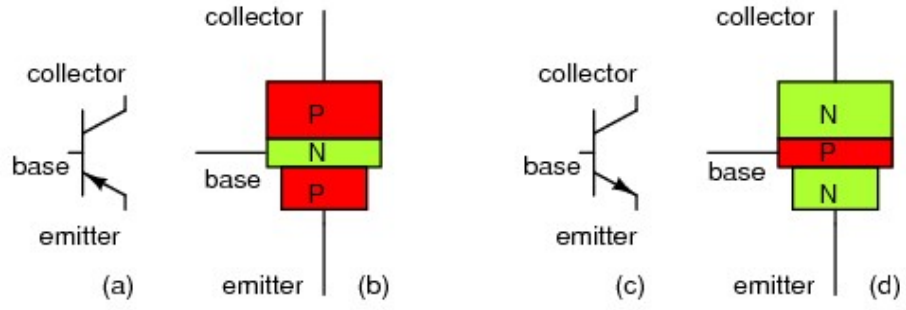
To obtain the input and output (V – I) characteristics of a BJT in Common Emitter Configuration and to plot the characteristics.

Software required:

LT spice

Theory :

BJT is a two-junction, three-layer, three-terminal semiconductor device. It is represented by two back-to-back connected PN junction diodes made from a single piece of semiconductor crystal. These two junctions give rise to three regions: emitter, base, and collector. The emitter region is more heavily doped than any of the other regions because its main function is to supply the majority of charge carriers to the base. The base forms the middle section, which is very thin (10–6 mm) and is very lightly doped. The collector's main function is to collect the majority of charge carriers coming from the emitter and passing through the base. In CE configuration, an input signal is applied between the base and emitter, and an output signal is taken from the collector and emitter circuit. Figure 1 shows the circuit symbol and layers of transistors.

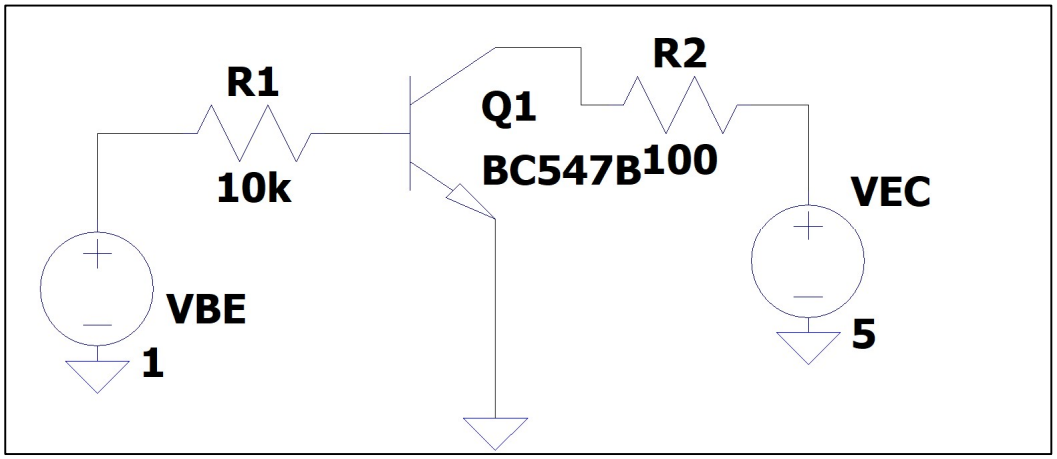


(a) Symbol and (b) structure of PNP transistor (c) symbol and (d) structure of NPN transistor

A transistor can be used in three different configurations. Out of these three configurations, the common emitter (CE) configuration is the most preferred. Emitter base junctions should be forward biased, and collector base junctions should be reverse biased. In CE configuration, an input signal is applied between the base and emitter, and an output signal is taken from the collector and emitter circuit. Input characteristics tests are useful in finding the input impedance of the device. For some constant value of VCE, the V_{BE} is varied and the corresponding base current is noted. Output characteristic curves are used to find the output admittance of the

device. In order to find the output characteristics, the input voltage V_{BE} is kept constant, and the increasing value of V_{CE} for the I_C is noted.

