Course Name:	**EEEEL**	**Semester:**	**I/II**
Date of Performance:	**22 / 11 /2024**	**Batch No:**	**C4-1**
Student Name:	Ramesh Patel	**Roll No:**	**16010124224**
Faculty Sign & Date:		**Grade/Marks:**	**/20**

Experiment No: 8 Title: BJT Common Emitter Characteristics

Aim and Objective of the Experiment:

- To understand the structure and working of Bipolar Junction Transistor
- To plot the Common Emitter characteristics of a BJT

COs to be achieved:

CO5: Understand Bipolar Junction transistor and its applications.

Requirements:

PC with internet facility

Link for virtual lab:
https://be-iitkgp.vlabs.ac.in/exp/common-emitter-characteristics/

Theory:

Structure of Bipolar Junction Transistor

A bipolar junction transistor, BJT, is a single piece of silicon with two back-to-back P-N junctions. BJTs can be made either as PNP or as NPN. They have three regions and three terminals, emitter, base, and collector represented by E, B, and C respectively.

Emitter (E): It is the region to the left end which supply free charge carriers i.e., electrons in n-p-n or holes in p-n-p transistors. These majority carriers are injected to the middle region i.e. electrons in the p region of n-p-n or holes in the n region of p-n-p transistor. Emitter is a heavily doped region to supply a large number of majority carriers into the base.

Base (B): It is the middle region where either two p-type layers or two n-type layers are sandwiched. The majority carriers from the emitter region are injected into this region. This region is thin and very lightly doped.

Collector (C): It is the region to right end where charge carriers are collected. The area of this region is largest compared to emitter and base region. The doping level of this region is intermediate between heavily doped emitter region and lightly doped base region.

Input Characteristics

It is the plot of the base current, I_B, versus the base-emitter voltage,VBE, for various values of the collector-emitter voltage,V_{CE} for constant V_{CE}

Output Characteristics

It is the plot of the collector current, I_C, versus the collector-emitter voltage, V_{CE}, for various values of the base current, I_B

Circuit Diagram/ Block Diagram:

