NORTH SOUTH UNIVERSITY

Department of Electrical & Computer Engineering

Lab Report

Course Code: EEE111L

Course Title: Analog Electronics

Section: 03

Experiment No: 05

Experiment Name: The input output characteristics of CE configuration of BJT

Experiment Date: 11th April 2021

Date of Submission: 25th April 2021

Course Instructor: Riasat Khan

Submitted by Group 05

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Submitted to: Fatema Zahra

Experiment No : 05

Name of the experiment : The input output characteristics of CE (Common emitter) configuration of BJT.

Objective : Study of the input output characteristics of CE (Common emitter) configuration of BJT.

Theory : A transistor is a three terminal device. The terminals are base, emitter and collector. In CE configuration input voltage is applied between base and emitter terminals. Therefore, the emitter terminal is common to both input and output. So, for normal operation Base emitter junction is forward biased. as compared to CB arrangement I_B increases less rapidly with V_{BE}.

Therefore, input resistance of CE circuit is higher than CB circuit. There are three different currents (I_E, I_B, I_C).

Here, $I_E = I_B + I_C$ and current gain $\frac{I_C}{I_B}$.

The characteristics of transistor is measured by following two characteristics curve.

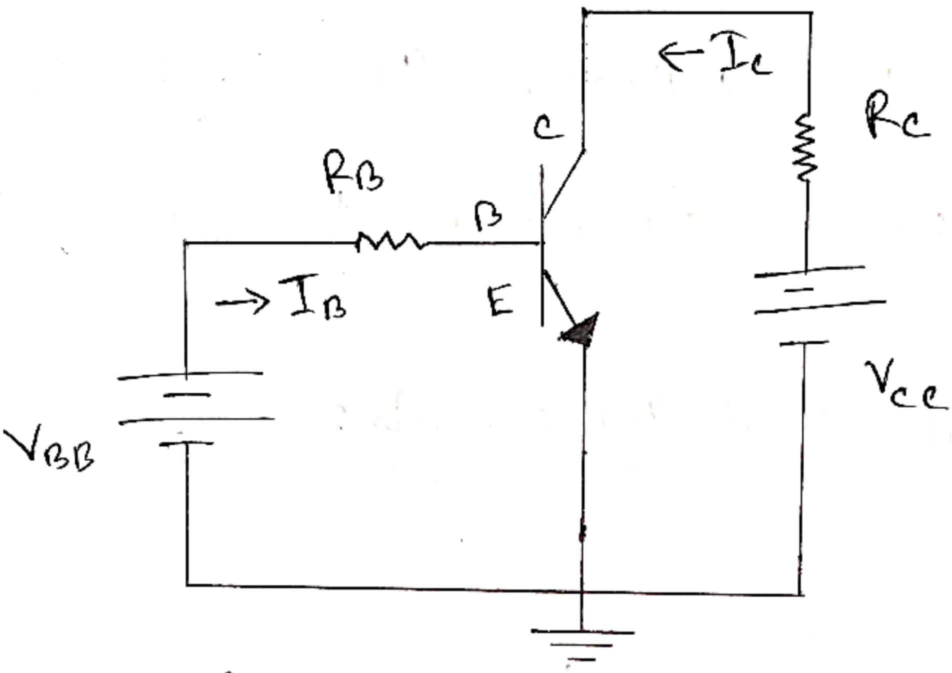
Input characteristics curve: It is the same graph / curve that is found for a forward bias diode. Because, it's the curve between input current (I_B) vs output voltage (V_{CE}) for constant output voltage (V_{CE}).

Output characteristic curve: It is output current (I_C) vs output voltage (V_{CE}) for constant (I_B). It has three region Saturation, Active, cutoff. In saturation region collector diode is not in reversed bias so, here, V_{CE} is the rising part of the curve. when it becomes reverse biased the graph becomes horizontal. when, $I_B = 0$ the collector curve is in cutoff region where, transistor works as switch.

Equipements and components:

Serial	Component name	Specification	Quantity
1	Transistor	C828	1 piece
2	Resistor	100kΩ, 1kΩ	1 piece each
3	Trainer board		1 unit
4	Dc power supply		1 unit
5	Digital multimeter (DMM)		1 unit
6	chords and wire		as required

Circuit Diagram :



Data Collection :

