



Expt. No: 7
Date:

Common Emitter Characteristics

AIM: To study, the Input-Output characteristics of a BJT in Common Emitter Configuration.

SOFTWARE TOOLS / OTHER REQUIREMENTS:

1. Multisim Simulator/Circuit Simulator

THEORY:

The most frequently encountered transistor configuration appears in Fig.10.1 for the pnp and npn transistors. It is called the common-emitter configuration because the emitter is common to both the input and output terminals (in this case common to both the base and collector terminals). Two sets of characteristics are again necessary to describe fully the behavior of the common-emitter configuration: one for the input or base-emitter circuit and one for the output or collector-emitter circuit. Both are shown in Fig. 10.2 (a) and 10.2 (b) respectively.

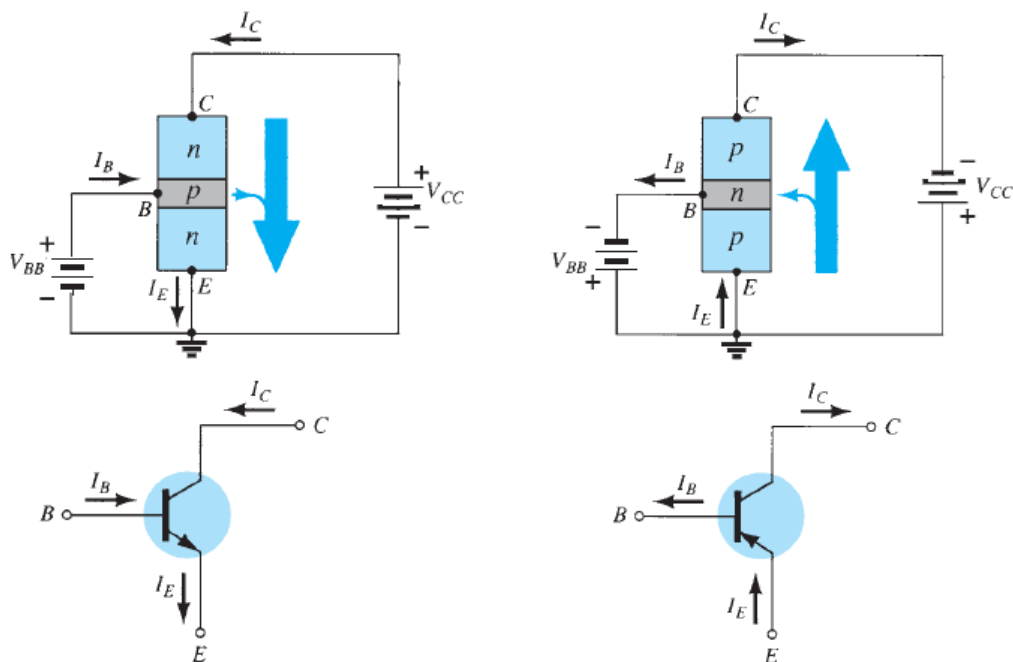


Fig. 10.1

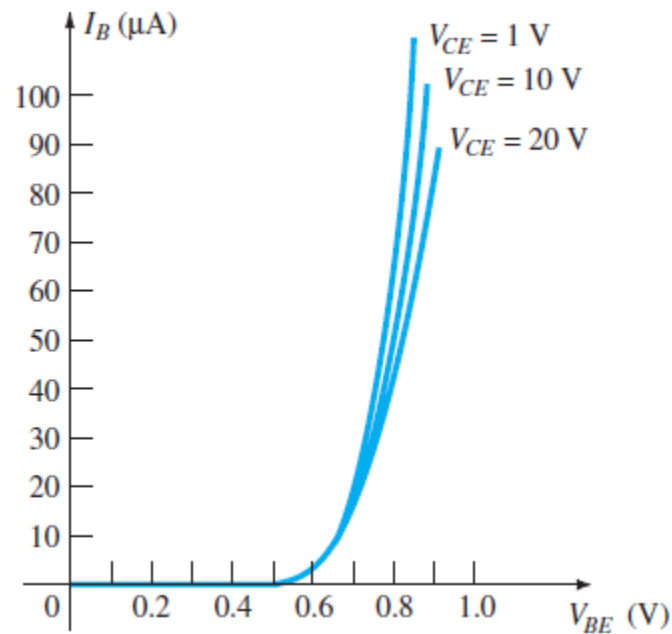


Fig. 10.2 (a) CE Input Characteristics

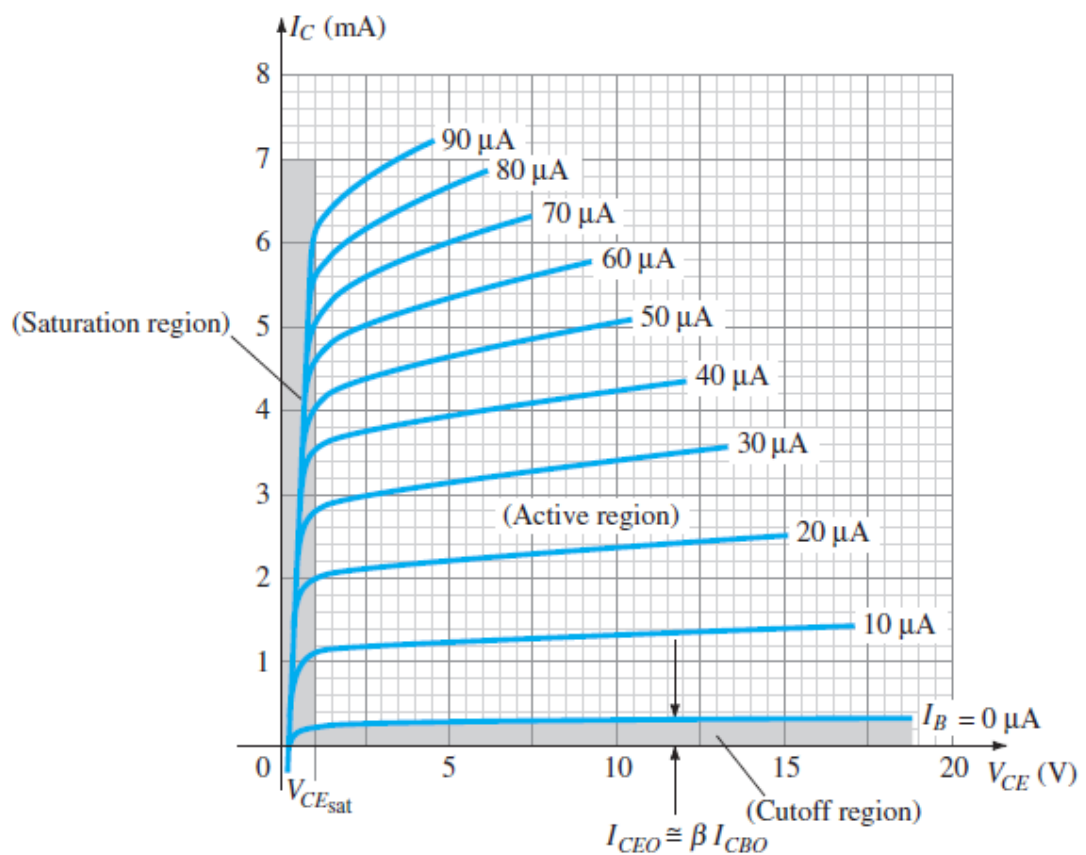
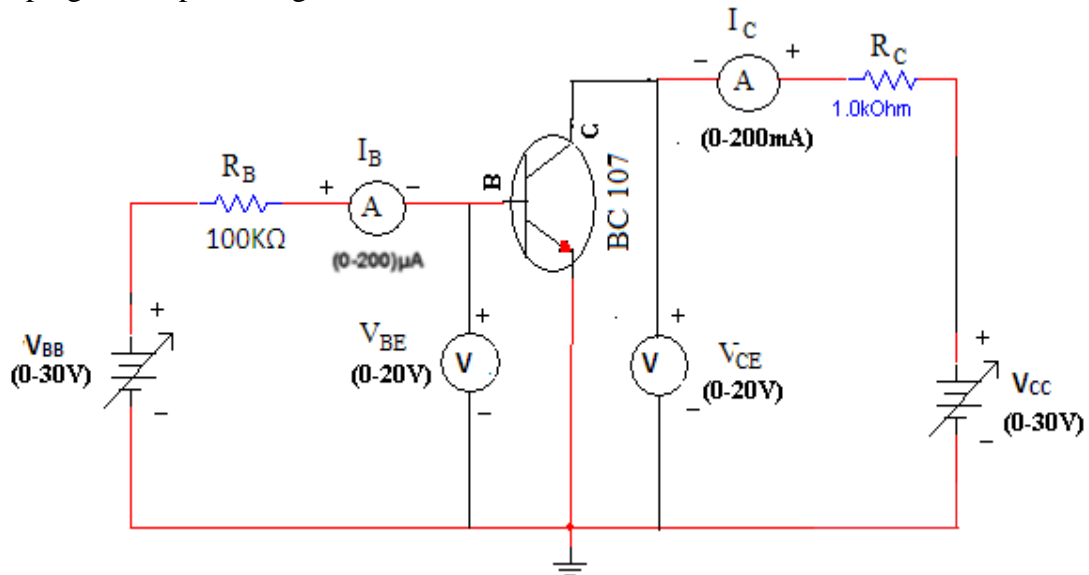


