CONFIGURATION OF TRANSISTOR CIRCUIT

A transistor is a three terminal device. But require ‗4'terminals for connecting it in a circuits. (i.e.) 2 terminals for input, 2 terminals for output.

Hence one of the terminal is made common to the input and output circuits.Common terminal is grounded.

TYPES OF CONFIGURATIONS

Three types of configuration is available

1) Common base(CB) configuration
2) Common emitter (CE) configuration
3) Common collector (CC) configuration

COMMON BASE (CB) CONFIGURATION

In common base configuration circuit is shown in figure. Here base is grounded and itis used as the common terminal for both input and output.

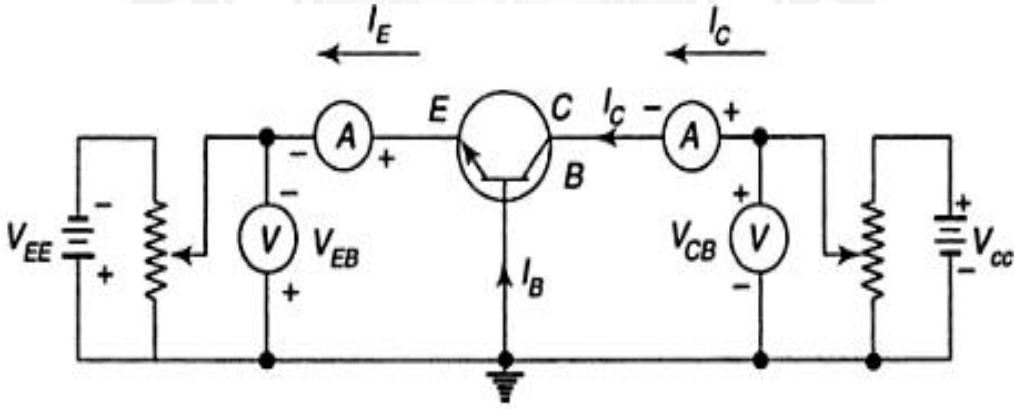


Figure 2.2.1 Circuit to determine CB static characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 310]

It is also called as grounded base configuration. Emitter is used as an input terminal whereas collector is the output terminal.

Input characteristics:

It is defined as the characteristic curve drawn between input voltages to input currentwhereas output voltage is constant.

To determine input characteristics, the collector base voltage V_{CB} is kept constant at zero and emitter current I_E is increased from zero by increasing V_{EB}.This is repeated for higher fixed values of V_{CB}.

A curve is drawn between emitter current and emitter base voltage at constant collector base voltage is shown in figure 2.2.1.When V_{CB} is zero EB junctions is forward biased. So it behaves

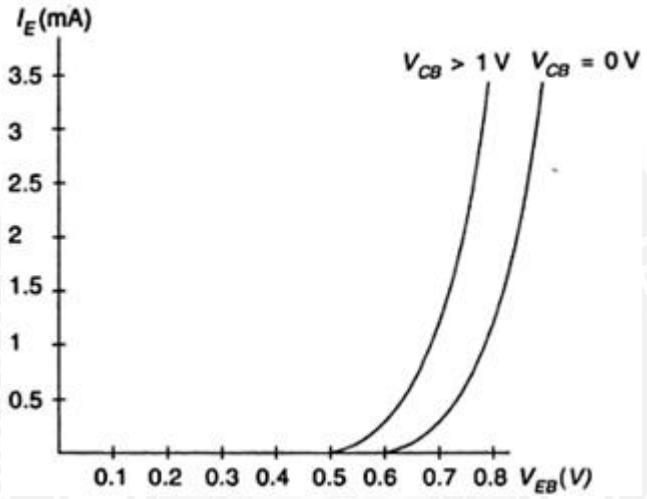


Figure 2.2.2 CB input characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 311]

Output Characteristics

It is defined as the characteristic curve drawn between output voltages to output current whereas input current is constant. To determine output characteristics, the emitter current I_E is kept constant at zero and collector current Ic is increased from zero by increasing V_{CB}.This is repeated for higher fixed values of I_E.

From the characteristic it is seen that for a constant value of I_E, Ic is independent of V_{CB} and the curves are parallel to the axis of V_{CB}.As the emitter base junction is forward biased the majority carriers that is electrons from the emitter region are injected into the base region.

In CB configuration a variation of the base-collector voltage results in a variation of the quasi- neutral width in the base. The gradient of the minority-carrier density in the base therefore changes, yielding an increased collector current as the collector-base current isincreased. This effect is referred to as the early effect.