BJT Common Emitter - Input Characteristics

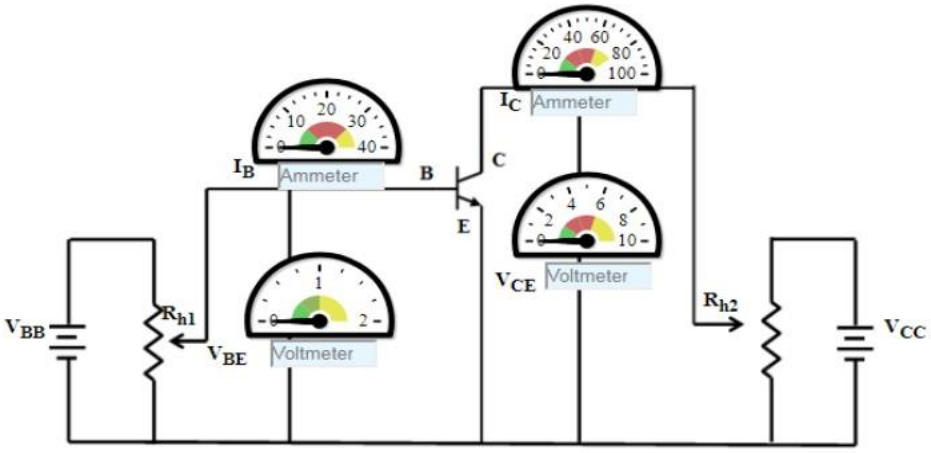


Figure:1

BJT Common Emitter - Output Characteristics

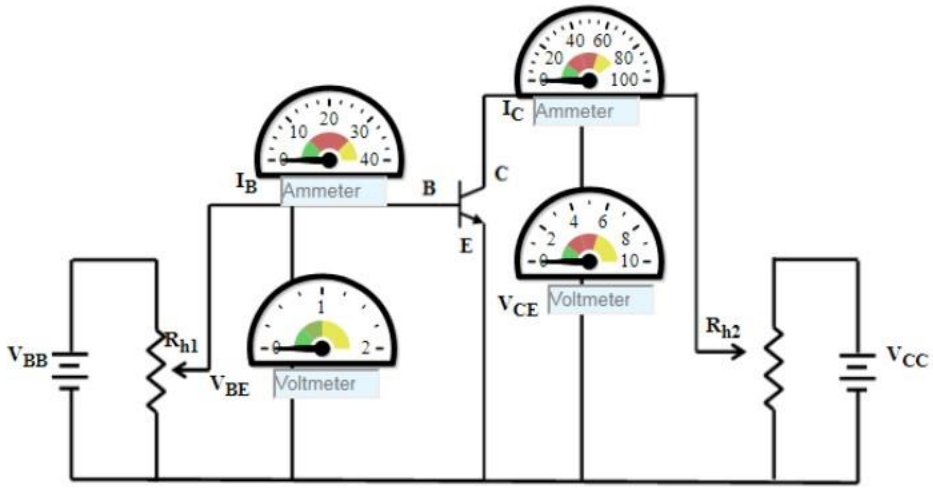


Figure: 2

Stepwise-Procedure:

BJT Common Emitter - Input Characteristics

1. Initially set rheostat Rh1 = 1 Ω and rheostat Rh2 = 1 Ω
2. Set the Collector-Emitter Voltage(VCE) to 1 V by adjusting the rheostat Rh2
3. Base Emitter Voltage(VBE) is varied by adjusting the rheostat Rh1.
4. Note the reading of Base current(IB)in micro Ampere.
5. Click on 'Plot' to plot the I-V characteristics of Common-Emitter configuration. A graph is drawn with VBE along X-axis and IB along Y-axis.
6. Click on 'Clear' button to take another sets of readings
7. Now set the Collector-Emitter Voltage(VCE) to 2 V, 3 V, 4 V

BJT Common Emitter - Output Characteristics

1. Initially set rheostat Rh1 = 1 Ω and rheostat Rh2 = 1 Ω
2. Set the Base current(IB)15 uA by adjusting the rheostat Rh1
3. Vary the Collector-Emitter Voltage(VCE)is varied by adjusting the rheostat Rh2.
4. Note the reading of Collector current(IC).
5. Click on 'Plot' to plot the I-V characteristics of Common-Emitter configuration. A graph is drawn with VCE along X-axis and IC along Y-axis.
6. Click on 'Clear' button to take another sets of readings

7. Now set the Base Current(IB) to 20 uA

V-Lab Screen shots

BJT- CE INPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Collector-Emitter Voltage 1.000 V	
	Base-Emitter Voltage V	Base Current(μA)
1	0.1000	2.326
2	0.2000	2.680
3	0.3000	3.089
4	0.4000	3.560
5	0.5000	4.104
6	0.6000	4.732
7	0.7000	5.455
8	0.8000	6.290
9	0.9000	7.253
10	1.000	8.364
11	1.200	11.12
12	1.400	14.80
13	1.600	19.68
14	1.800	26.19

