Experiment No. - 05

Common Base (CB)

Object :-

Current Transfer characteristic of Common Base transfer configuration.

Apporatus required :-

NPN transistor Kit, milliammeters, maltimiter Voltmeter, power supply connection wires.

Formula use :-

$$\alpha_{ac} = \frac{\Delta I_C}{\Delta I_E}$$

Construction :-

The Bipolar Junction Transistor :-

Basically, it consists of two back-to-back P-N Juncation manufactured in a single piece of a semiconductor crystal. There two junctions give rise to three regions called emitter base and collector.

The emitter base and collector are provided with terminals which are labelled as E, B and c. The two juncations are: emitter-base (E/B) Juncation and collector-base (C/B) junction. for NPN transistor it points from base to emitter meaning that base (and collector as well) is positive with respect to emitter.

1. Emitter :-

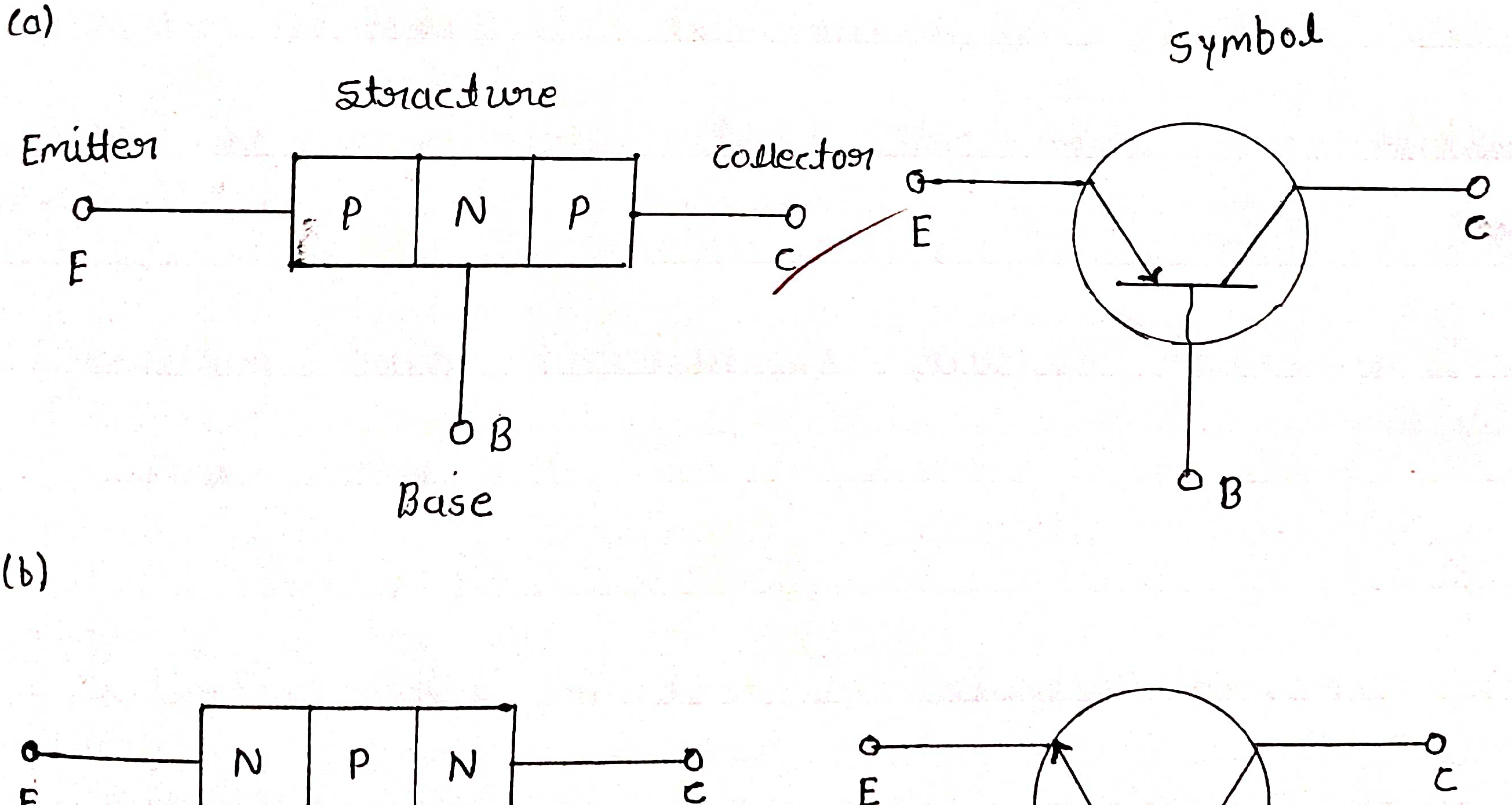
It forms the left-hand section of region of the transistor as shown in fig.