Table ① Input characteristic of BJT

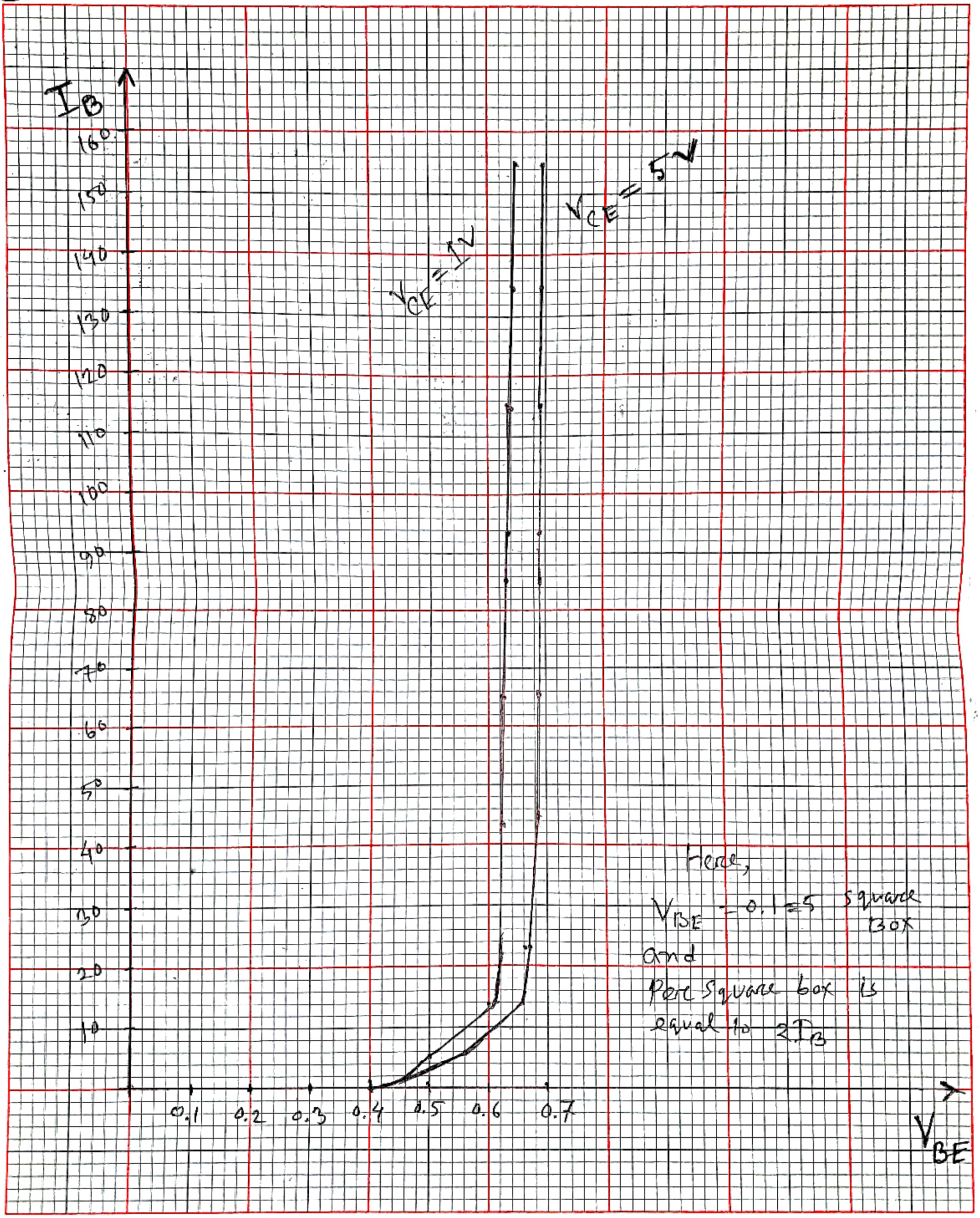
$V_{CE} = 1V$			$V_{CE} = 5V$	
V_{BB} (V)	V_{BE} (V)	$I_B = \frac{V_{RB}}{R_B}$ (μA)	V_{BE} (V)	$I_B = \frac{V_{RB}}{R_B}$
0.1	0.10	0	0.11	0
0.3	0.21	0	0.24	0
0.5	0.46	0.10	0.48	0.10
0.7	0.50	5.7	0.57	1.0
1.0	0.62	3.7	0.62	3.6
2.0	0.63	13.2	0.66	13.3
3.0	0.63	23.6	0.67	22.6
4.0	0.64	35.0	0.68	33.1
5.0	0.64	43.7	0.68	43.1
7.0	0.64	64.0	0.68	63.6
9.0	0.64	83.4	0.68	83.6
10.0	0.65	93.9	0.68	93.8
12.0	0.65	114.0	0.68	114.0
14.0	0.65	133.7	0.69	133.4
16.0	0.65	153.4	0.69	153.9

