Experiment 3

Basic Electronic Circuits
IIIT Chittoor

Characteristics of BJT transistor in common emitter configuration

The basic circuit diagram for studying characteristics of BJT is shown in the Fig. 3.1. The input voltage is applied between base and emitter terminals and the output voltage is measured between collector and emitter terminals. Here emitter region of the transistor is common to both input and output and hence the name common emitter configuration. While performing the experiment do not exceed the ratings of the transistor. This may lead to damage the transistor. Connect voltmeter and ammeter or multimeters with correct polarities as shown in the circuit diagram

Input characteristics are obtained between the input current and input voltage keeping the output voltage (V_{CE}) constant.

1. Connect the circuit as shown in Fig 3.1
2. Keep output voltage $\mathbf{V_{CE}}$ = 0 V by varying $\mathbf{V_{CC}}$.
3. Varying $\mathbf{V_{BB}}$ gradually, note down base current $\mathbf{I_B}$ and base-emitter voltage $\mathbf{V_{BE}}$.
4. Vary in steps of 0.1 V from 0 V to 1.2 V.
5. Repeat above procedure (step 3) for $\mathbf{V_{CE}}$ = 5V.Tabulate readings in Table 3.1
6. Plot the graph between V_{BE} and I_B for constant V_{CE} values.

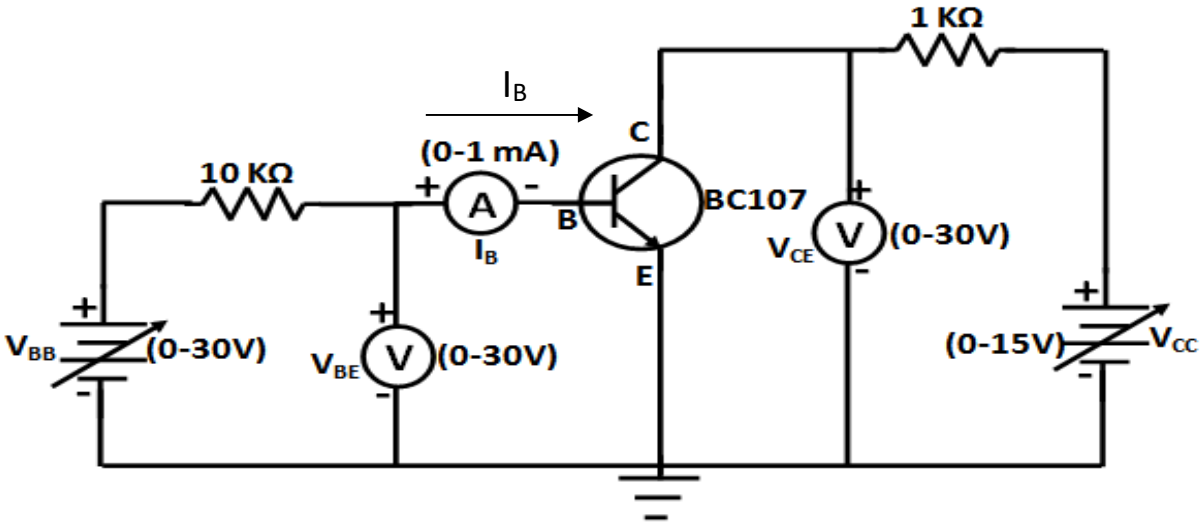

Fig. 3.1: Circuit for plotting input characteristics of BJT in CE configuration

V_{CE} = 0V		V_{CE} = 5V	
V_{BE} (V)	I_B (μA)	V_{BE} (V)	I_B (μA)

Table 3.1: Experimental data for V_{BE} vs. I_B for different values of V_{CE}

To obtain input resistance find ΔV_{BE} and ΔI_B for a constant $\mathbf{V_{CE}}$ on one of the input characteristic

Input impedance = $h_{ie} = R_i = \frac{\Delta V_{BE}}{\Delta I_B}$ ($\mathbf{V_{CE}}$ is constant) =

Reverse voltage gain = $h_{re} = \frac{\Delta V_{BE}}{\Delta V_{CE}}$ ($\mathbf{I_B}$ = constant) =

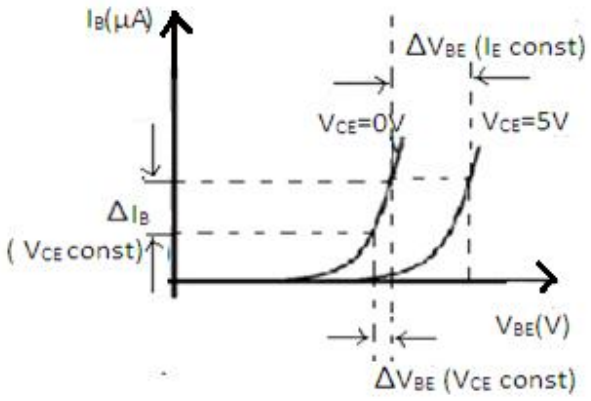

Fig. 3.2: Input characteristics of BJT in CE configuration

Output characteristics are plotted between the output voltage (V_{CE}) and output current (I_C) at constant input current.