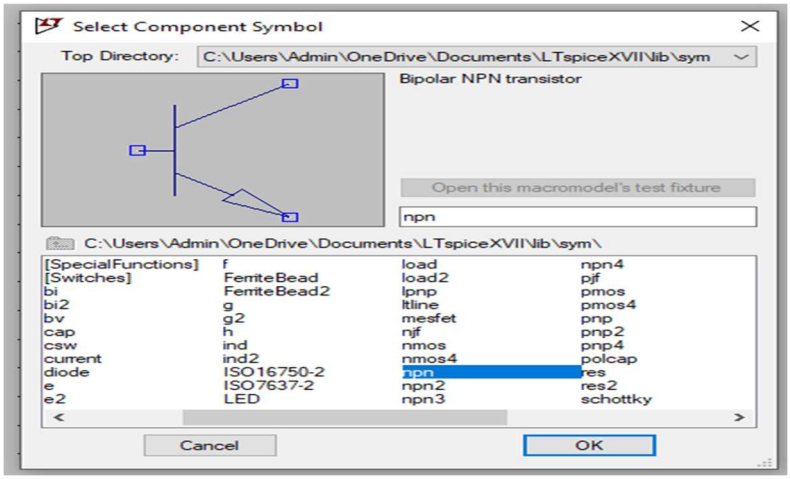
Circuit:

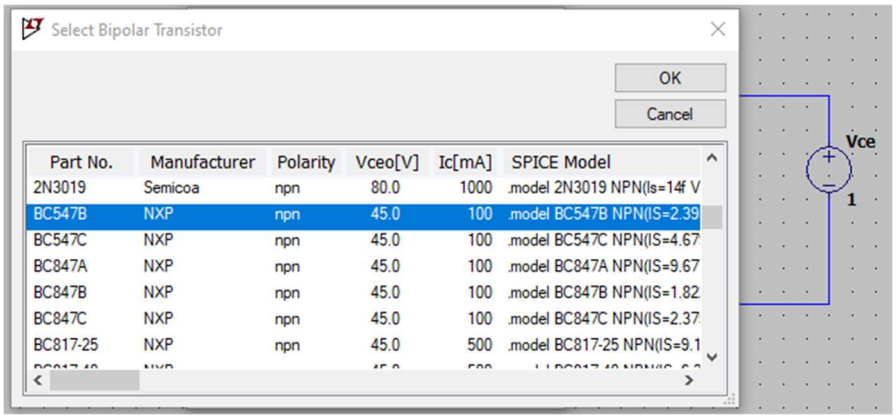


Procedure:

1. Construct the given circuit in LT spice

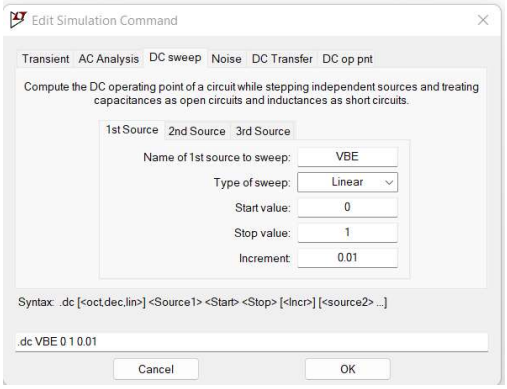
2. To select the transistor, go to Pick new Transistor and select BC547B