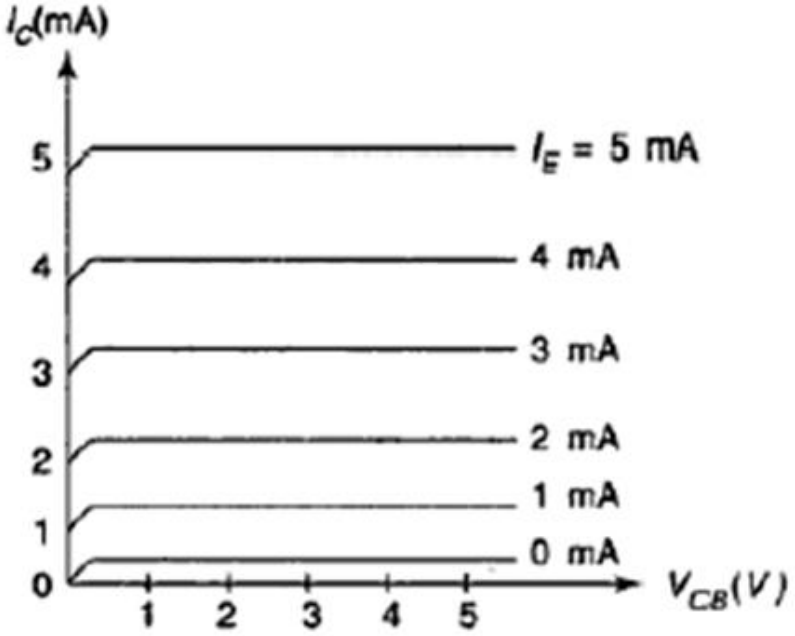


Figure 2.2.3 CB output characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 311]

COMMOM EMITTER CONFIGURATION

In common emitter configuration circuit is shown in figure. Here emitter is grounded and it is used as the common terminal for both input and output. It is also called as grounded emitter configuration. Base is used as a input terminal whereas collector is the output terminal.

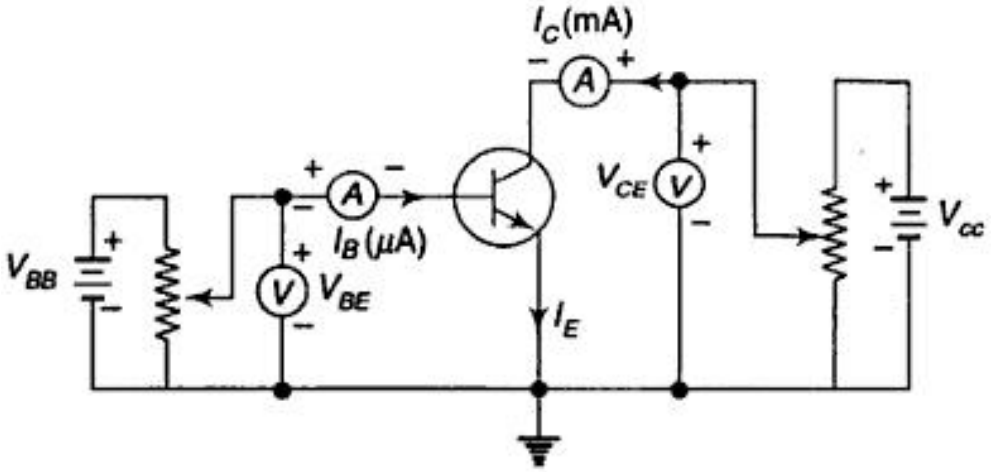


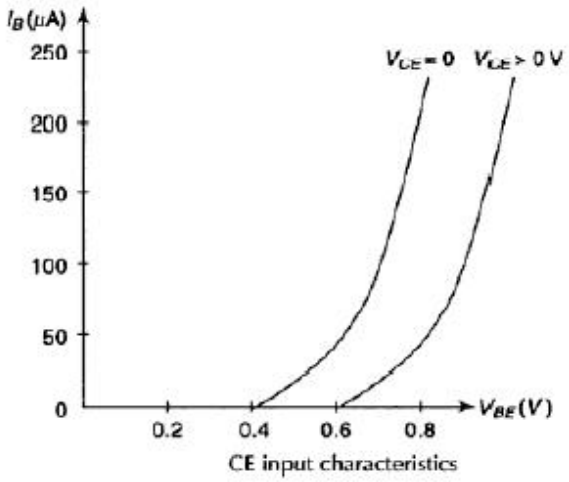
Figure 2.2.4 Circuit to determine CE static characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 312]

Input Characteristics

It is defined as the characteristic curve drawn between input voltages to input current whereas output voltage is constant.