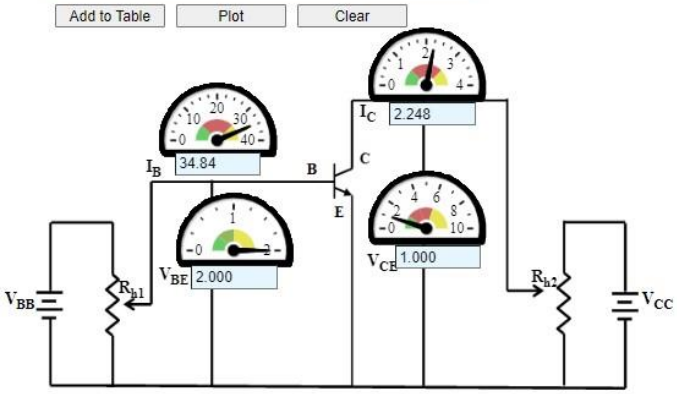
CONTROLS

R_{h1} Ohms 100
R_{h2} Ohms 10

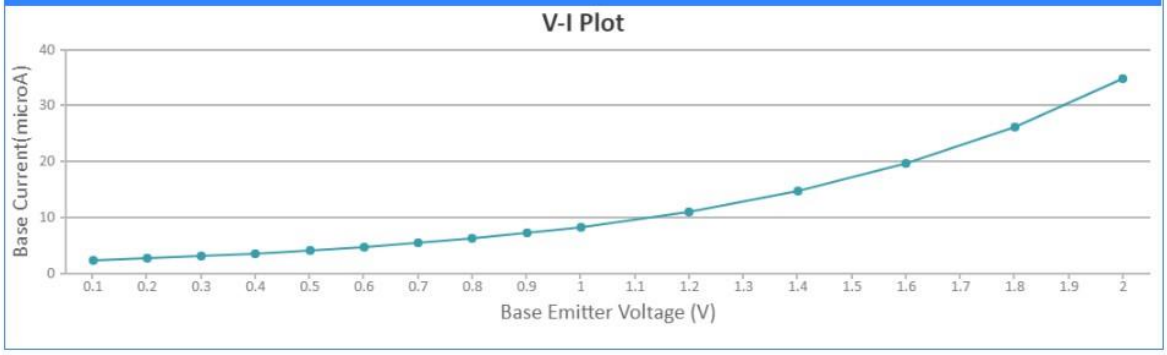
Add to Table | Plot | Clear

Print It

Take another sets of Base-Emitter and Base Current readings for another Collector-Emitter value



GRAPH PLOT



BJT- CE INPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Collector-Emitter Voltage 2.000 V	
	Base-Emitter Voltage V	Base Current(μA)
1	0.1000	2.335
2	0.2000	2.690
3	0.3000	3.098
4	0.4000	3.570
5	0.5000	4.114
6	0.6000	4.741
7	0.7000	5.465
8	0.8000	6.300
9	0.9000	7.263
10	1.000	8.374
11	1.200	11.13
12	1.400	14.81
13	1.600	19.69
14	1.800	26.20

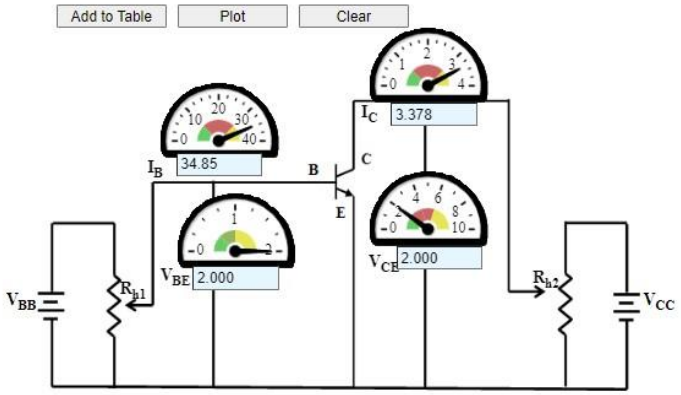
CONTROLS

R_{h1} Ohms 100
R_{h2} Ohms 20

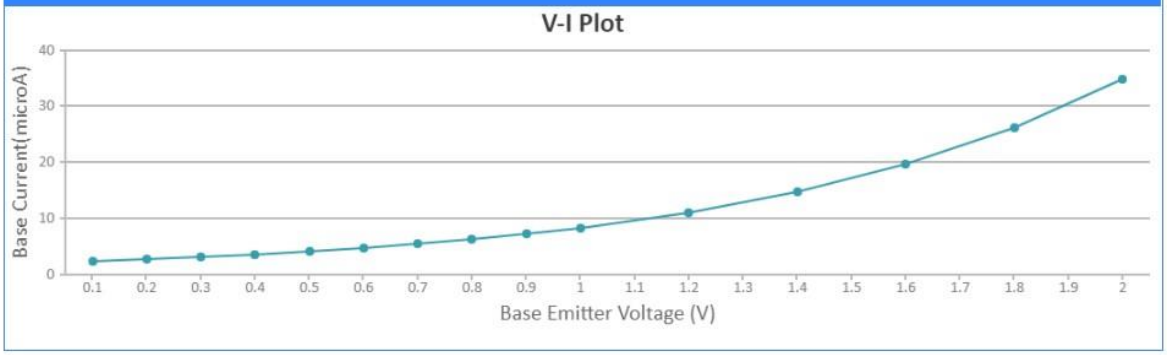
Add to Table | Plot | Clear

Print It

Take another sets of Base-Emitter and Base Current readings for another Collector-Emitter value