3. To plot the input characteristics

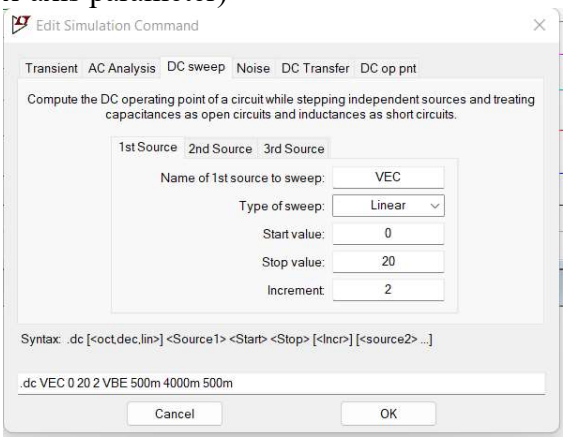
i. Set VEC = 5V constant
ii. Set VBE =1V
iii. Go to Simulation -> Edit simulation cmd -> DC sweep
iv. Select first source and enter the following values



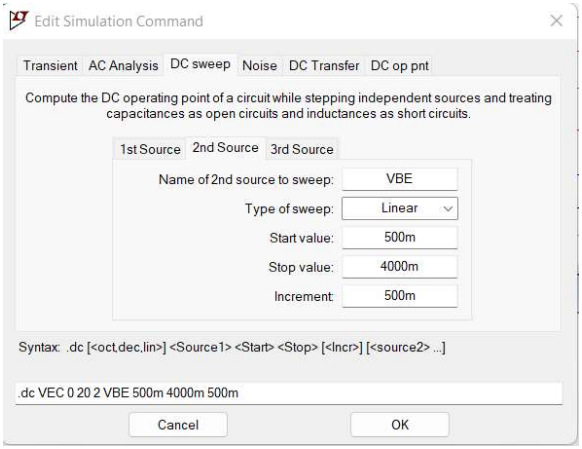
v. Click ok and Run the simulation
vi. Measure Ib.
vii. Capture the input characteristics (VBE vs Ib)

4. To plot the output characteristics

i. Go to Simulation -> Edit simulation cmd -> DC sweep
ii. Select first source and enter the following values VEC (First source will act as x-axis parameter)



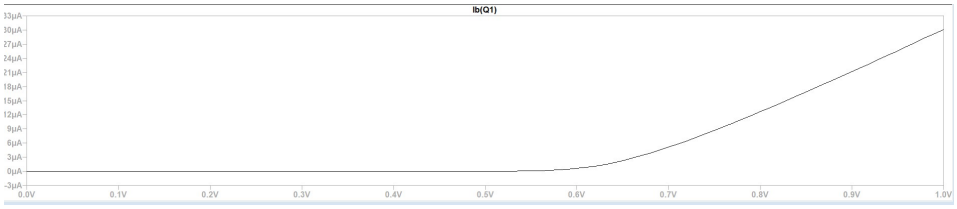
iii. Select the second source and enter the values as shown in the image



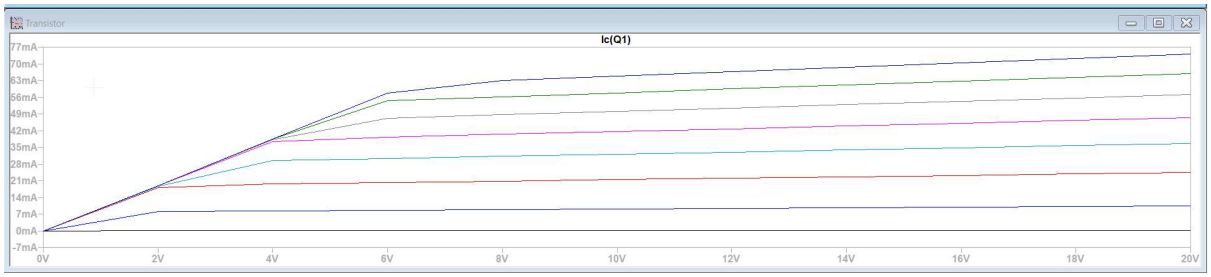
iv. Click ok and run the simulation
v. Measure Ic.
vi. Capture the output characteristics (VEC vs Ic)

Simulation Results:

1) Input Characteristics



2) Output Characteristics



RESULT:

Thus the transistor characteristics are simulated using LTspice.