Fig. 10.2 (b) CE Output Characteristics



INPUT CHARACTERISTICS

The input characteristics are a plot of the input current (I_B) versus the input voltage (V_{BE}) for a range of values of output voltage (V_{CE}). The curve describes the changes in the values of input current with respect to the values of input voltage keeping the output voltage constant.



Circuit Diagram to obtain CE Input/Output Characteristics

PROCEDURE

1. Connect the circuit as shown in the circuit diagram.
2. Keep output voltage $V_{ce} = 1$ V by adjusting V_{cc} .
3. Varying V_{bb} gradually, note down base current I_b and base-emitter voltage V_{be} .
4. Step size is not fixed because of non linear curve. Initially vary V_{bb} in steps of 0.1v. Once the current starts increasing vary V_{bb} in steps of 1 V up to 5 V.
5. Repeat above procedure (step 3) for $V_{ce} = 1$ V and 5 V.

OUTPUT CHARACTERISTICS

The output characteristics are a plot of the output current (I_C) versus output voltage (V_{CE}) for a range of values of input current (I_B). The curve describes the changes in the values of output current against output voltage keeping the input current constant.

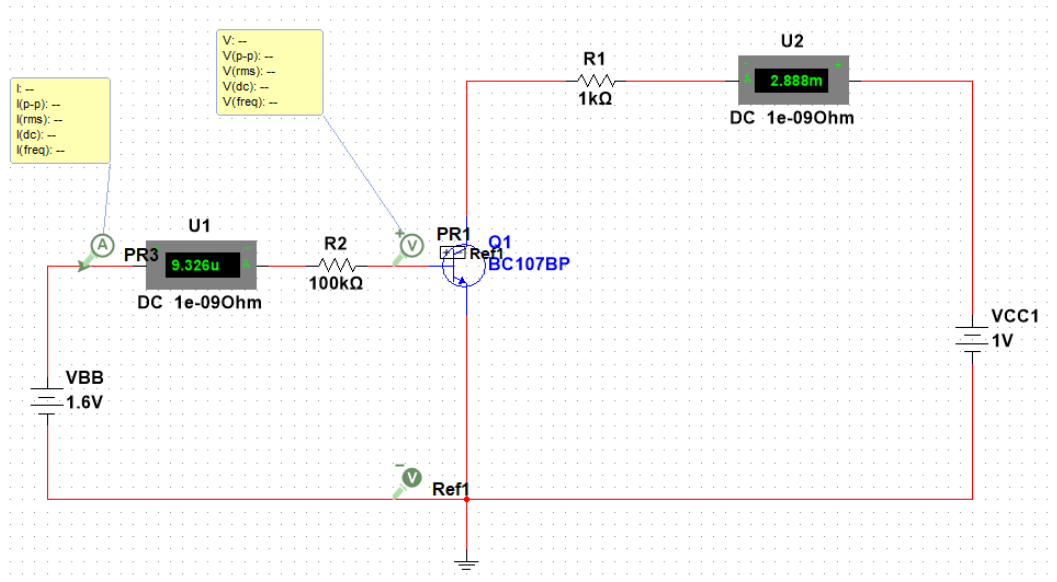
PROCEDURE

1. Connect the circuit as shown in the circuit diagram.
2. Set the emitter current $i_b = 10$ μ A by varying V_{bb} .
3. Varying V_{cc} gradually in steps of 1 v up to 10 v and note down collector current I_c and collector-emitter voltage(V_{ce}).
4. Repeat above procedure (step 3) for $I_b = 20$ μ A and 50 μ A.