Table (2) Output characteristic of BJT

$I_B = 20 \mu A$			$I_B = 30 \mu A$	
V_{cc} (V)	V_{CE} (V)	$I_c = \frac{V_{Rc}}{R_c}$ (mA)	V_{CE} (V)	$I_c = \frac{V_{Rc}}{R_c}$ (mA)
1.0	0.09	0.95	0.07	0.98
2.0	0.12	1.84	0.10	1.88
3.0	0.16	2.77	0.12	2.86
4.0	0.56	3.37	0.14	3.76
5.0	1.46	3.40	0.17	4.79
6.0	2.49	3.43	0.24	5.66
8.0	4.40	3.43	1.81	6.13
10.0	6.28	3.49	3.73	6.26
12.0	8.25	3.54	5.54	6.35
14.0	10.09	3.60	7.44	6.50
16.0	12.29	3.69	9.38	6.59
18.0	14.28	3.71	11.32	6.73
20.0	16.24	3.75	13.12	6.84
22.0	18.10	3.81	15.03	6.95
24.0	20.20	3.96	16.87	7.05
/	/	/	/	/

(1)

Roll No. ....



I_B
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0.1
0.2
0.3
0.4
0.5
0.6
0.7
V_{BE}
$V_{CE} = 1V$
$V_{CE} = 5V$
Here,
V_{BE} - 0.1 = 5 square box
and
Per square box is equal to $2I_B$

(2)

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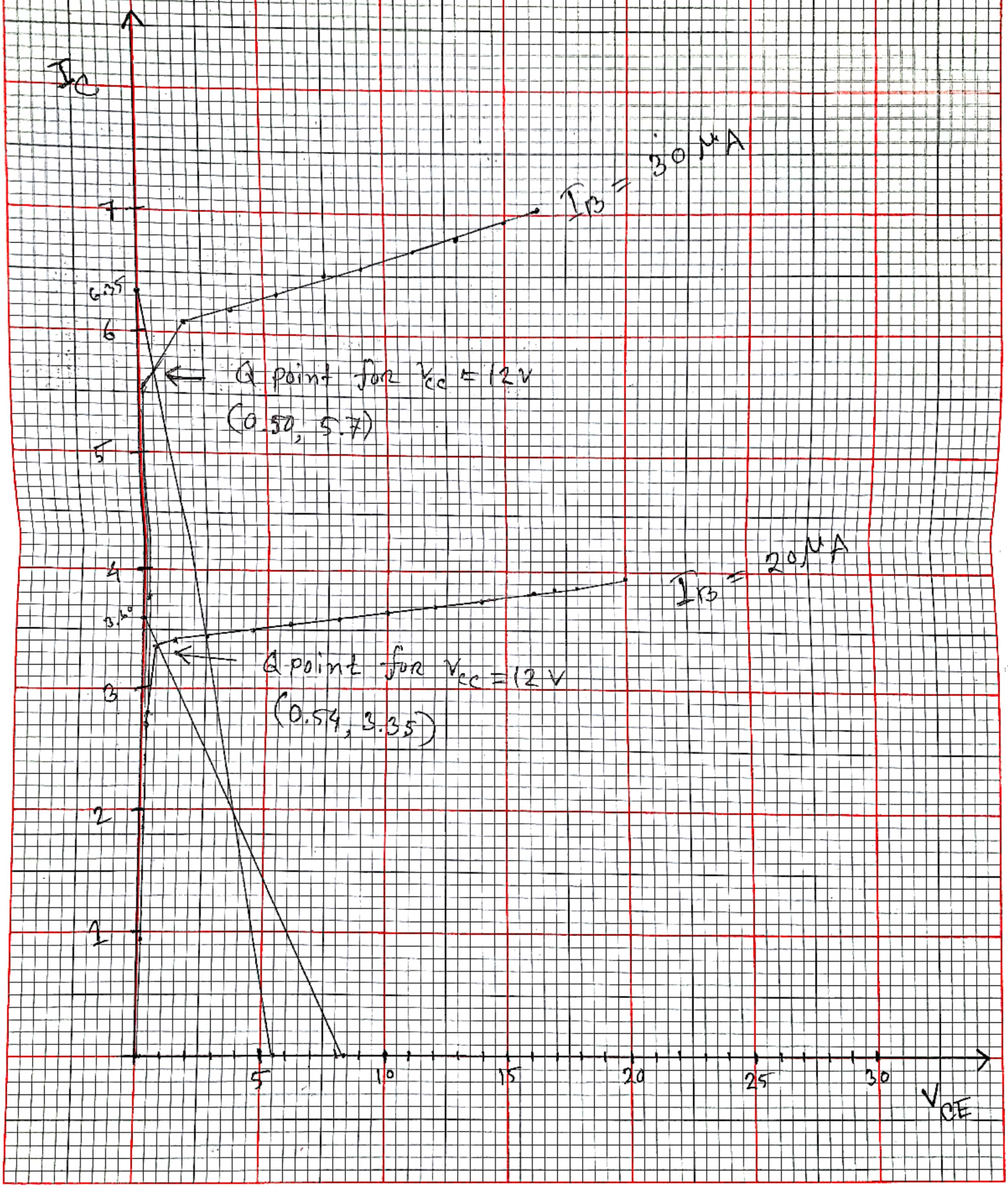

