

Characteristic of PNP Transistor in CE configuration

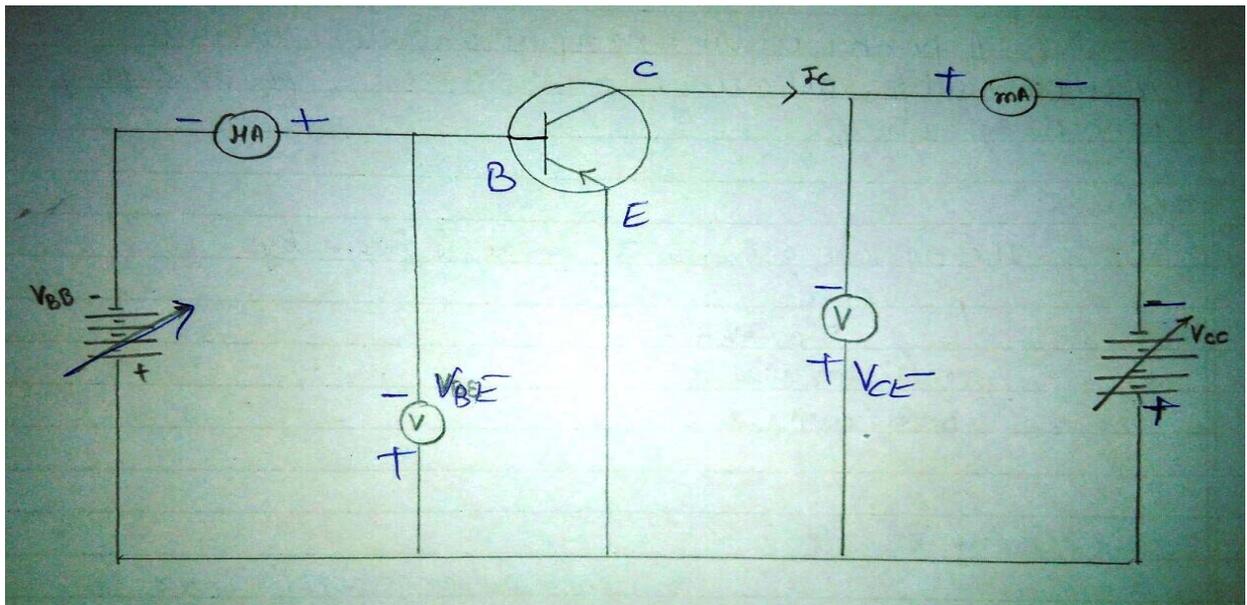
Object: To draw and study the characteristic of PNP transistor in common emitter configuration.

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: There are four characteristic curves of transistor in common emitter configuration which are defined as follows.

- (1) **Input characteristic:** The variation of input current (I_B) with input voltage (V_{BE}) at constant output voltage (V_E) 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_{CE}) at constant input current (I_B) 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_B) at constant output voltage (V_{CB}) provides the forward current transfer characteristics. The slop of curve gives the DC current gain in CE configuration.
- (4) **Reverse voltage transfer characteristic:** The variation of input voltage (V_{BE}) with output voltage (V_{CE}) at constant input current (I_B) provides the reverse voltage transfer characteristics.

Circuit Diagram:



Observation:-

(i). Table for graph between I_B vs V_{BE} [Table For Input characteristics]

