Characteristic of PNP Tranistor in CB configuration

Object: To study the characteristic of PNP transistor in common base configuration.

Apparatus used: Transistor, variable DC source of range 0-3 volt and 0-15volts, voltmeter of range 0-3 and 0-15volt, mili-ammeter, wires/leads.

Theory: Transistor is an electronic component which is used in place of triode valve. It has application in amplification of signals, design of oscillators etc. It has three terminals which are termed as emitter, base and collector. It can be connected in circuit in three modes.

(1) Common base configuration

(2) Common emitter configuration and

(3) Common collector configuration.

According to two port analysis in terms of hybrid parameters, the input voltage (V_{EB}) and output current (I_C) are function of input current (I_E) and output voltage (V_{CB}) . i.e.

$$\left.\begin{aligned} V_{EB} &= h_{ib}\, I_E + h_{rb}\, V_{CB} \\ I_C &= h_{fb}\, I_E + h_{ob}\, V_{CB} \end{aligned}\right\} \qquad (1)$$

According to equation (1), there are four characteristic curves of transistor in common base configuration which are defined as follows.

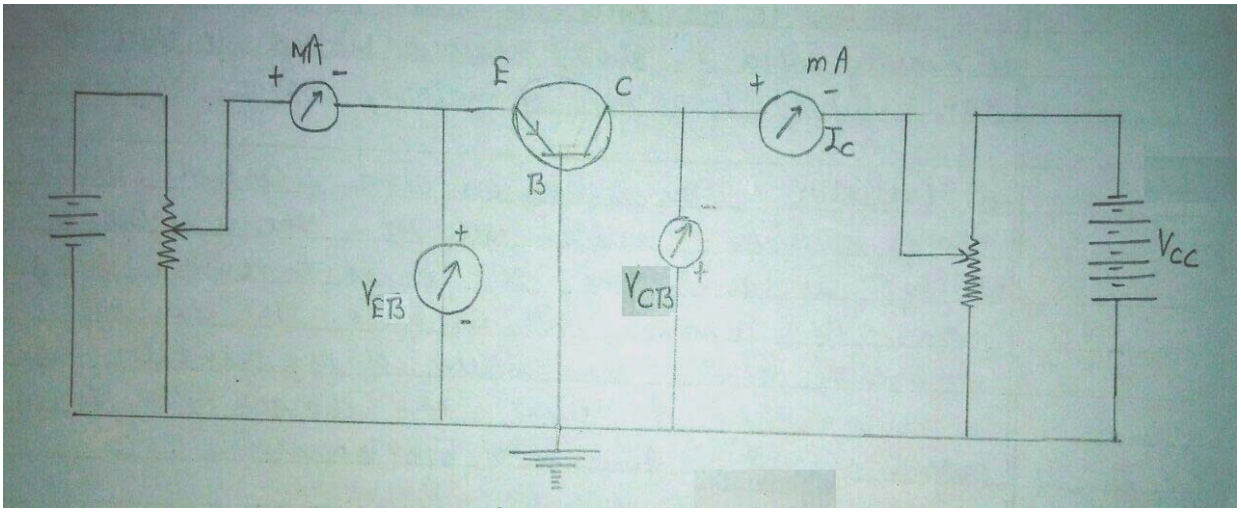
(1) Input characteristic: The variation of input current (I_E) with input voltage (V_{EB}) at constant output voltage (V_{CB}) provides the input characteristics. Input resistance can be obtained by this characteristic curve.

(2) Output characteristic: The variation of output current (I_C) with output voltage (V_{CB}) at constant input current (I_E) provides the output characteristics. Output admittance and output resistance can be determined with help of this characteristic curve.

(3) Forward current transfer characteristic: The variation of output current (I_C) with input current (I_E) at constant output voltage (V_{CB}) provides the forward current transfer characteristics. The slop of curve gives the DC current gain in CB configuration.

