Experiment No. 5.

AIM: To plot Input and Output Characteristic curve of transistor in CB mode.

APPRATUS REQUIRED: Trainer kit comprising of voltmeter, ammeter, bipolar junction transistor, connecting wires, Power supply etc.

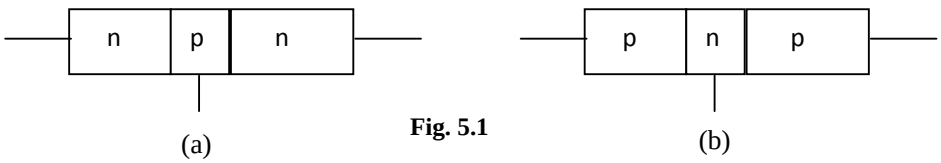
THEORY: A transistor consists of two pn-junctions connected back to back. It is formed by sandwiching either p-type or n-type semiconductors between a pair of opposites type, consisting of three terminals, Emitter (E), Base (B) and Collector (C).

(i) Emitter: One of the sides that supplies charge carriers is called emitter. It is always forward biased with respect to base so that it can supply a large number of carriers.

(ii) Collector: The section that collects the carriers is called collector. It is always reversed biased with respect to the base. Its function is to remove, charges from its junction with the base.

(iii) Base: The middle section which forms two pn-junctions between the emitter and collector is called the base. The base emitter is forward biased allowing low resistance to the emitter circuit and the base collector junction is reverse biased and provides high resistance.

Base is much thinner than that of the emitter while the collector is wider than the both as shown in fig 5.1 (a & b). Emitter is heavily doped so that it can inject a large number of charge carriers into the base. The base is lightly doped and it's thin; it passes most of the emitter injected charges into the collector. The collector is moderately doped.



(a) (b)

Fig. 5.1

Symbol of Transistors: Both the type of transistors are represented as shown in the fig 5.2 (a) npn transistor and fig. 5.2 (b) pnp transistor. An arrow sign differentiate one of the transistors from the other.

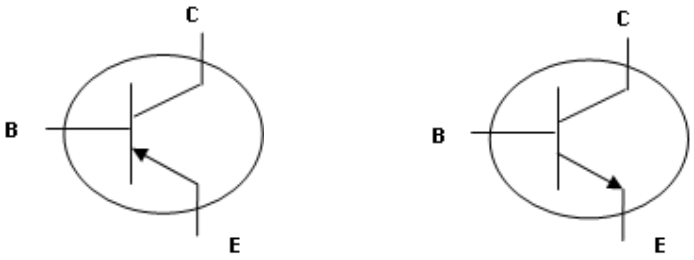


Fig. 5.2

CIRCUIT DIAGRAM:

Fig 5.3(a) shows the connection for the characteristics of P-N-P Transistor in common base (CB) configuration

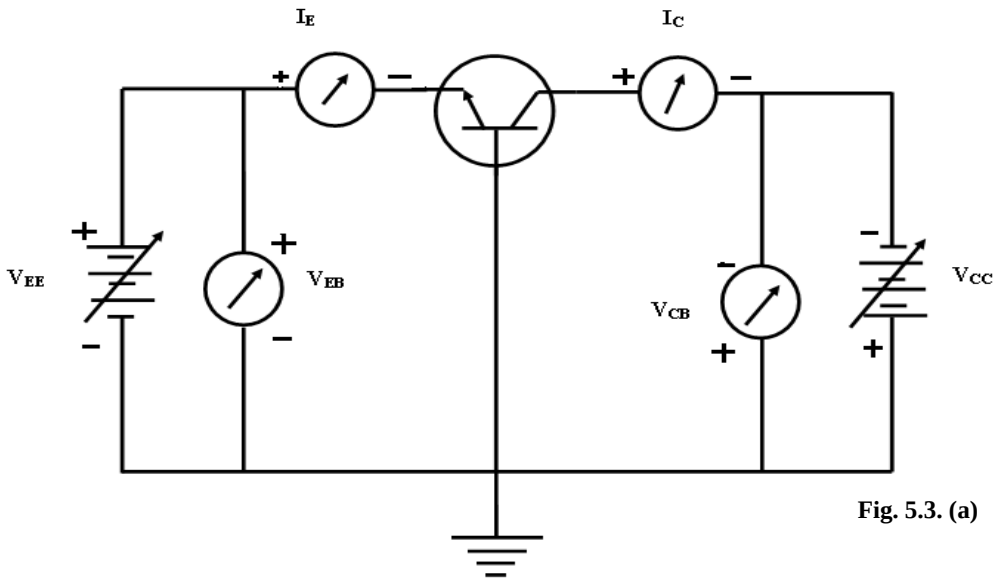


Fig. 5.3. (a)

Fig 5.3(b) shows the connection for the characteristics of N-P-N Transistor in common emitter (CB) configuration.