| S.N. | $V_{CE} = 0V$ | | $V_{CE} = 2V$ | |
|------|---------------|-------------|---------------|-------------|
| | V_{BE} | I_B | V_{BE} | I_B |
| 1. | 0.52 | 5 μA | 0.60 | 5 μA |
| 2. | 0.56 | 10 μA | 0.62 | 10 μA |
| 3. | 0.58 | 15 μA | 0.64 | 15 μA |
| 4. | 0.60 | 20 μA | 0.66 | 25 μA |
| 5. | 0.62 | 35 μA | 0.68 | 45 μA |
| 6. | 0.64 | 40 μA | 0.70 | 60 μA |
| 7. | 0.66 | 55 μA | 0.72 | 70 μA |
| 8. | 0.68 | 70 μA | 0.74 | 85 μA |
| 9. | 0.70 | 85 μA | 0.76 | 110 μA |
| 10. | 0.72 | 100 μA | 0.78 | 125 μA |
| 11. | 0.74 | 120 μA | 0.80 | 140 μA |
| 12. | 0.76 | 135 μA | 0.82 | 155 μA |
| 13. | 0.78 | 155 μA | 0.84 | 175 μA |
| 14. | 0.80 | 170 μA | | |
| 15. | 0.82 | 190 μA | | |