GRAPH PLOT



BJT- CE INPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Collector-Emitter Voltage 3.000 V	
	Base-Emitter Voltage V	Base Current(μA)
1	0.1000	4.011
2	0.2000	4.365
3	0.3000	4.774
4	0.4000	5.246
5	0.5000	5.789
6	0.6000	6.417
7	0.7000	7.141
8	0.8000	7.975
9	0.9000	8.939
10	1.000	10.05
11	1.200	12.81
12	1.400	16.48
13	1.600	21.37
14	1.800	27.87

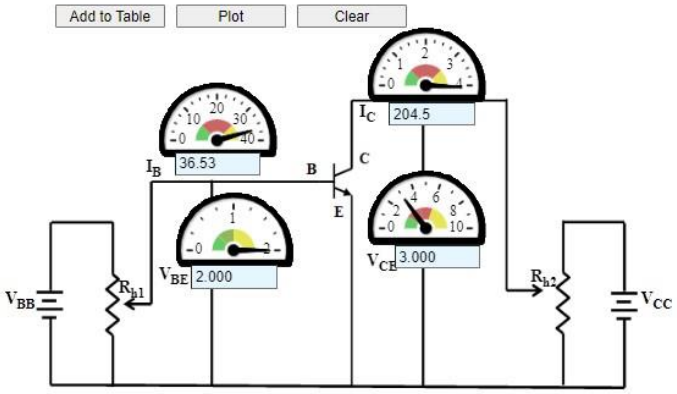
CONTROLS

R_{h1} Ohms 100
R_{h2} Ohms 30

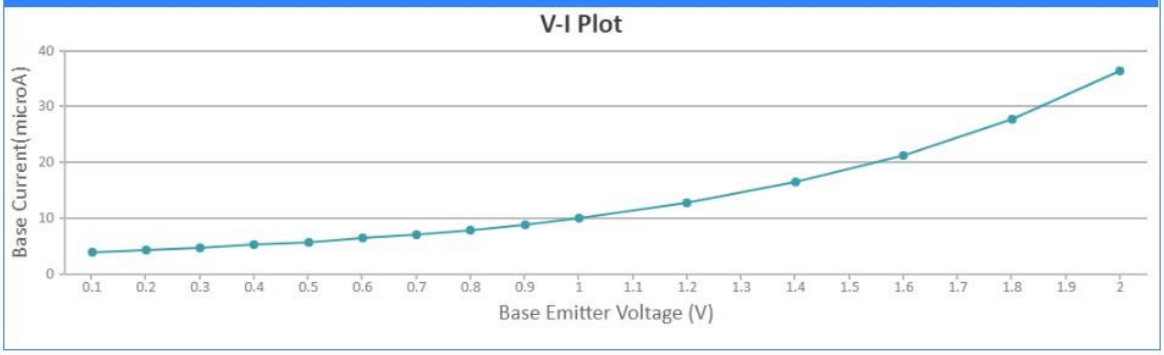
Print It

Take another sets of Base-Emitter and Base Current readings for another Collector-Emitter value

Add to Table | Plot | Clear



GRAPH PLOT



BJT- CE OUTPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Base-Current 15.35 µA	
	Collector-Emitter Voltage V	Collector Current mA
1	0.1000	5.994
2	0.2000	11.87
3	0.3000	17.52
4	0.4000	22.85
5	0.5000	27.79
6	1.000	45.81
7	2.000	57.98
8	4.000	60.10
9	5.000	60.14
10	6.000	60.14
11	8.000	60.14
12	10.00	60.14

