Basic Electronics Circuit's Lab

Experiment no. 4

1. Characteristics of BJT transistor in Common Emitter Configuration

The basic circuit diagram for studying characteristics of BJT is shown in the Fig. 1.1. 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 multi meters with correct polarities as shown in the circuit diagram.

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

Procedure:

1. Connect the circuit as shown in Fig 1.1

2. Keep output voltage V_{CE} = 0 V by varying V_{CC}.

3. Varying V_{BB} gradually, note down base current I_B and base-emitter voltage $_{BE}$.

4. Vary in steps of 0.2 V from 0 V to 1 and in steps of 1 V from 1 to 12 V.

5. Repeat above procedure (step 3) for V_{CE} = 5V.Tabulate readings in Table 1.1

6. Plot the graph between V_{BE} and I_B for constant V_{CE} values as in Graph 1.1.
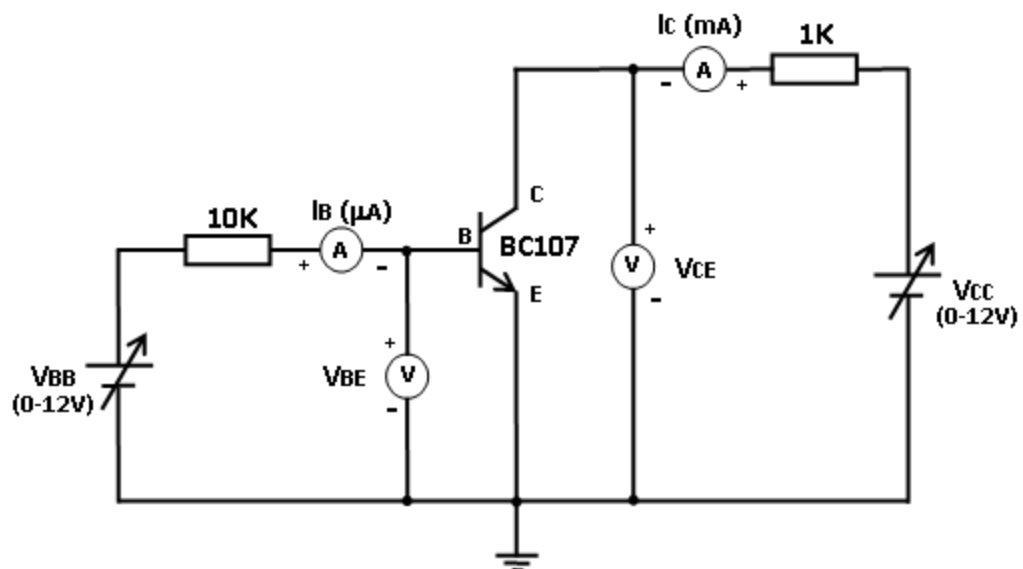
Fig. 1.1: Circuit for plotting input characteristics of BJT in CE configuration
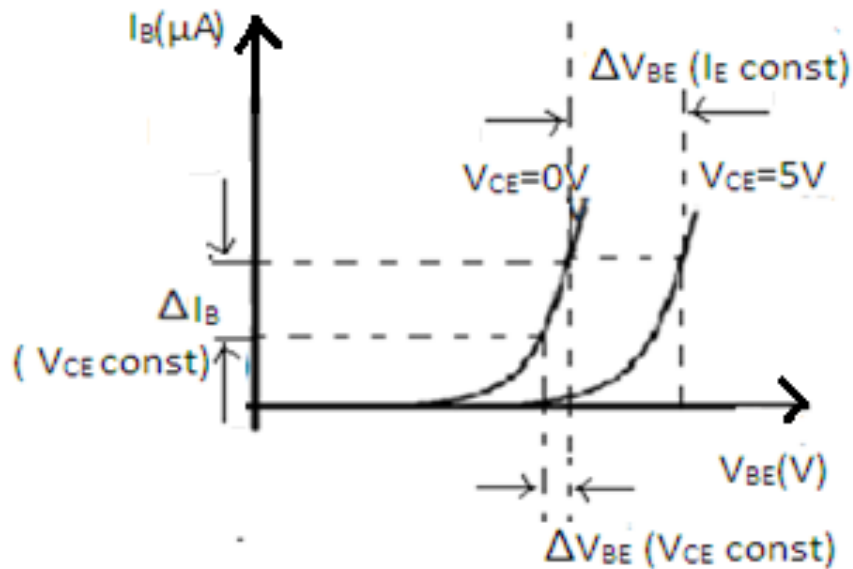
VCE = 0 V		VCE = 5 V	
IB(μA)	VBE	IB(μA)	VBE

Table. 1.1

To obtain input resistance find V_{BE} and I_B for a constant V_{CE} on one of the input characteristics.

Input Resistance h_{ie} = r_i = $\dfrac{\Delta VBE}{\Delta IB}$ (V_{CE} Constant) -----------------------

Reverse Voltage Gain h_{re} = $\dfrac{\Delta VBE}{\Delta VCE}$ (I_B Constant) -----------------------

Graph 1.1: 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 (I_B).