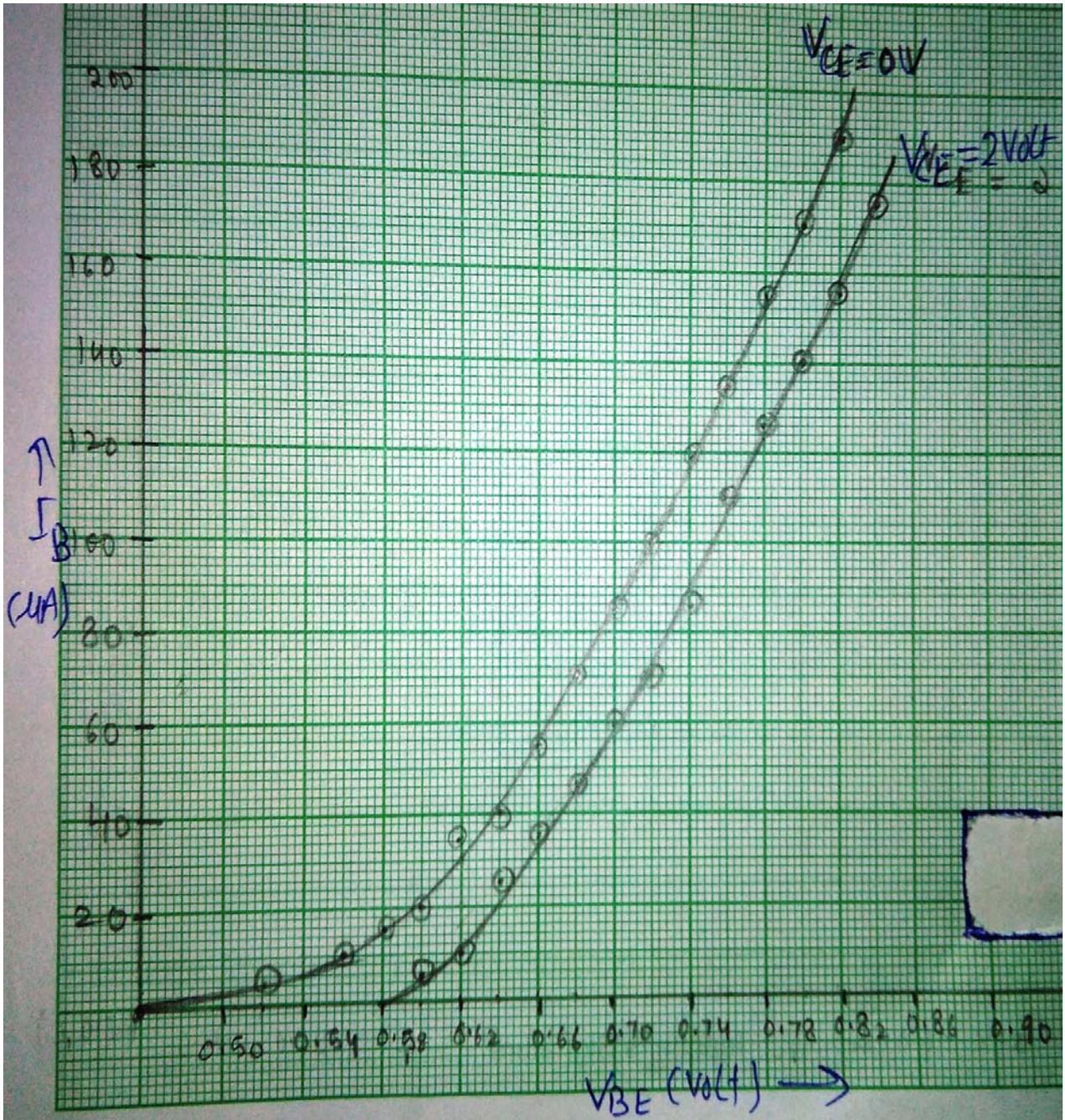
B. Table for Output characteristic

| <i>Sr. No.</i> | <i>V_{CE}</i> (volts) | <i>I_C</i> (mA) | | | |
|--------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| | | <i>I_B</i> =20 μ A | <i>I_B</i> =40 μ A | <i>I_B</i> =60 μ A | <i>I_B</i> =80 μ A |
| 1. | 0 | 0 | 0 | 0 | 0 |
| 2. | 0.2 | 2.5 | 5.0 | 8.0 | 11.0 |
| 3. | 0.4 | 3.0 | 6.0 | 9.0 | 12.0 |
| 4. | 0.6 | 3.0 | 6.0 | 9.0 | 12.0 |
| 5. | 0.8 | 3.0 | 6.0 | 9.0 | 12.0 |
| 6. | 1 | 3.0 | 6.0 | 9.0 | 12.0 |
| 7. | 2 | 3.0 | 6.0 | 9.0 | 12.0 |
| 8. | 3 | 3.0 | 6.0 | 9.0 | 12.0 |
| 9. | 4 | 3.0 | 6.0 | 9.0 | 12.0 |
| 10. | 5 | 3.0 | 6.0 | 9.0 | 12.0 |
| 11. | 6 | 3.0 | 6.0 | 9.0 | 12.0 |
| 12.. | 7 | 3.0 | 6.0 | 9.0 | 12.0 |
| 13. | 8 | 3.0 | 6.0 | 9.0 | 12.0 |
| 14. | 9 | 3.0 | 6.0 | 9.0 | 12.0 |