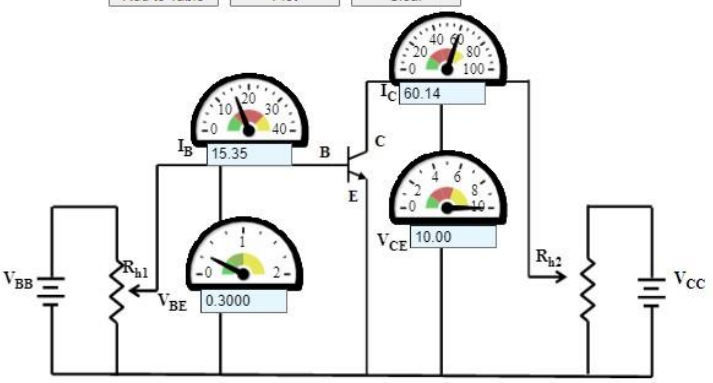
CONTROLS

R_{h1} Ohms 15
R_{h2} Ohms 100

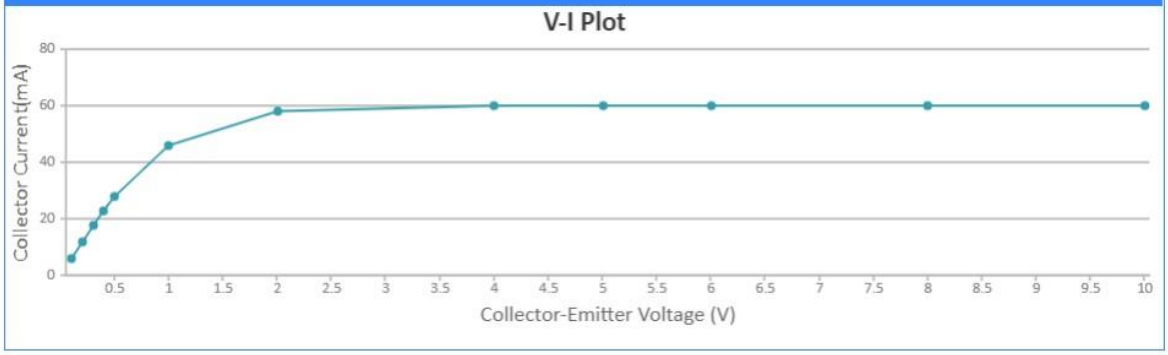
Print It

Take another sets of Collector-Emitter and
Collector Current readings for another Base Current

Add to Table | Plot | Clear



GRAPH PLOT



BJT- CE OUTPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Base-Current 20.43 µA	
	Collector-Emitter Voltage V	Collector Current mA
1	0.1000	9.202
2	0.2000	18.22
3	0.3000	26.90
4	0.4000	35.08
5	0.5000	42.66
6	1.000	70.31
7	2.000	89.00
8	4.000	92.26
9	6.000	92.32
10	8.000	92.32
11	10.00	92.32

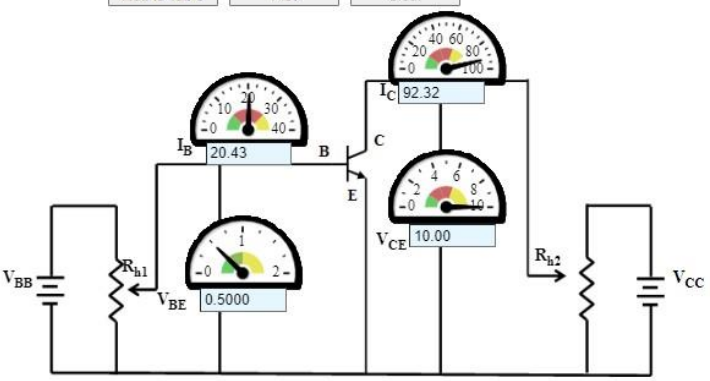
CONTROLS

R_{h1} Ohms 25
R_{h2} Ohms 100

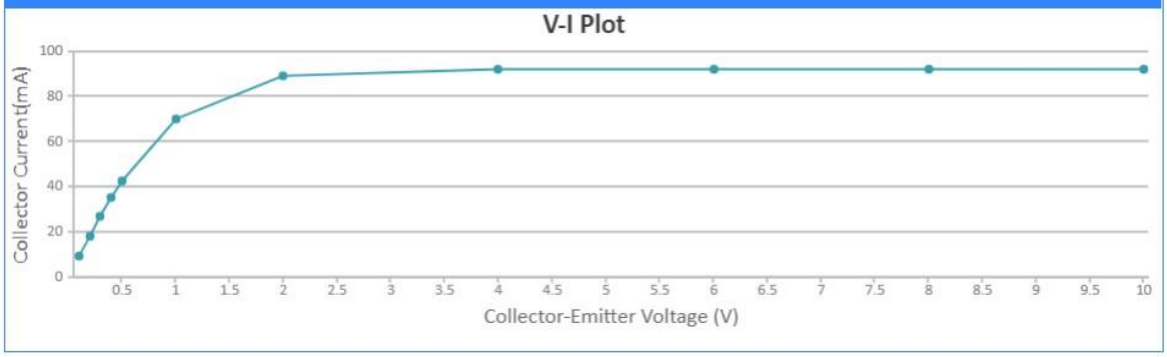
Print It

Take another sets of Collector-Emitter and Collector Current readings for another Base Current