It is more heavily dopend than any of the other regions because its main funcation is to supply majority charge carriers to the base.

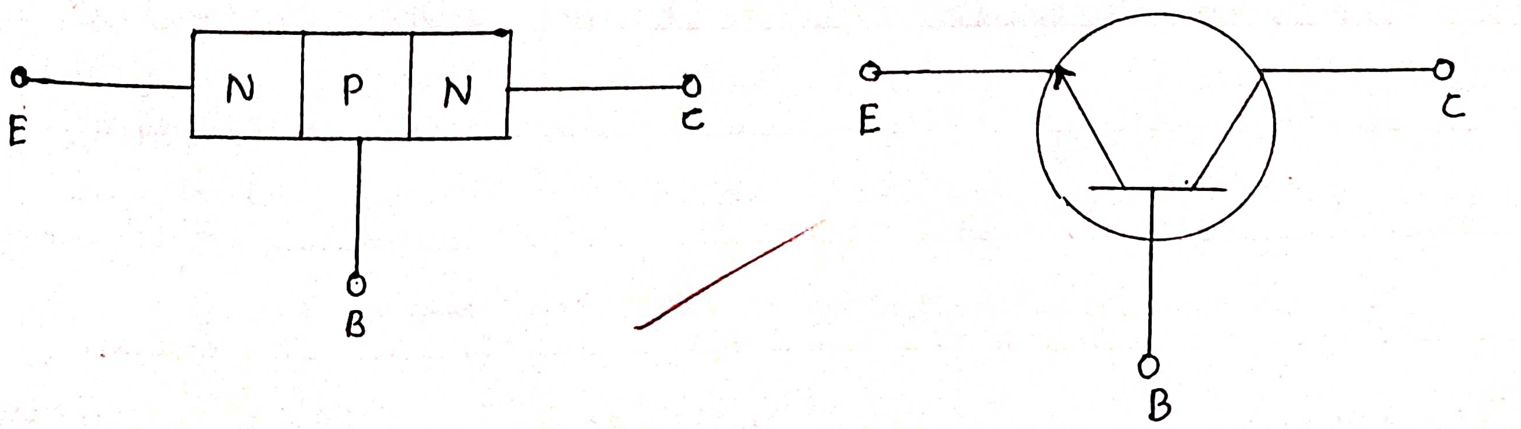
2. Base :-

It forms the middle section of the transistor. It is very thin (10^{-6}m) as compared to either the emitter or collector and is very lightly doped.

(a)



(b)



3. Collector :-

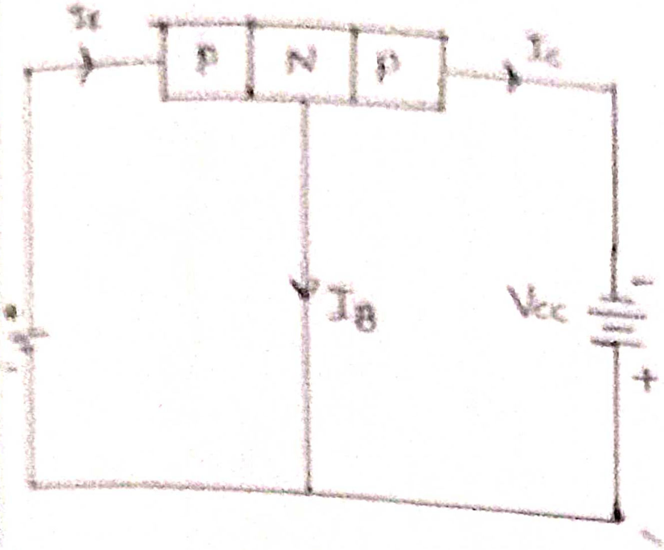
If form the right-hand side section of the transistor shown in fig. and its main funcation is to collect majority charge carriers through the base.

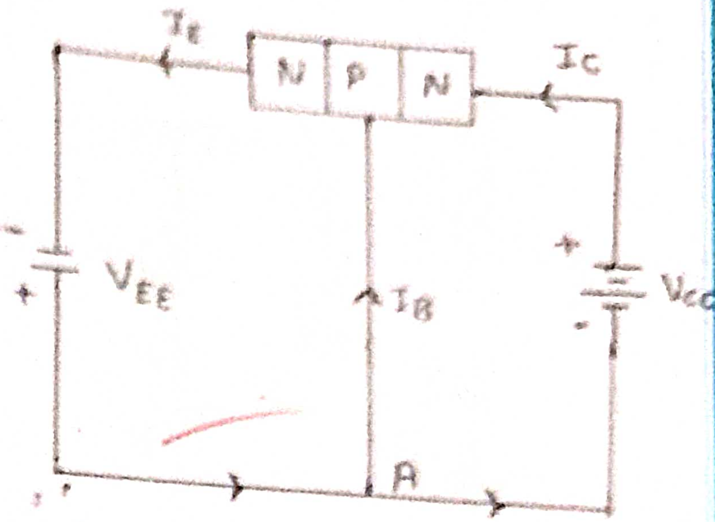
Transistor Biasing :-

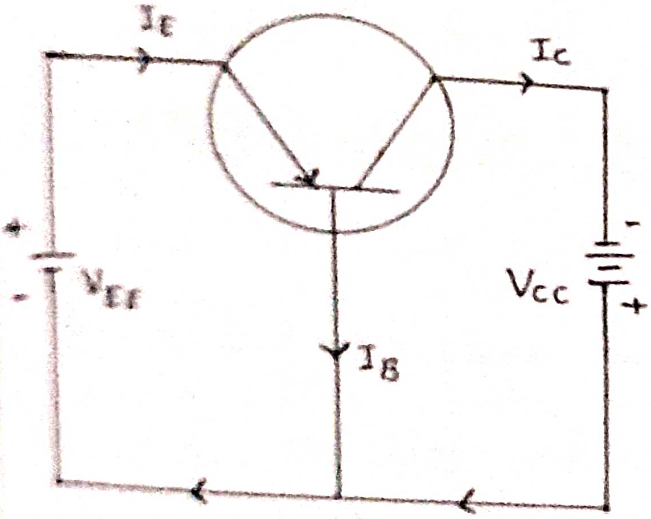
For people of a transistor it is essential to apply voltage of correct polarity across its two junctions. It is worth-while to remember that the normal operation.

1. emitter - base junction ~~is~~ always forward biased, and

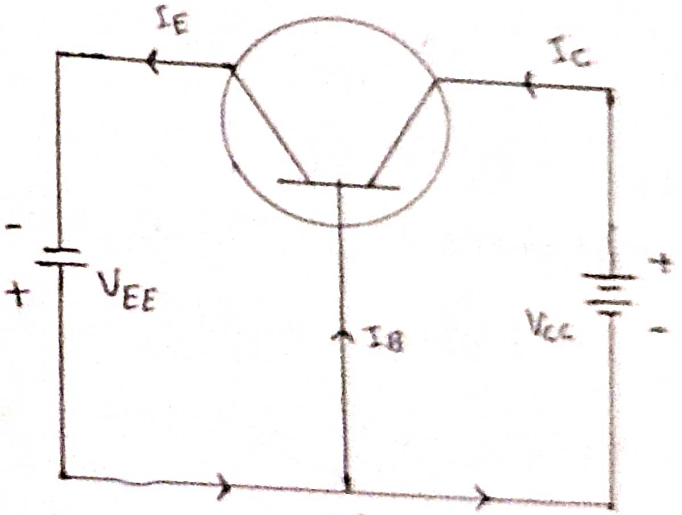
2. Collector - base junction is always reverse biased.





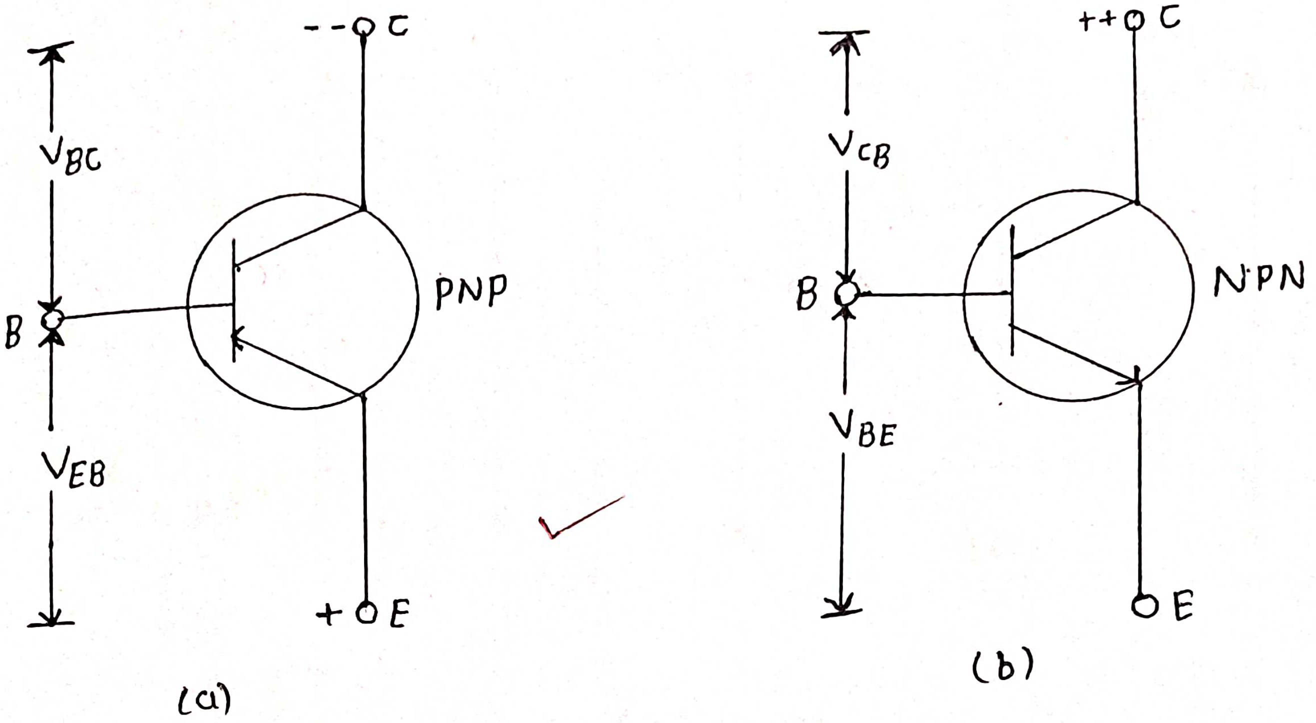


(a)