1. Connect the circuit as shown in the Fig 1.2.

2. Keep base current I_B = 10 µA by varying V_{BB}.

3. Varying V_{CC} gradually in steps of 1V up to 15V and note down collector current I_C and Collector-Emitter Voltage (V_{CE}).

4. Repeat above procedure (step 3) for I_B =20 µA, 30 µA and 40 µA. Tabulate readings in Table 1.2.

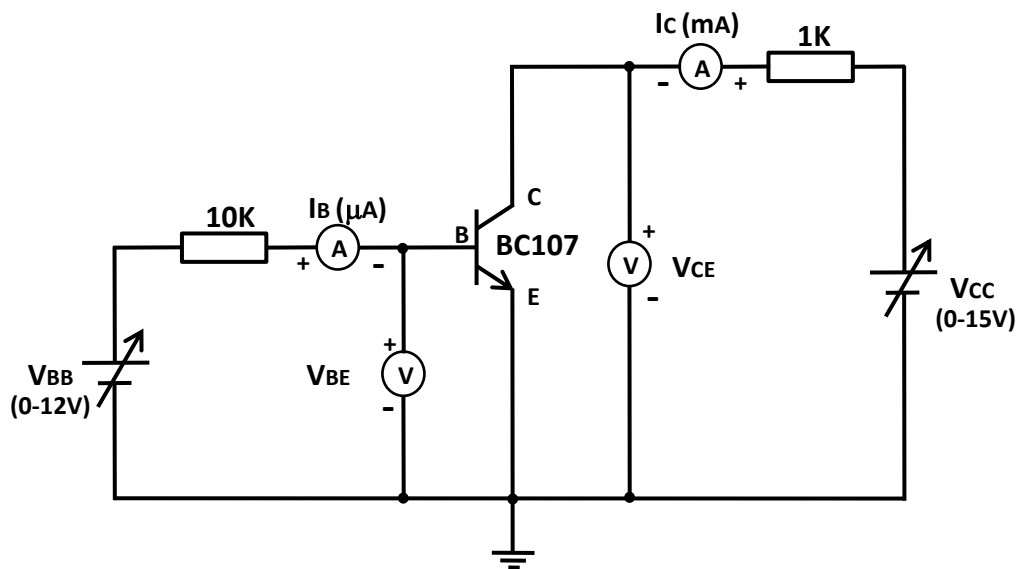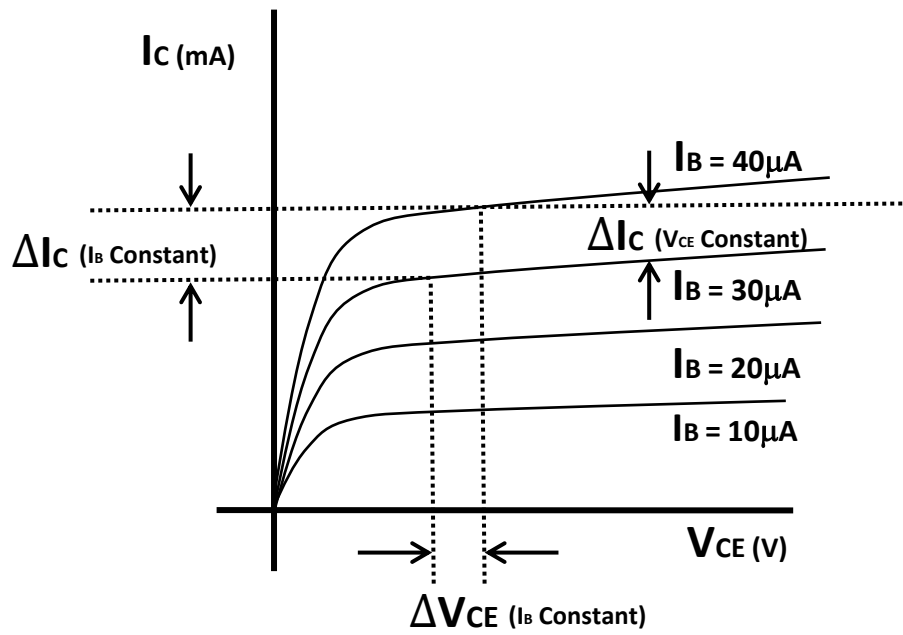5. Plot the graph between V_{CE} and I_C for different values of I_B as in graph 1.2

Fig. 1.2: Circuit for plotting output characteristics of BJT in CE configuration

$I_B = 10\ \mu A$		$I_B = 20\ \mu A$		$I_B = 30\ \mu A$		$I_B = 40\ \mu A$	
V_{CE}	$I_{C(mA)}$	V_{CE}	$I_{C(mA)}$	V_{CE}	$I_{C(mA)}$	V_{CE}	$I_{C(mA)}$

Table. 1.2

To obtain output resistance find I_C and V_{BE} for a constant I_B on one of the input characteristics.

Output Admittance = $\dfrac{1}{hoe} = \dfrac{\Delta IC}{\Delta VCE}$ (I_B Constant) -----------------------

Forward Current Gain hfe = $\dfrac{\Delta IC}{\Delta IB}$ (V_{CE} Constant) -----------------------

Graph 1.2: Output characteristics of BJT in CE configuration