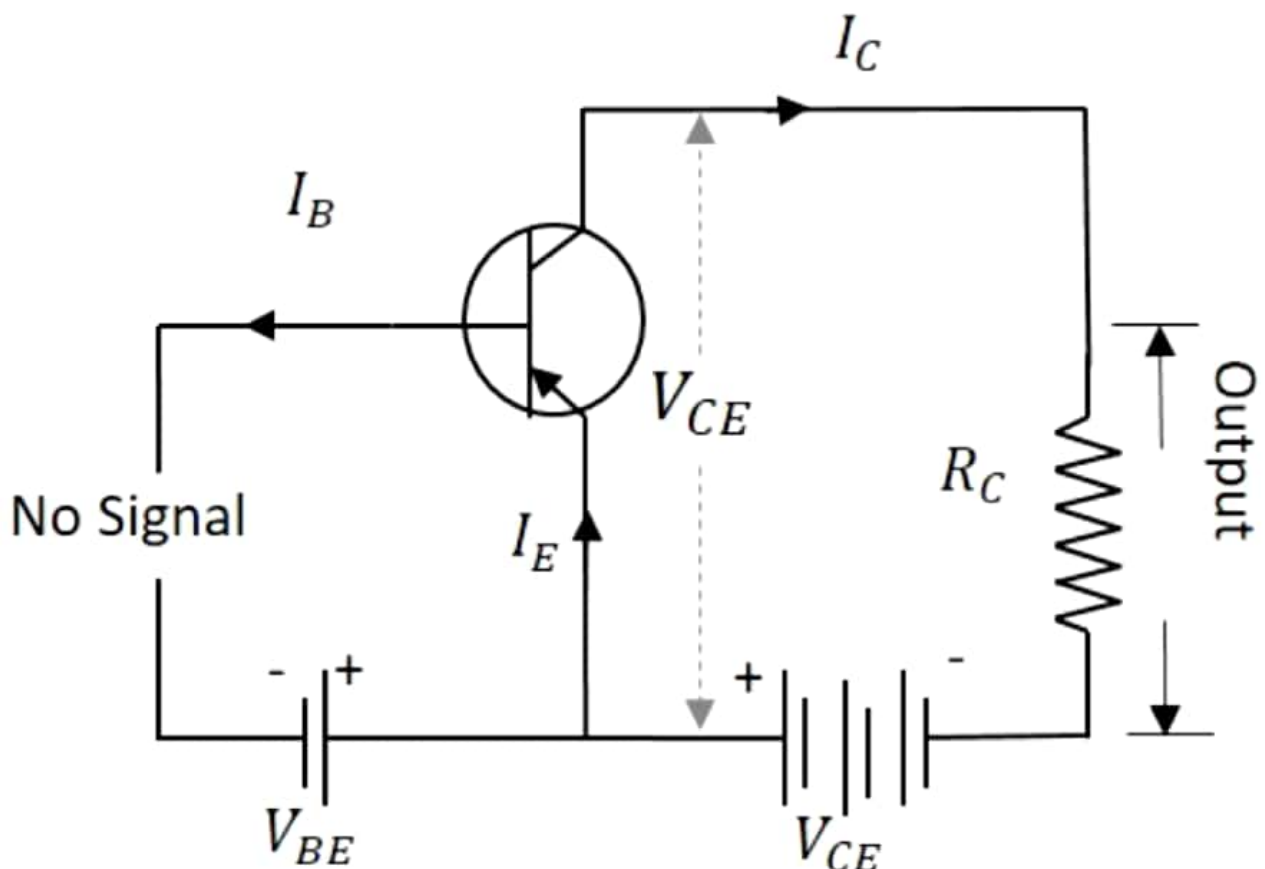


DC Load Line in a Transistor

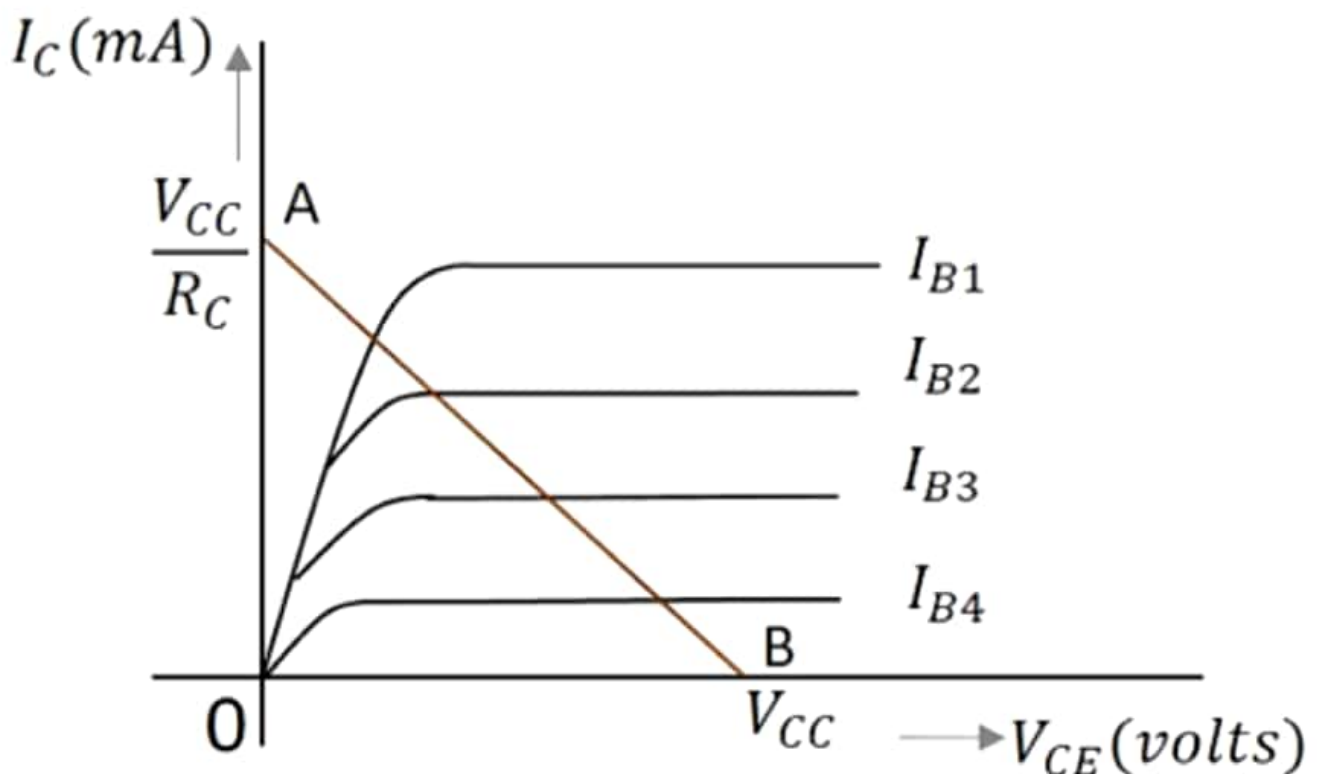
When the transistor is given the bias and no signal is applied at its input, the load line drawn at such condition, can be understood as **DC** condition. Here there will be no amplification as the signal is absent. The circuit will be as shown below.



The value of collector emitter voltage at any given time will be

$$V_{CE} = V_{CC} - I_C R_C$$

As V_{CC} and R_C are fixed values, the above one is a first degree equation and hence will be a straight line on the output characteristics. This line is called as **D.C. Load line**. The figure below shows the DC load line.



To obtain the load line, the two end points of the straight line are to be determined. Let those two points be A and B.

To obtain A

When collector emitter voltage $V_{CE} = 0$, the collector current is maximum and is equal to V_{CC}/R_C . This gives the maximum value of V_{CE} . This is shown as

$$V_{CE} = V_{CC} - I_C R_C$$

$$0 = V_{CC} - I_C R_C$$

$$I_C = \frac{V_{CC}}{R_C}$$

This gives the point A ($OA = V_{CC}/R_C$) on collector current axis, shown in the above figure.

To obtain B

When the collector current $I_C = 0$, then collector emitter voltage is maximum and will be equal to the V_{CC} . This gives the maximum value of I_C . This is shown as

$$V_{CE} = V_{CC} - I_C R_C$$

$$= V_{CC}$$

(As $I_C = 0$)

This gives the point B, which means (OB = V_{CC}) on the collector emitter voltage axis shown in the above figure.

Hence we got both the saturation and cutoff point determined and learnt that the load line is a straight line. So, a DC load line can be drawn.