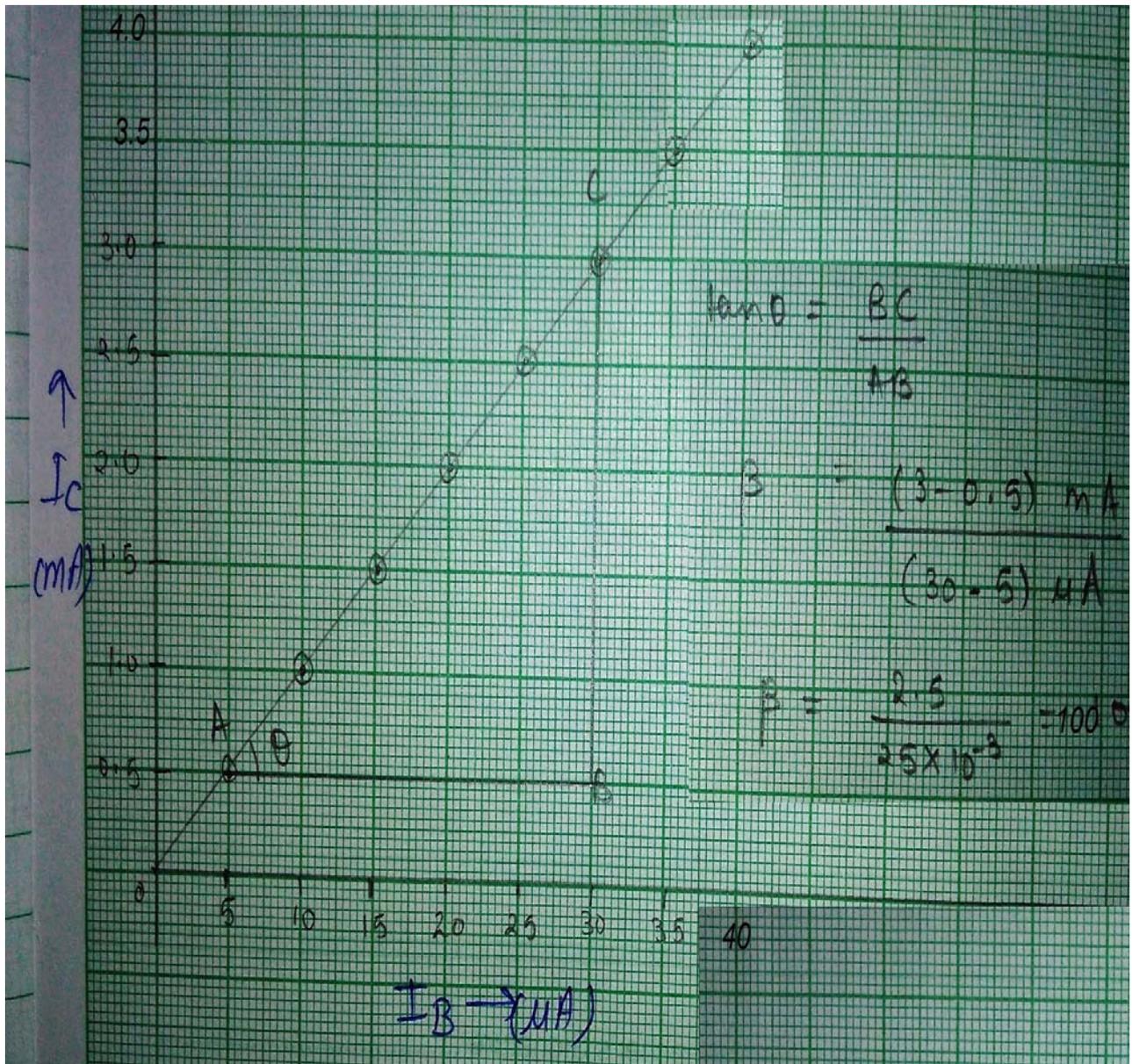
A. Table for forward current transfer characteristic