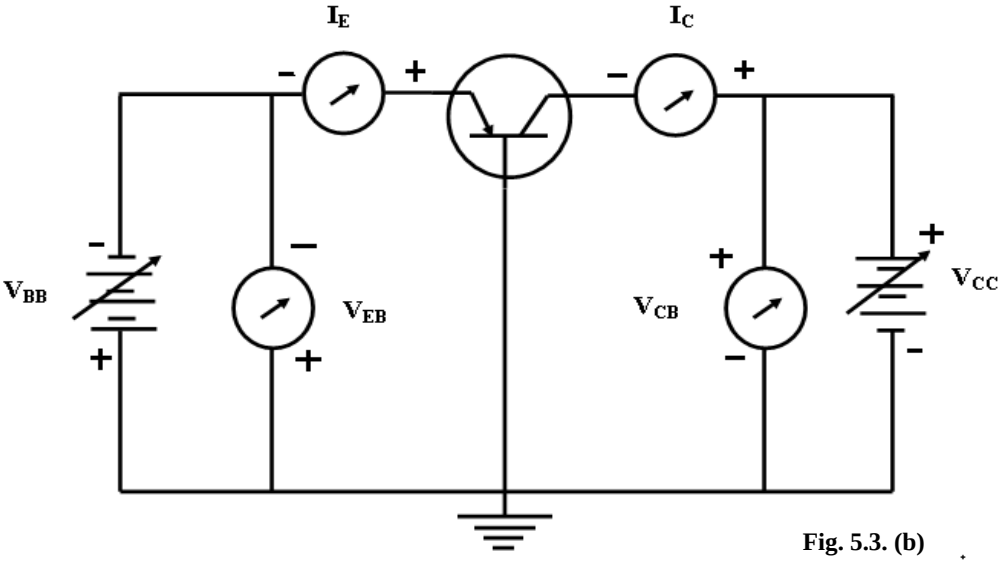


Fig. 5.3. (b)

GRAPH:

INPUT CHARACTERISTICS:

The graph shows the variation of input current (I_E) with change in input voltage (V_{EB}) when output voltage is kept constant. It is found that the current increases very slowly with the voltage, but at a particular increase in voltage current reaches infinity.

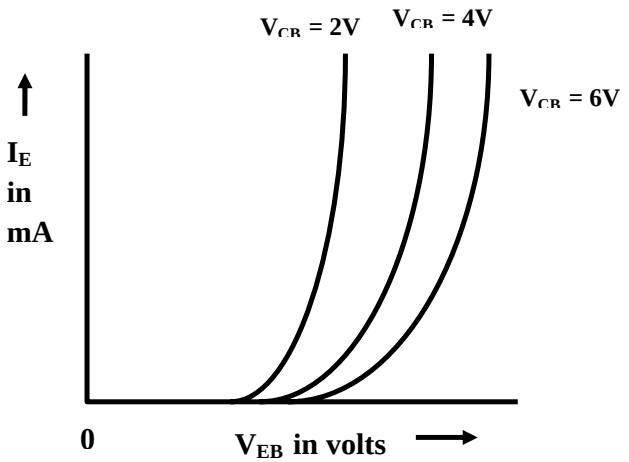


Fig 5.4 (a)

OUTPUT CHARACTERISTICS

It shows the variation of output current (I_C) in mA and output voltage (V_{CB}) in volts. When input current (I_E) in mA is kept constant. It is observed that current slightly increases with increase in input voltage and becomes constant with further increase of the voltage.