Add to Table | Plot | Clear



GRAPH PLOT



BJT- CE OUTPUT CHARACTERISTICS

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Base-Current 25.67 µA	
	Collector-Emitter Voltage V	Collector Current mA
1	0.1000	12.96
2	0.2000	25.67
3	0.3000	37.89
4	0.4000	49.42
5	0.5000	60.11
6	1.000	99.07
7	2.000	125.4
8	4.000	130.0
9	6.000	130.1
10	8.000	130.1
11	10.00	130.1

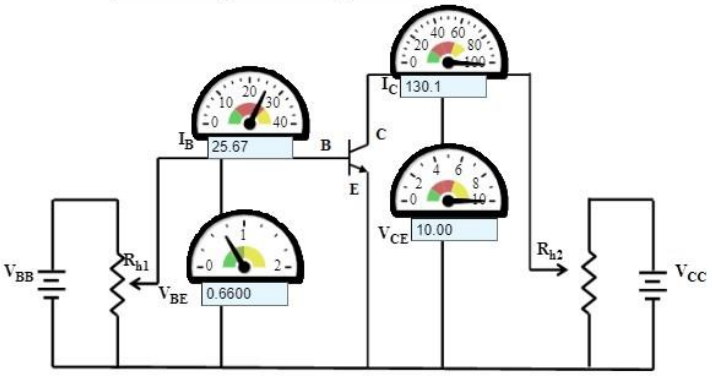
CONTROLS

R_{h1} Ohms 33
R_{h2} Ohms 100

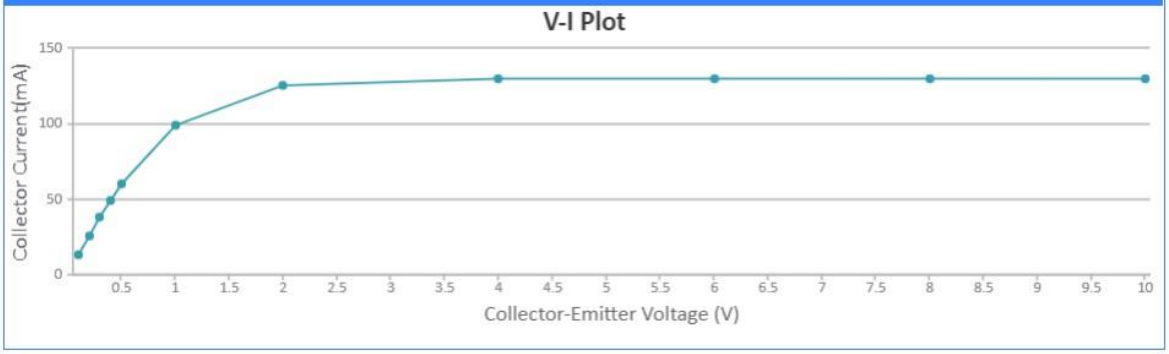
Add to Table | Plot | Clear

Print It

Take another sets of Collector-Emitter and Collector Current readings for another Base Current



GRAPH PLOT



Post Lab Subjective/Objective type Questions:

1. Explain the structute of a BJT and the current relationships of the BJT CE amplifier

A bipolar junction transistor (BJT) is a semiconductor device that amplifies current and is made up of three doped regions and two P-N junctions:

Emitter: The left-most region that supplies majority carriers, such as electrons in an NPN transistor or holes in a PNP transistor

Base: The middle region that receives majority carriers from the emitter

Collector: The right-most region that collects charge carriers

2. Draw and explain the various regions of operation of the BJT amplifier

Conclusion:

Signature of faculty in-charge with Date: