University of Anbar
College of Engineering
Dept. of Electrical Engineering

Lab. Name: Electronic I
Experiment no.: 1
Lab. Supervisor: Munther N. Thiyab

Experiment #1- Part#3

Characteristics of Bipolar Junction

Procedure

1. Connect the common emitter test circuit shown in Fig.12. Try to identify the leads of the BC337 transistor correctly. It is built in a M90 package as depicted in Fig.12.
2. Set V_{CE} = 0V, and increase the base current I_B in several steps from 0 to 100µA by varying the DC supply voltage V_{BB}, and record V_{BE} in each step as shown in Table-1.
3. Reduce V_{BB} to 0V and set V_{CE} = 5V by adjusting the DC power supply V_{CC}. Increase I_B from 0 to 100µA (by slowly increasing V_{BB}) in several steps and record V_{BE}. V_{CE} should be kept constant at 5V in each step by adjusting V_{CC}.

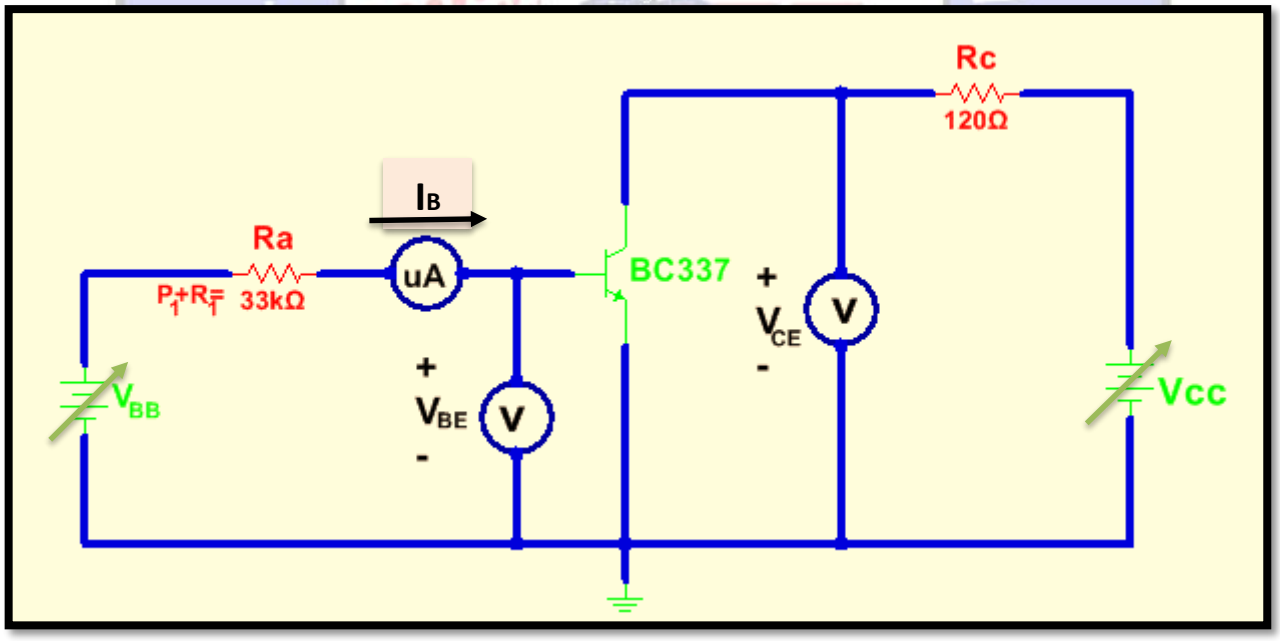

Figure 12: Transistor Test Circuit Used to obtain the Input Characteristics

V_{CE} = 0V		V_{CE} = 5V	
I_B(μA)	$V_{BE(V)}$	I_B(μA)	V_{BE}(V)
0		0	
10		10	
20		20	
30		30	
40		40	
50		50	
60		60	
70		70	
80		80	
90		90	
100		100	