To determine input characteristics, the collector base voltage V_{CB} is kept constant at zero and base current I_B is increased from zero by increasing V_{BE}.This is repeated for higher fixed values of V_{CE}. A curve is drawn between base current and base emitter voltage at constant collector base voltage is shown in figure2.14. Here the base width decreases. So curve moves right as V_{CE} increases.



] Figure 2.2.5 CE input characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 312

Output Characteristics

It is defined as the characteristic curve drawn between output voltages to output current whereas input current is constant.

To determine output characteristics, the base current I_B is kept constant at zero and collector current Ic is increased from zero by increasing V_{CE}.This is repeated for higher fixed values of I_B.

From the characteristic it is seen that for a constant value of I_B, Ic is independent of $V_{CB}$and the curves are parallel to the axis of V_{CE}.

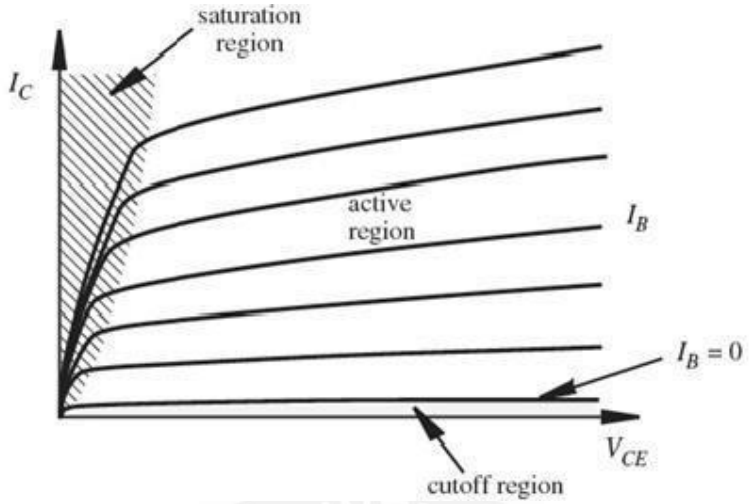


Figure 2.2.6 CE output Characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 312]

The output characteristic has 3 basic regions:

- Active region –defined by the biasing arrangements.
- Cutoff region – region where the collector current is 0A
- Saturation region- region of the characteristics to the left of VCB = 0V.

Active region	Saturation region	Cut-off region
IE increased, IC increased. BE junction forward bias and CB junction reverse bias. Refer to the graph, IC≈ IE IC not depends on VCB Suitable region for the transistor working as amplifier.	BE and CB junction is forward bias Small changes in VCB will cause big different to IC The allocation for this region is to the left of VCB=0V.	Region below the line of IE=0 A BE and CB is reverse biase No current flow at collector, only leakage current.