$V_{CB}=2.4$ volts =constant

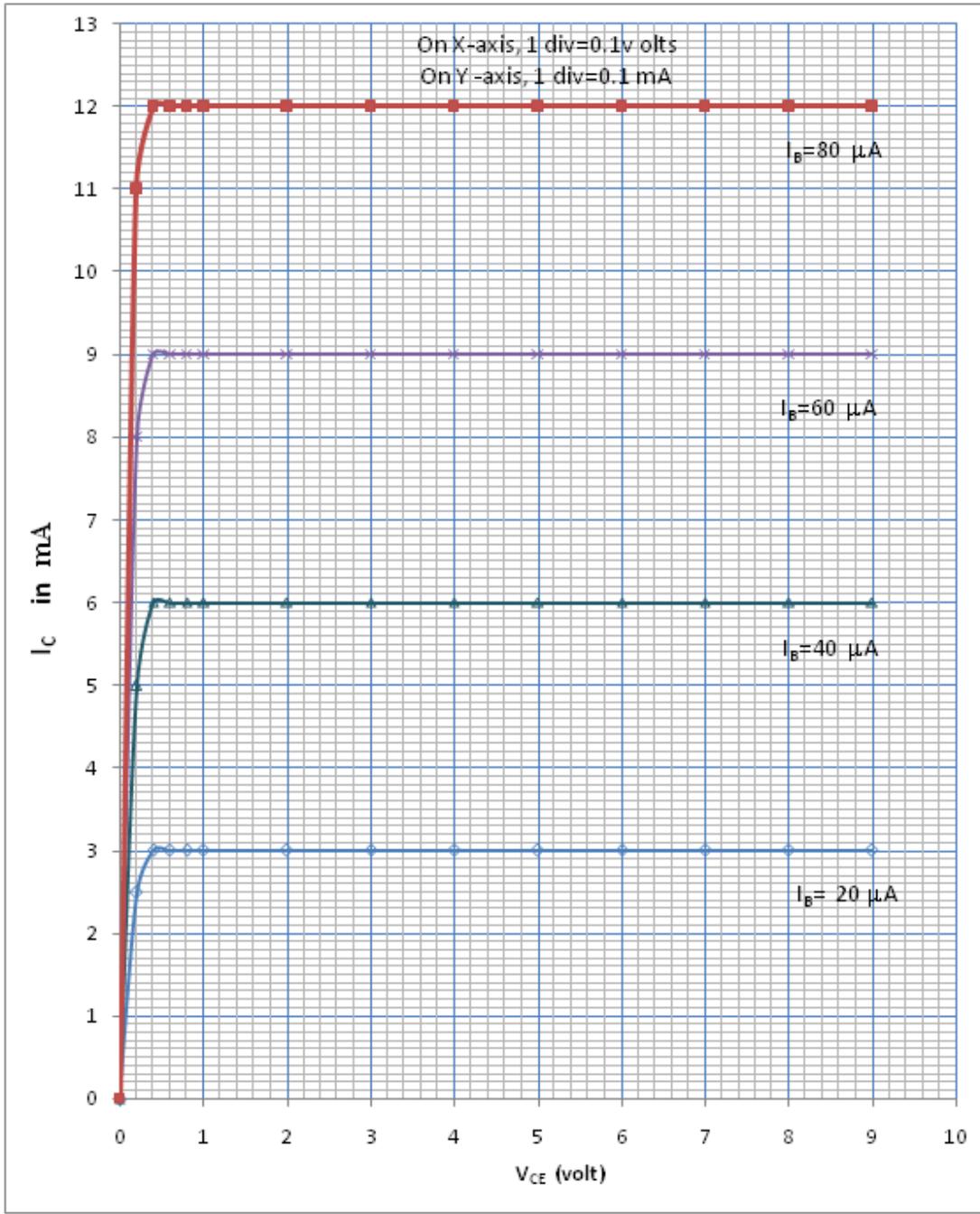
| <i>Sr. No.</i> | <i>I_B</i> (μ A) | <i>I_C</i> (mA) |
|--------------------|------------------------------------|------------------------------|
| 1. | 0 | 0 |
| 2. | 5 | 0.5 |
| 3. | 10 | 1.0 |
| 4. | 15 | 1.5 |
| 5. | 20 | 2.0 |
| 6. | 25 | 2.5 |
| 7. | 30 | 3.0 |
| 8. | 35 | 3.5 |
| 9. | 40 | 4.0 |



Input characteristic Curve



Current Transfer characteristic Curve



Output characteristic Curve

Result:-

The value of $\beta = 100$
from transfer characteristics

Discussion of Graph :-

- i). A study of input characteristics shows that the base current I_B rapidly increases as the value of V_{BE} is increased from knee voltage to the positive voltage.
- ii). The collector voltage V_{CE} has very little effect on the value of I_B .
- iii). At constant V_{BE} , I_B decreases with increase in V_{CE} .
- iv). A study of output characteristic shows that the collector current I_C depends upon the collector voltage and the base current starting from $V_{CE} = 0$. I_C varies at first steeply and after a particular voltage V_{CE} has been reached, I_C increases at a very slow rate. The linear is not as much as it is in the case of common base characteristic.

A graph between I_B & I_C is plotted obtaining a straight line for constant V_{CE} .

$$I_C \propto I_B$$
$$\Rightarrow I_C = \beta I_B$$