I_C
7
6.35
6
5
4
3.60
3
2
1
5
10
15
20
25
30
V_{CE}
$I_B = 30\mu A$
$I_B = 20\mu A$
Q point for $V_{CC} = 12V$
(0.50, 5.7)
Q point for $V_{CC} = 12V$
(0.54, 3.35)

(3) From table-2 output characteristic of BJT we see V_{CE} is 1.46 volt when V_{CC} is 5 volt. when $I_B = 20 \mu A$ and for $I_B = 30 \mu A$ $V_{CE} = 1.81$ Volt when $V_{CC} = 8.0$ Volt. As we know between '0' and approximately 1 volt V_{CE} the region is called as saturation region. So, for active region β we will consider V_{CE} after 1 volt.

β table for I_B in active region:

$I_B = 20\,\mu A$			$I_B = 30\,\mu A$		
V_{ce} (V)	I_c (mA)	$\beta = \frac{I_c}{I_B}$	V_{ce} (V)	I_c (mA)	$\beta = \frac{I_c}{I_B}$
5.0	3.40	170	5.0	-	-
6.0	3.43	171.5	6.0	-	-
8.0	3.49	174.5	8.0	6.13	204.3
10.0	3.54	177	10.0	6.26	208.67
14.0	3.69	182	14.0	6.50	216.67
18.0	3.75	187.5	18.0	6.73	224.33
22.0	3.85	192.5	22.0	6.95	231.67
24.0	3.96	198	24.0	7.05	235

(4) For $V_{cc} = 12\ V$, we drew the load line on the graph and we get two different co-ordinates for $I_B = 20\ \mu A$ and $30\ \mu A$ graph.

When $I_B = 20\ \mu A$ graph Q Point : $(0.54, 3.35)$

When, $I_B = 30\ \mu A$ graph Q point : $(0.50, 5.7)$

Discussion : The base current I_B increases with the increases in the emitter-base voltage V_{BE} which is similar to the forward diode characteristic.

The value of the collector current I_c increased with the increase of V_{cc} at constant voltage. The value β also increases when V_{cc} falls. The I_c also decrease rapidly.

The collector-base junction of the transistor in saturation work as forward biased but in active region work as reverse biased.

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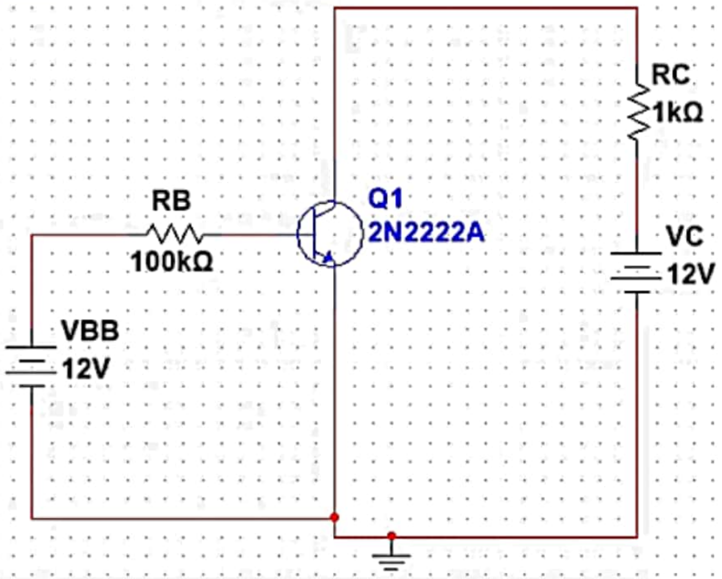

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Parameter Sweep | Parameter Sweep | Parameter Sweep | Parameter Sweep

lab05
Device Parameter Sweep

	Variable, Parameter setting	Operating point value
1	V(3), vvc dc=0	12.00000
2	V(3), vvc dc=0.6	12.00000
3	V(3), vvc dc=1.2	12.00000
4	V(3), vvc dc=1.8	12.00000
5	V(3), vvc dc=2.4	12.00000
6	V(3), vvc dc=3	12.00000
7	V(3), vvc dc=3.6	12.00000
8	V(3), vvc dc=4.2	12.00000
9	V(3), vvc dc=4.8	12.00000
10	V(3), vvc dc=5.4	12.00000
11	V(3), vvc dc=6	12.00000

Nets | Components | Copper layers | Simulation

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