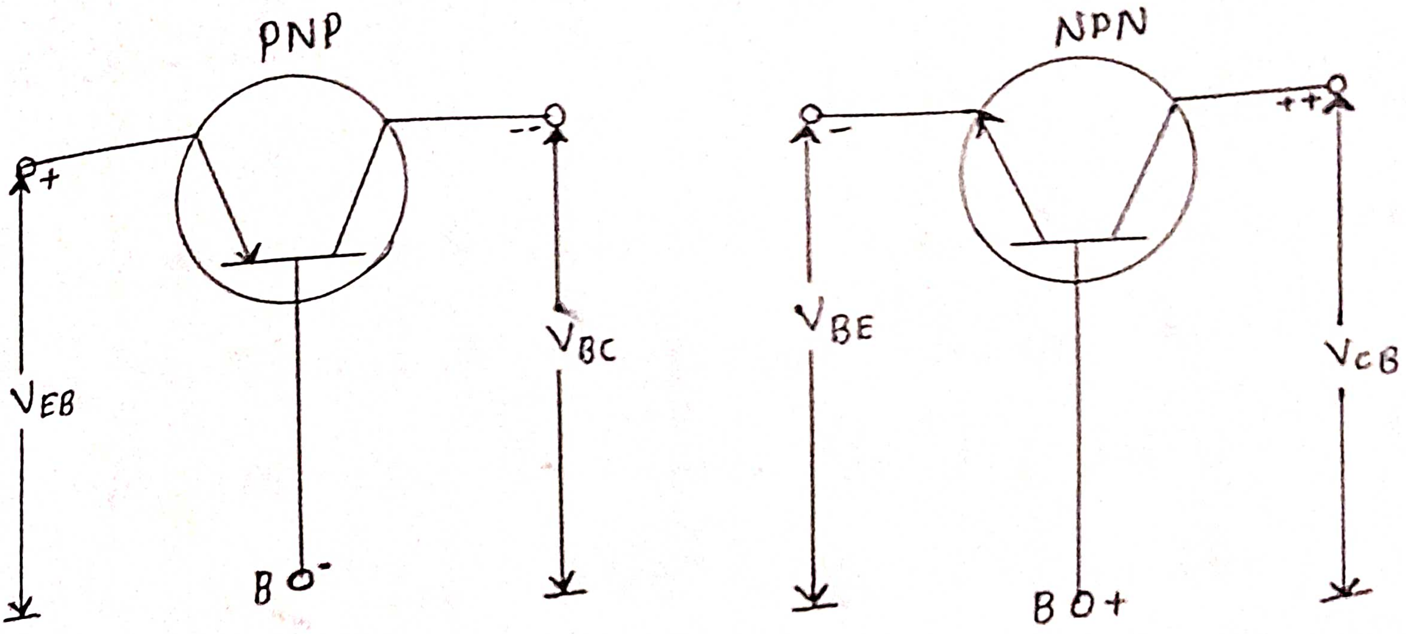
(b)

In fig two batteries respectively provide the dc emitter supply voltage V_{EE} and collector supply voltage V_{CC} for properly biasing the two junctions of the transistor.