INPUT/OUTPUT CHARACTERISTICS

CIRCUIT DIAGRAM (FROM MULTISIM)



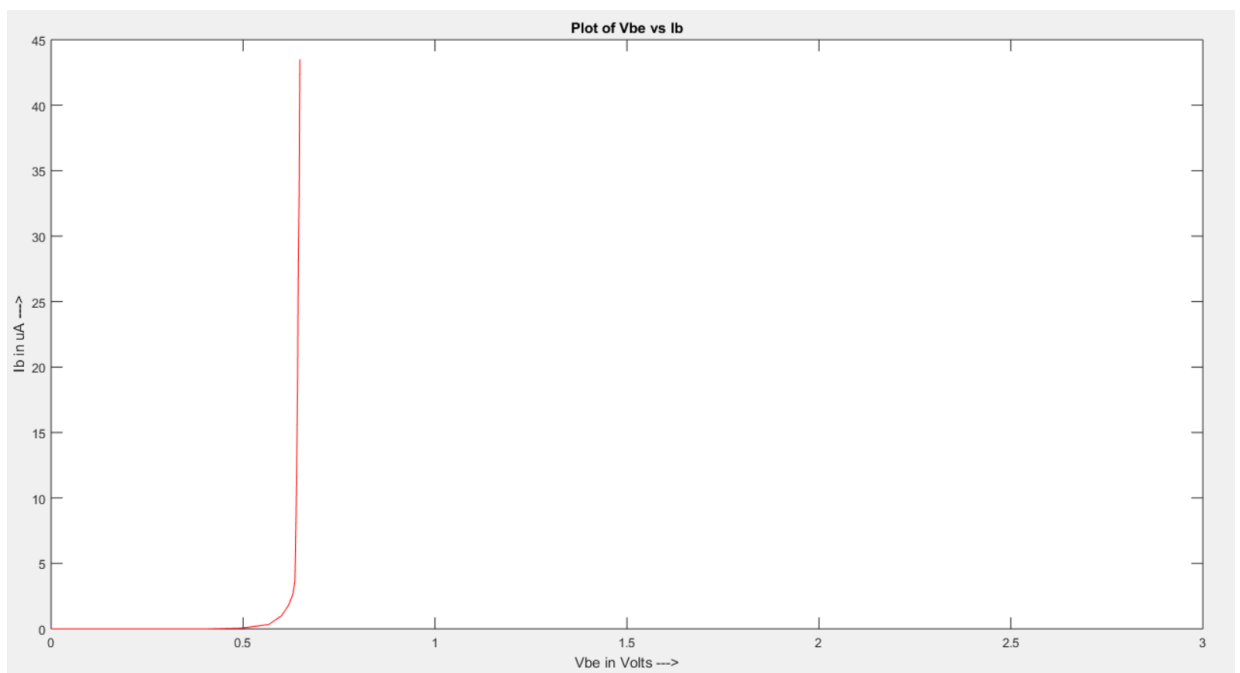
OBSERVATION TABLE

V_{bb}	$V_{ce} = 1\text{ V}$		$V_{ce} = 2\text{ V}$		$V_{ce} = 5\text{ V}$	
	V_{be} (in Volts)	I_b (in μA)	V_{be} (in Volts)	I_b (in μA)	V_{be} (in Volts)	I_b (in μA)
0	0	0				
0.1	0.1	0				
0.2	0.2	0				
0.3	0.3	0				
0.4	0.4	0				
0.5	0.496	0.0555				
0.6	0.567	0.333				
0.7	0.6	0.999				
0.8	0.618	1.78				



0.9	0.63	2.66				
1	0.635	3.66				
1.5	0.638	8.66				
2	0.64	13.5				
2.5	0.642	18.7				
3	0.643	24				
3.5	.644	28.4				
4	0.646	33.3				
4.5	0.647	39.1				
5	0.648	43.5				