Table: Common Emitter Region

COMMON COLLECTOR CONFIGURATION

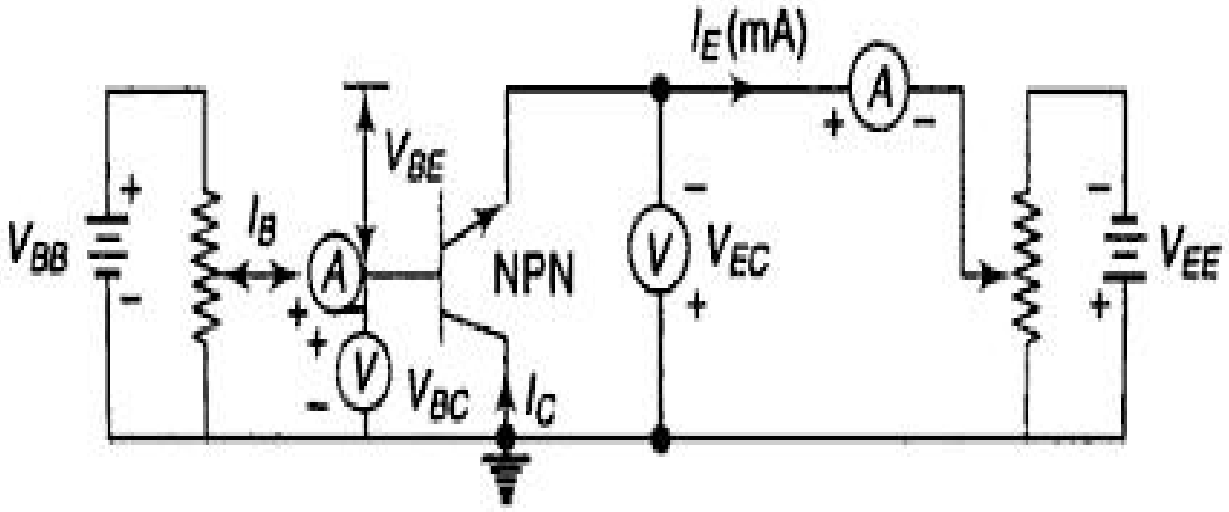


Figure 2.2.7 Circuits to determine CC static characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 313]

Input Characteristics

It is defined as the characteristic curve drawn between input voltages to inputcurrent whereas output voltage is constant.

To determine input characteristics, the emitter base voltage V_{EB} is kept constant at zero and base current I_B is increased from zero by increasing V_{BC}.This is repeated for higher fixed values of V_{CE}.A curve is drawn between base current and base emitter voltage at constant collector base voltage is shown in figure2.2.7

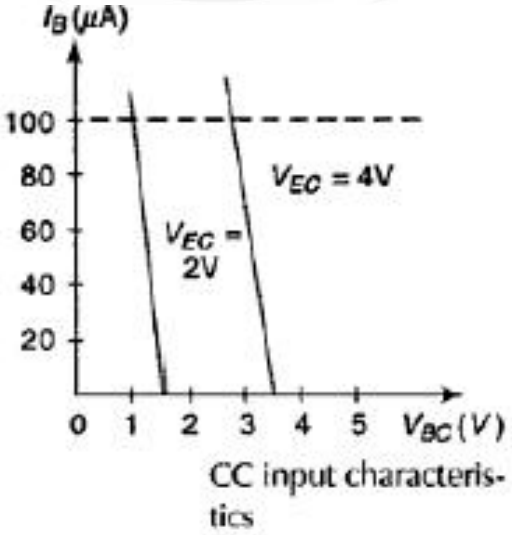


Figure 2.2.8 CC input characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 313]

Output Characteristics

It is defined as the characteristic curve drawn between output voltages to output current whereas input current is constant.

To determine output characteristics, the base current I_B is kept constant at zero and emitter current I_E is increased from zero by increasing V_{EC}. This is repeated for higher fixed values of I_B.

From the characteristic it is seen that for a constant value of I_B, I_E is independent of $V_{EB}$and the curves are parallel to the axis of V_{EC}.

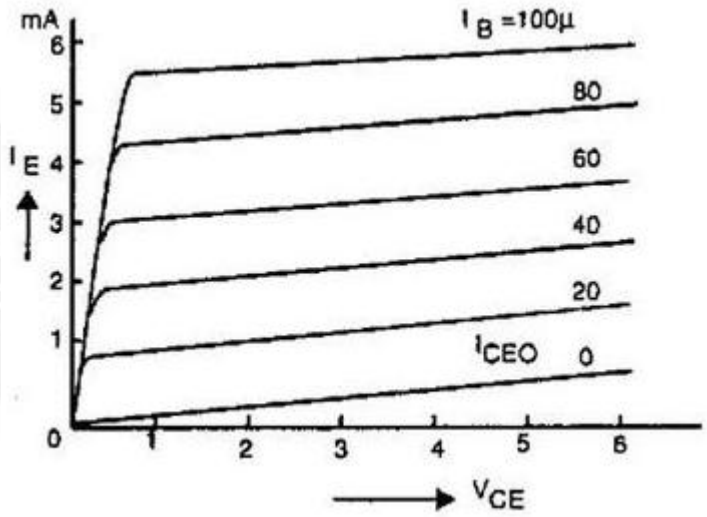


Figure 2.2.9 Common Collector output characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 313]

A comparison of CB, CE and CC Configurations

Property	*CB*	*CE*	*CC*
Input resistance	Low (about 100 Ω)	Moderate (about 750 Ω)	High (about 750 kΩ)
Output resistance	High (about 450 kΩ)	Moderate (about 45 kΩ)	Low (about 25 Ω)
Current gain	1	High	High
Voltage gain	About 150	About 500	Less than 1
Phase shift between input & output voltages	0 or 360°	180°	0 or 360°
Applications	for high frequency circuits	for audio frequency circuits	for impedance matching