Table-1: Recorded Data for the Transistor Input Characteristics

4. Connect the circuit shown in Fig.13 to obtain the output characteristics of the transistor.

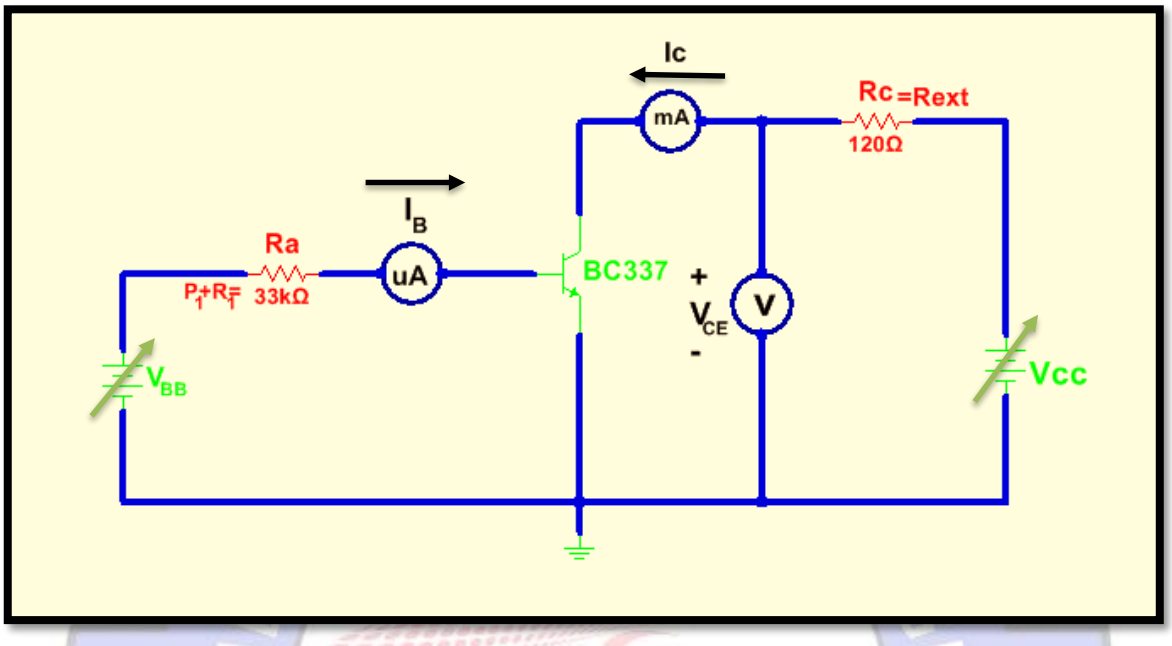

Figure 13: Transistor Test Circuit Used to obtain the Output Characteristics

5. Start with both power supplies set to 0V. Slowly increase V_{BB} until $I_B = 20\mu A$. Now slowly increase V_{CC} in several steps and record V_{CE} and I_C in each step as shown in Table-2.

6. Repeat step 5 for base current values of 40μA, and 60μA respectively. Record data as illustrated in Table-2.

Table-2: Recorded Data for the Transistor Output Characteristics

$I_B(\mu A)$ =20		$I_B(\mu A)$ =40		$I_B(\mu A)$ =60	
$V_{CE(V)}$	I_C (mA)	$V_{CE(V)}$	I_C (mA)	$V_{CE(V)}$	I_C (mA)
0		0		0	
0.1		0.1		0.1	
0.2		0.2		0.2	
0.4		0.4		0.4	
0.6		0.6		0.6	
0.8		0.8		0.8	
1		1		1	
3		3		3	
5		5		5	
8		8		8	
10		10		10	

Discussion

1. From the obtained data in Table-1, plot the input characteristic curves of the transistor.
2. Sketch the three output characteristic curves of the transistor from the results obtained in Table-2.
3. Find the *h-parameters* of the transistor at I_B = 40μA and V_{CE} = 5V from the plotted input and output characteristics.
4. Use the plotted characteristic curves to determine the DC current gain β_{dc} for the transistor at V_{CE} = 3.0V and base current of 20μA, 40μA, and 60μA

respectively. Repeat for V_{CE} = 5.0V. Tabulate your results as illustrated in Table-3 below.

5. Does the experimental data indicate that β_{dc} is constant at all points? Does this have any effect on the linearity of the transistor? What effect would a higher β_{dc} have on the characteristic curves you measured?
6. What is the maximum power dissipated in the transistor for the data taken in the experiment?
7. Show that the DC alpha of the transistor is given by: 1+

$$\alpha_{dc} = \frac{\beta_{dc}}{\beta_{dc} + 1}$$

Compute α_{dc} for your transistor at V_{CE} = 5.0V and I_B = 40μA.

8. What value of V_{CE} would you expect if the base terminal of the transistor is opened? Explain your answer.