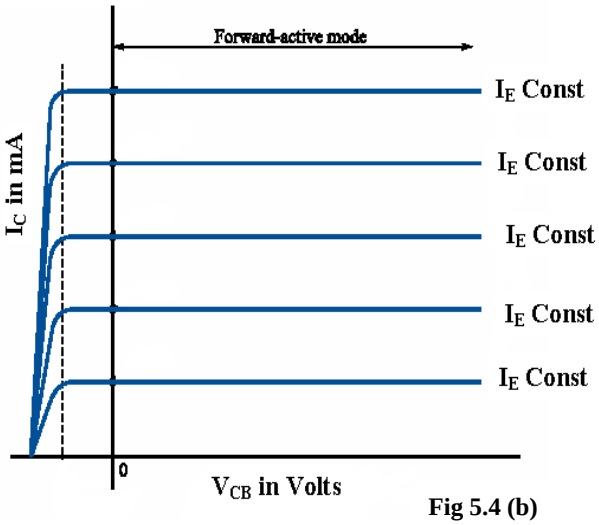


Fig 5.4 (b)

PROCEDURE:

A. FOR INPUT CHARACTERISTICS:

1. Make connections as shown in fig. 5. 3. (a) for NPN and fig 5.3. (b) for PNP transistors respectfully.
2. Now keep output voltage (V_{CB}) at constant volt.
3. Don't vary the reading of V_{CB} till complete reading is taken for the input characteristics.
4. Now vary the voltage (V_{EB}) and note the corresponding reading of the current (I_E).
5. Now selecting constant value for the output voltage (V_{CB}), take different readings for the input characteristics.
6. Now plot the curve between input voltage and the current with proper scale.

B. FOR OUTPUT CHARACTERISTICS:

7. Make connections as shown in fig. 5. 3. (a) for NPN and fig 5.3. (b) for PNP transistors respectfully.
8. Now keep input current (I_E) at constant value (mA).
9. Don't vary the reading of I_E till complete reading is taken for the output characteristics.
10. Now vary the voltage (V_{CB}) and note the corresponding reading of the current (I_C).
11. Now select another constant value for the input current (I_E), and take different readings for the input characteristics.
12. Now plot the curve between output voltage and the current by considering proper scale.

OBSERVATION:

For NPN Transistor:

Reading of meters for input characteristics:

i) L.C. of Voltmeter = …….

ii) L. C. of Ammeter = ……..…...

iii) Range of Voltmeter for F. B. =…….

iv) Range of Ammeter in F. B. =……

S. No.	V_{CB} = 2V		V_{CB} = 4V		V_{CB} = 6V	
	V_{EB} in V	I_E in mA	V_{EB} in V	I_E in mA	V_{EB} in V	I_E in mA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Reading of meters for output characteristics:

v) L.C. of Voltmeter = …….

vi) L. C. of Ammeter = ……..…...

vii) Range of Voltmeter for R. B. =……..….. viii) Range of Ammeter in R. B. =…….....

S. No.	I_E = 5 mA		I_E = 10 mA		I_E = 15 mA	
	V_{CB} in V	I_C in mA	V_{CB} in V	I_C in mA	V_{CB} in V	I_C in mA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

For PNP Transistor:

Reading of meters for input characteristics:

ix) L.C. of Voltmeter = …….

x) L. C. of Ammeter = ……..…...

xi) Range of Voltmeter for F. B. =…….

xii) Range of Ammeter in F. B. =……

S. No.	V_{CB} = 2V		V_{CB} = 4V		V_{CB} = 6V	
	V_{EB} in V	I_E in mA	V_{EB} in V	I_E in mA	V_{EB} in V	I_E in mA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Reading of meters for output characteristics:

xiii) L.C. of Voltmeter = ……. xv) Range of Voltmeter for R. B. =……..…..

xiv) L. C. of Ammeter = ……..…... xvi) Range of Ammeter in R. B. =…….....

S. No.	I_E = 5 mA		I_E = 10 mA		I_E = 15 mA	
	V_{CB} in V	I_C in mA	V_{CB} in V	I_C in mA	V_{CB} in V	I_C in mA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

RESULTS: Graph shows the input and output characteristic curve of the both NPN and PNP transistors.

PRECAUTIONS:

1. The EB junction of the transistors should always be forward bias and CB junction should always be in reverse bias condition.
2. While taking the reading, the kept constant value should not be varied.
3. Do not apply further voltage after current reaches infinity.
4. Proper connection should be done.
5. Power supply should be applied after connection is fully completed.

VIVA-VOCE

1. What is BJT? Define transistor.

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2. How many types of transistor are there?

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3. Give the configuration of the transistor.

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4. What the common term means in the various configurations?

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5. Which of the configuration is the best and why?

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6. How transistor is biased?

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7. Why the emitter terminal is forward bias as compared to that of the base and collector?

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8. Can two diodes form a transistor?

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9. What happen when the biasing of the transistor is reversed?

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10. What do you mean by term amplification?

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