1. Connect the circuit as shown in the Fig 3.3.
2. Keep base current $\mathbf{I_B}$ = 20 μA by varying $\mathbf{V_{BB}}$.
3. Varying $\mathbf{V_{CC}}$ gradually in steps of 1V up to 12V and note down collector current $\mathbf{I_C}$ and Collector-Emitter Voltage ($\mathbf{V_{CE}}$).
4. Repeat above procedure (step 3) for $\mathbf{I_B}$ =20 μA,40 μA, 60 μA. Tabulate readings in Table 3.2
5. Plot the graph between V_{CE} and I_C for different values of I_B.

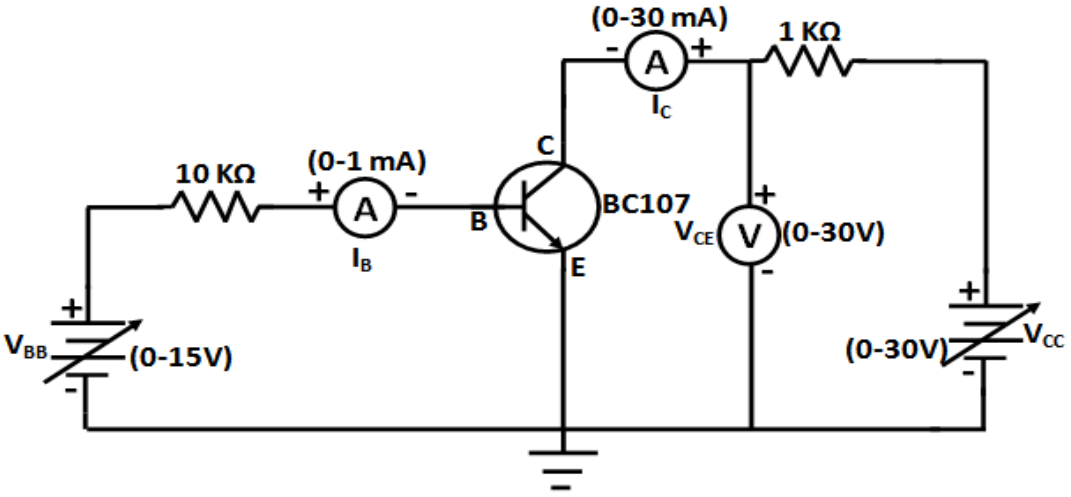

Fig 3.3: Circuit for plotting input characteristics of BJT in CE configuration

V_{BB}(Volts)	I_B = 20μA		I_B = 40μA		I_B = 60μA	
	V_{CE}(V)	I_C(mA)	V_{CE}(V)	I_C(mA)	V_{CE}(V)	I_C(mA)

Table 3.2: Experimental data for V_{CE} vs. I_C for different values of I_B

To obtain output resistance find ΔI_C and ΔV_{CB} at a constant I_B.on one of the output characteristics

Output admittance $\frac{1}{h_{oe}}$ = R_o = = $\frac{\Delta I_C}{\Delta V_{CE}}$ (I_B is constant) =

Forward current gain = $h_{fe} = \frac{\Delta I_C}{\Delta I_B}$ (V_{CE} = constant) =

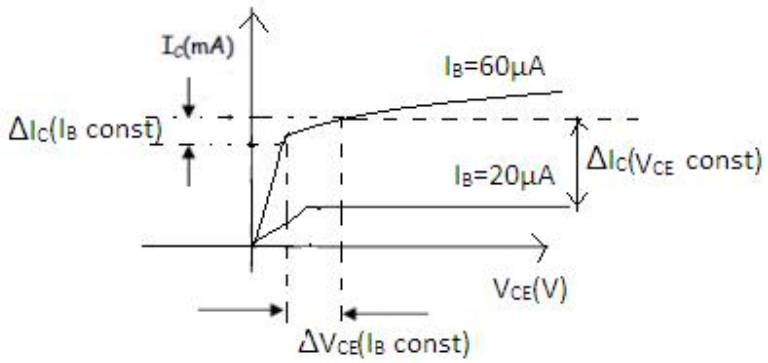

Fig. 3.4: output characteristics of BJT in CE configuration

Observations:

1. Comment on the nature of input characteristics
2. What is the range of input and output resistances of a BJT working in CE mode
3. What is the current gain of the transistor