Important Biasing Rule :-

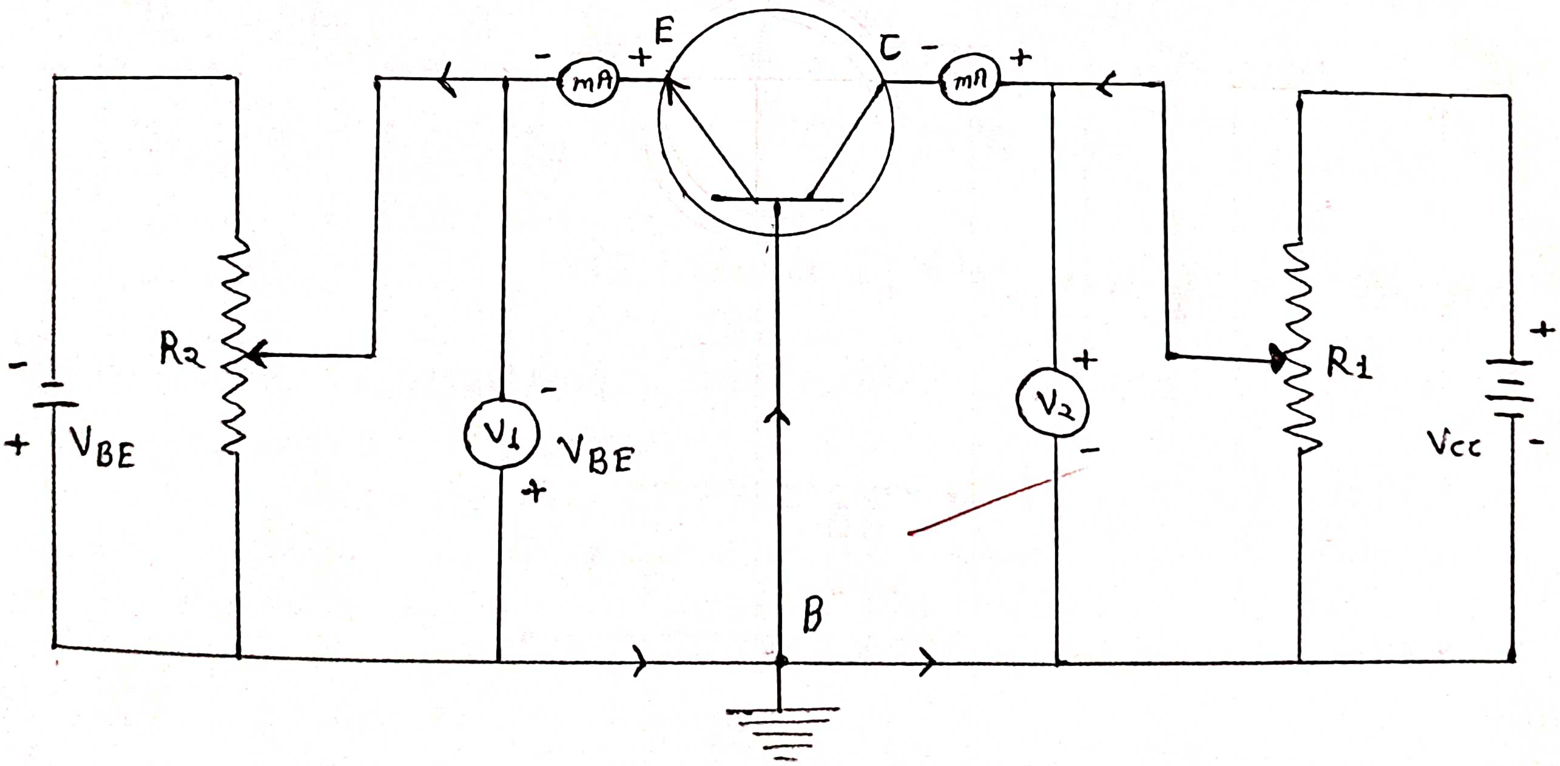
For a PNP transistor bath collector and base are negative with respect to the emitter of course, collector is more negative than base Similarly for NPN transistor bath collector and base are positive with respect to the emitter. A gain collector is more positive than the base as shown in fig.



respect to base. Now between the base and collector themselve, collector is more negative than base. Hence their potential difference is written as V_{BC} and note as V_{CB} Same is the case with voltage marked in fig.

Common Base Test Circuit :-

The static characteristics of an NPN transistor connected in common-base configuration can be determined by the use of test circuit shown in fig. millimmeters are included in series with the emitter and collector circuits to measure I_E and I_C similarly voltmeters are connected



Circuit :- NPN Transistor in CB mode

across E and B to measure Voltage V_{BE} and across C and B to measure V_{CB}*

Current Transfer characteristic :-

It shows how I_C veries with changes in I_E when V_{CB} in held constant. For drawing this characteristic first V_{CB} in set a convenient value and the I_E is increased in steps and corresponding values of I_C noted. A typical transfer characteristic is shown in fig.

As seen, α_{ac} may be found from the equation.

$$\alpha_{ac} = \frac{\Delta I_C}{\Delta I_E}$$

usually α_{ac} is found from output characteristic than from this characteristic.

It may be noted in the end that CB Connection is rarely employed for audio - frequency circuits because (i) its current gain is less than unity and (ii) Its input and output resistances are so different.