(4) Reverse voltage transfer characteristic: The variation of input voltage (V_{EB}) with output voltage (V_{CB}) at constant input current (I_E) provides the reverse voltage transfer characteristics.

Circuit Diagram:



Observation:

A. Table for input characteristic

1. Least count of voltmeter= 0.02 V
2. Least count of ammeter= 1 mA

Sr. No.	V_{CB}=0volt		V_{CB}=8volt	
	V_{EB} *(Volt)*	I_E (mA)	V_{EB} *(Volt)*	I_E (mA)
1.	*0*	*0*	*0*	*0*
2.	*0.6*	*0*	*0.6*	*1*
3.	*0.62*	*1*	*0.62*	*2*
4.	*0.64*	*2*	*0.64*	*3*
5.	*0.66*	*4*	*0.66*	*5*
6.	*0.68*	*6*	*0.68*	*8*
7.	*0.7*	*9*	*0.7*	*10*
8.	*0.72*	*11*	*0.72*	*13*
9.	*0.74*	*14*	*0.74*	*16*
10.	*0.76*	*17*	*0.76*	*19*
11	*0.78*	*20*	*0.78*	*23*
12.	*0.8*	*23*	*0.8*	*26*
13.	*0.82*	*26*	*0.82*	*30*
14.	*0.84*	*29*	*0.84*	*33*
15.	*0.86*	*33*	*0.86*	*38*
16.	*0.88*	*37*	*0.88*	*42*
17.	*0.9*	*40*	*0.9*	*46*
18.	*0.92*	*43*	*0.92*	*49*

B. Table for Output characteristic

1. Least count of voltmeter= 0.2 V
2. Least count of ammeter= 1 mA

Sr. No.	*V_{CB} (volts)*	*I_C (mA)*			
		I_E=2 mA	*I_E=4 mA*	*I_E=6 mA*	*I_E=8 mA*
1.	*0*	*1.8*	*3.8*	*5.8*	*7.8*
2.	*1*	*2.0*	*4.0*	*6.0*	*8.0*
3.	*2*	*2.0*	*4.0*	*6.0*	*8.0*
4.	*3*	*2.0*	*4.0*	*6.0*	*8.0*
5.	*4*	*2.0*	*4.0*	*6.0*	*8.0*
6.	*5*	*2.0*	*4.0*	*6.0*	*8.0*
7.	*6*	*2.0*	*4.0*	*6.0*	*8.0*
8.	*7*	*2.0*	*4.0*	*6.0*	*8.0*
9.	*8*	*2.0*	*4.0*	*6.0*	*8.0*
10.	*9*	*2.0*	*4.0*	*6.0*	*8.0*

C. Table for forward current transfer characteristic

V_{CB}=2 volts =constant

Sr. No.	*I_E (mA)*	*I_C (mA)*
1.	*0*	*0*
2.	*5*	*5*
3.	*10*	*10*
4.	*15*	*15*
5.	*20*	*19*
6.	*25*	*24*
7.	*30*	*29*
8.	*35*	*33*
9.	*40*	*38*

Result: ***The following results can be written on the basis of characteristic curve.***

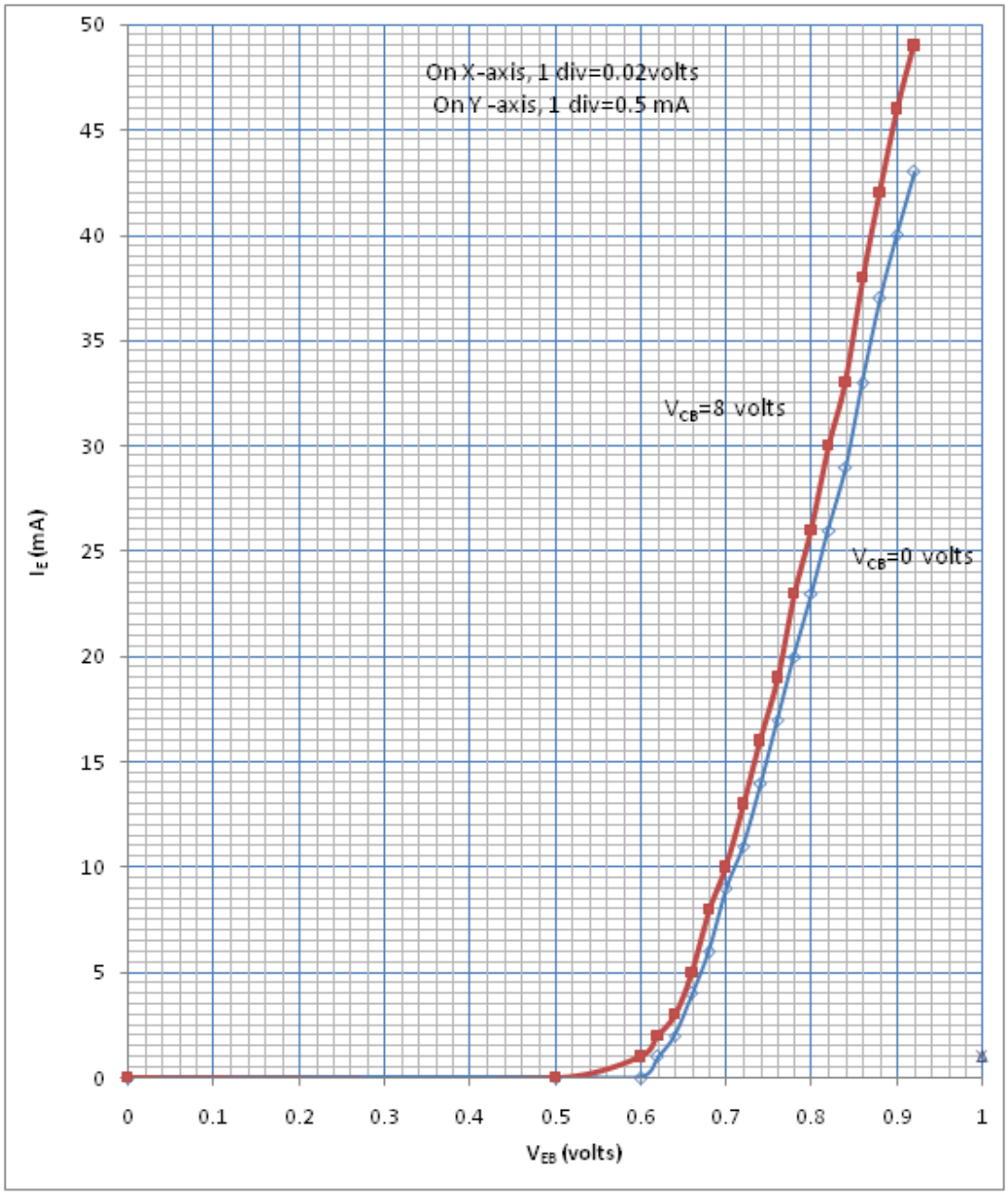
(A) Input characteristic curve shows that emitter current I_E increases rapidly with small increases in input voltage V_{EB} after knee voltage at constant output voltage. As output voltage V_{CB} made more negative, I_E rises more rapidly.

(B) Output characteristic curve shows that the output current I_C is approximately independent of output voltage V_{CB} at constant input current I_E . Even at zero output voltage, there is finite value of output current.

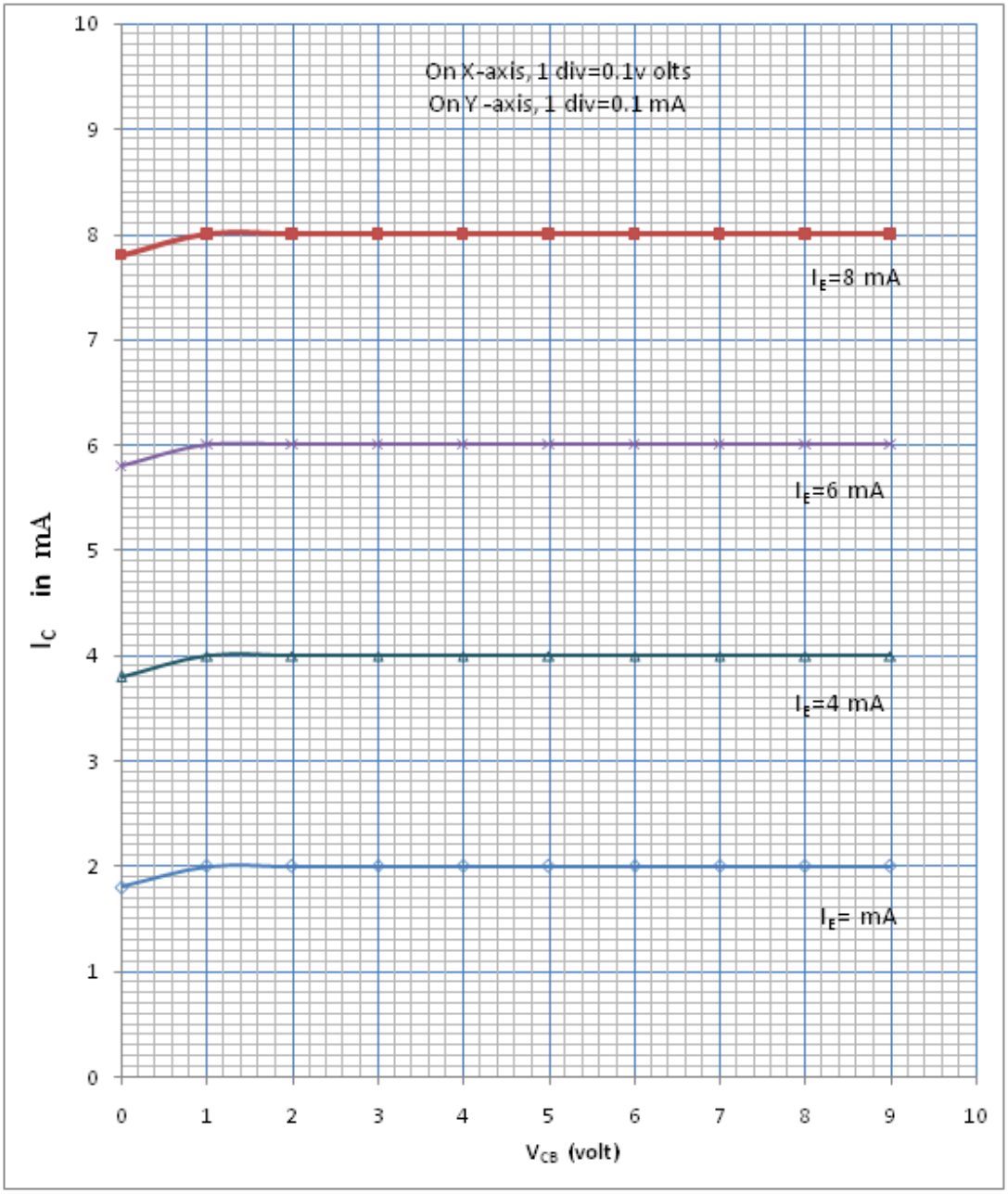
(C) The forward current transfer characteristic curve indicates that output current I_C is linearly related with input current I_E. But the value of I_C can not be greater than the I_E hence current gain will be less than 1.

Precautions:

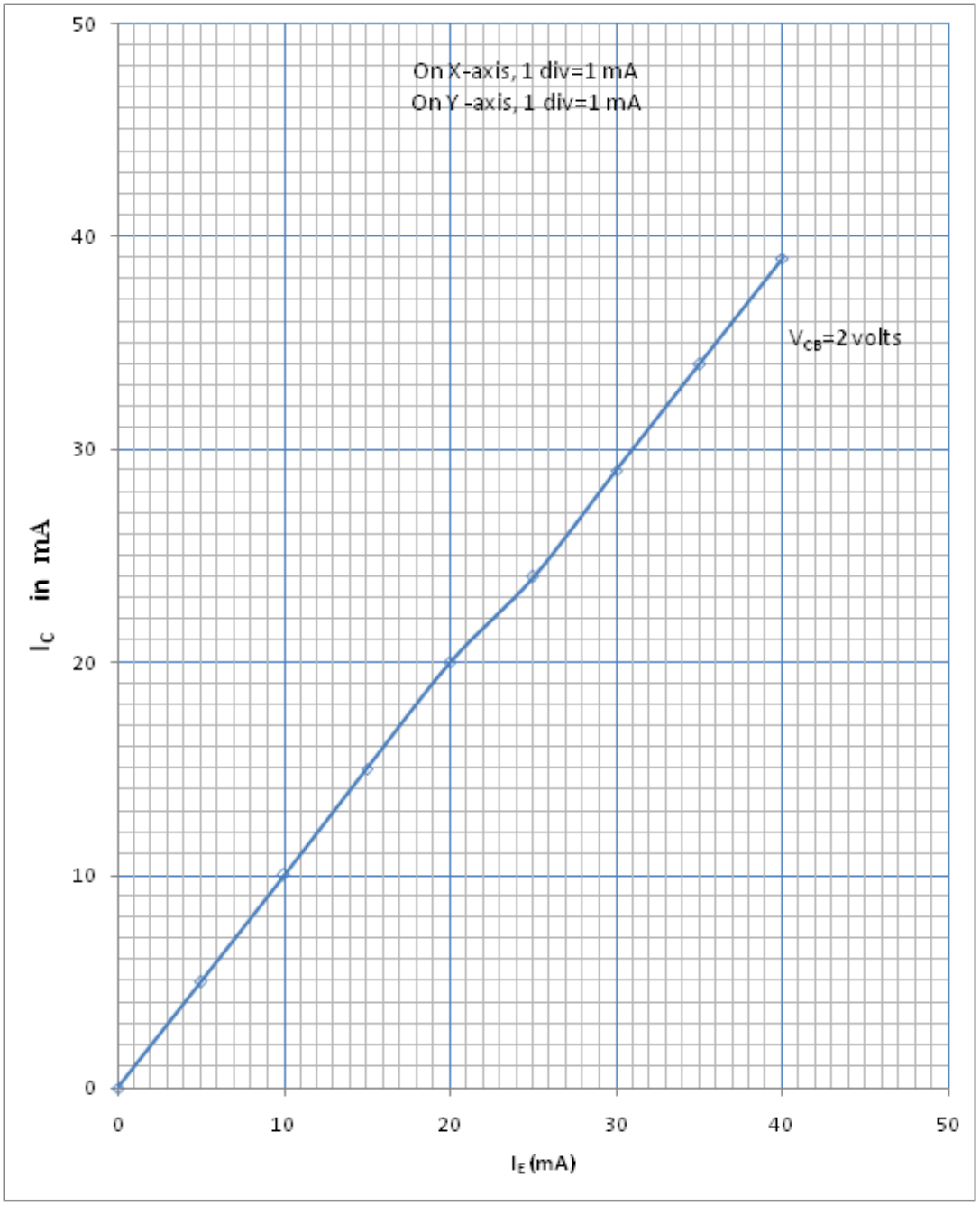
1. The connection should be tight otherwise fluctuation in voltage and current will happen.
2. At the turning point of curve, more reading should be taken.
3. For the accuracy, current should be taken both in mA and μA..
4. The reading should be in multiple of least count.



Input characteristic Curve



Output characteristic Curve



Current Transfer characteristic Curve