GRAPH

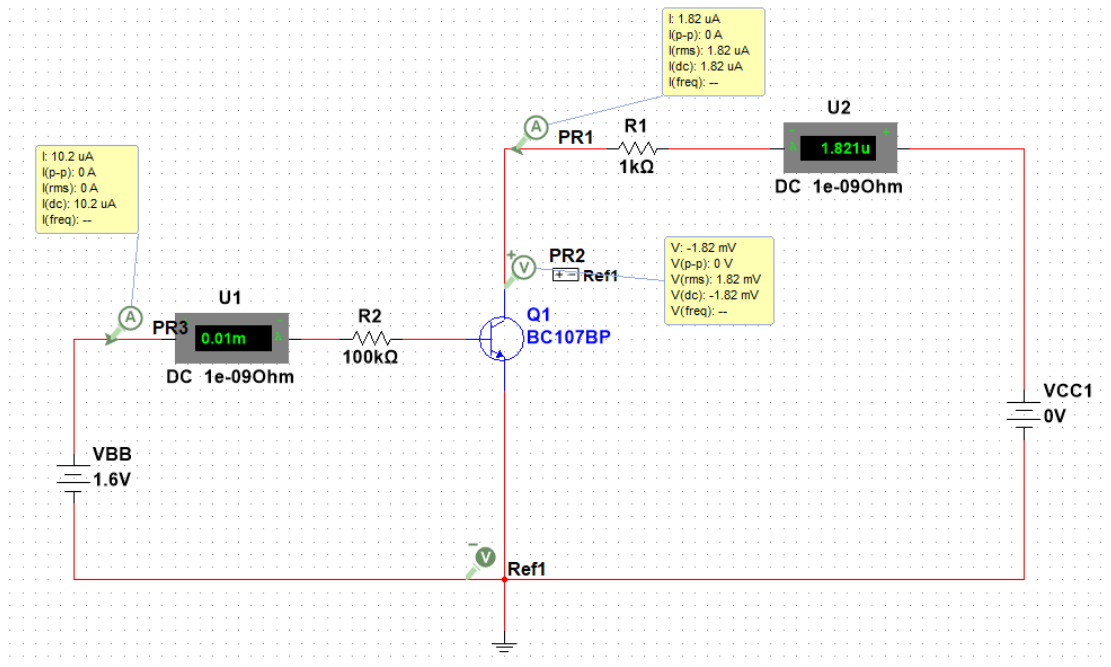


Plot of base current Ib vs Base to Emitter voltage Vbe



OUTPUT CHARACTERISTICS

CIRCUIT CONNECTION FROM MULTISIM



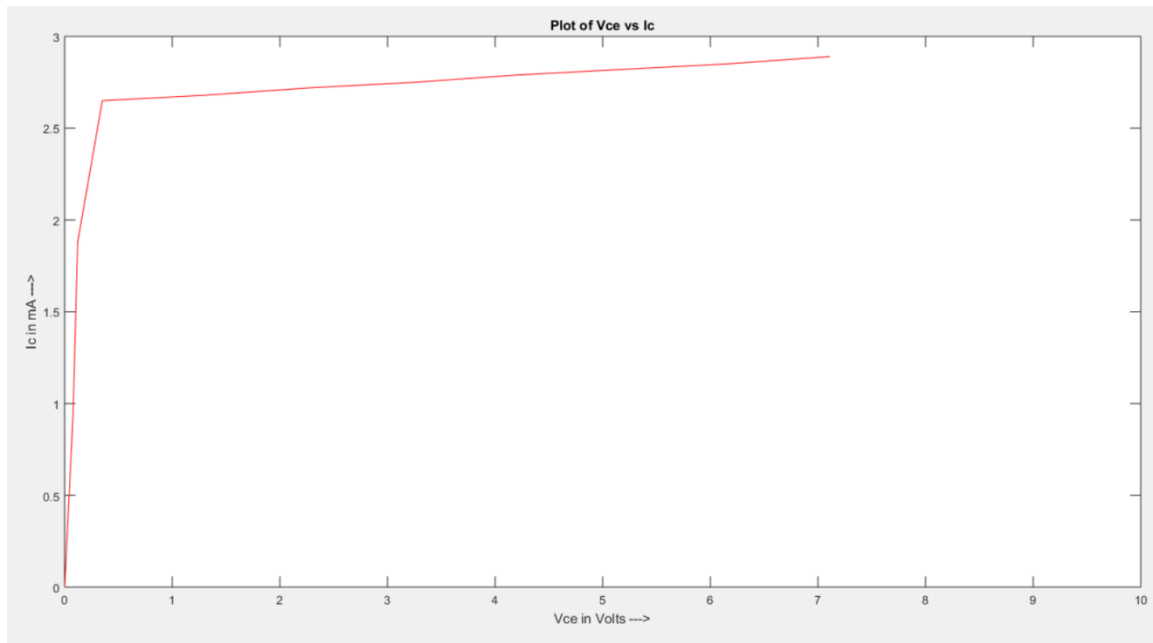
OBSERVATION TABLE

V_{cc}	$I_b = 10 \mu A$		$I_b = 20 \mu A$		$I_b = 50 \mu A$	
	V_{ce} (in Volts)	I_c (in mA)	V_{ce} (in Volts)	I_c (in mA)	V_{ce} (in Volts)	I_c (in mA)
0	0	0				
1	0.0766	0.923				
2	0.121	1.88				
3	0.350	2.65				
4	1.32	2.68				
5	2.28	2.72				
6	3.25	2.75				
7	4.21	2.79				
8	5.18	2.82				
9	6.15	2.85				



10	7.11	2.89				
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GRAPH



Plot of Collector current I_c vs Collector to Emitter voltage V_{ce}

CONCLUSIONS