Observation table :-

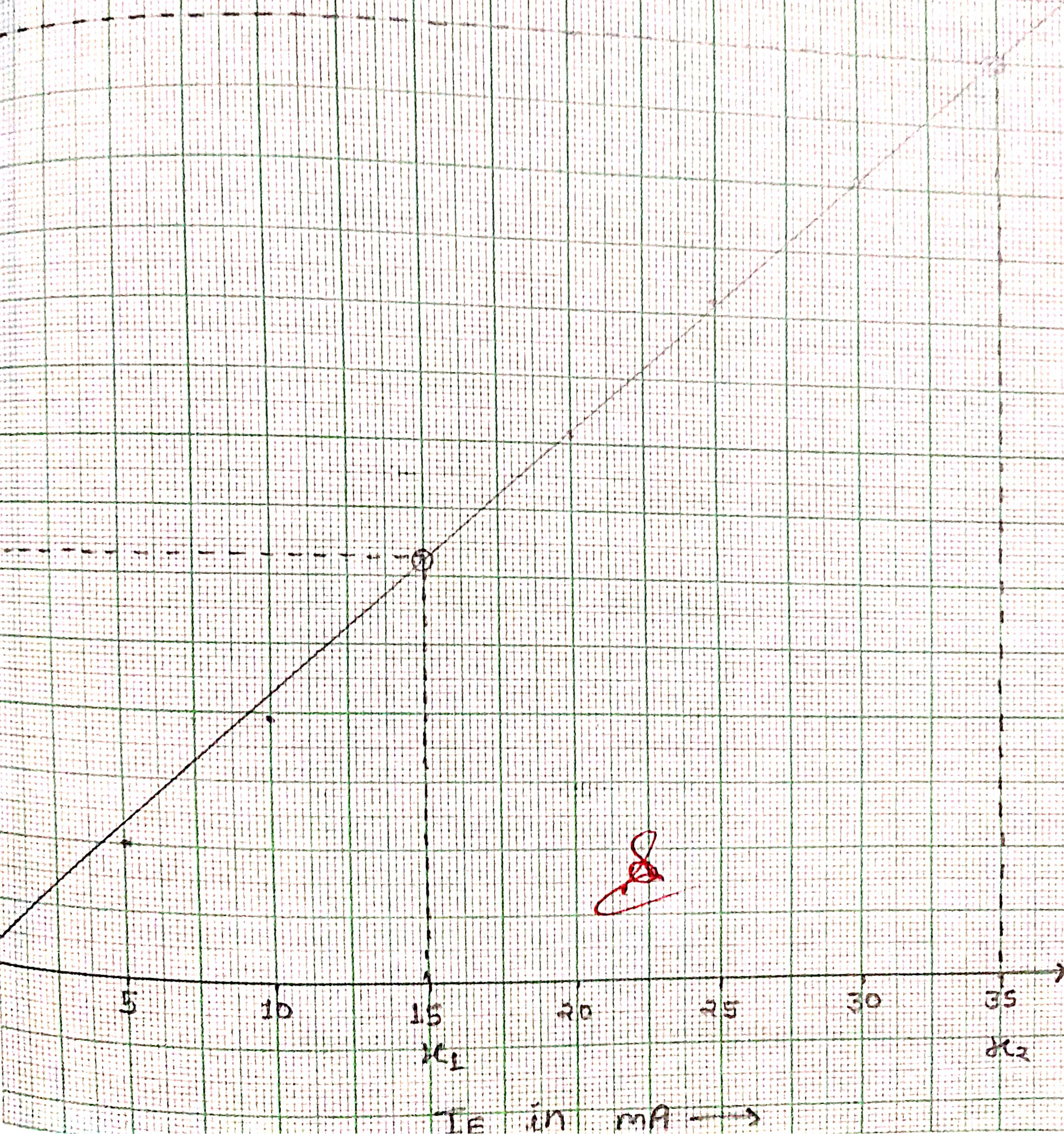
S.N.	Input emitter current I_E in (mA)	output collector current I_C in (mA)
1.	0	0
2.	5	5
3.	10	9
4.	15	16
5.	20	21
6.	25	26
7.	30	31
8.	35	35
9.	40	40
10.		

Date of Submission :

Scale

on x axis 1 cm = 5mA

on y axis 1 cm = 5mA



Calculation :-

$\delta I_c = 35 - 16$ and $\delta I_E = 35 - 15$

$\delta I_c = 19$ $\delta I_E = 20$

then.

$$\alpha_{ac} = \frac{\Delta I_c}{\Delta I_E}$$

$$\alpha = \frac{19}{20}$$

$$\alpha = 0.95$$

$$\alpha = 0.95 < 1$$

Result :-

The current gain of this given NPN transistor in common - base - configura -tion is $\alpha = 0.95$

Seen/checked by
6/1/23