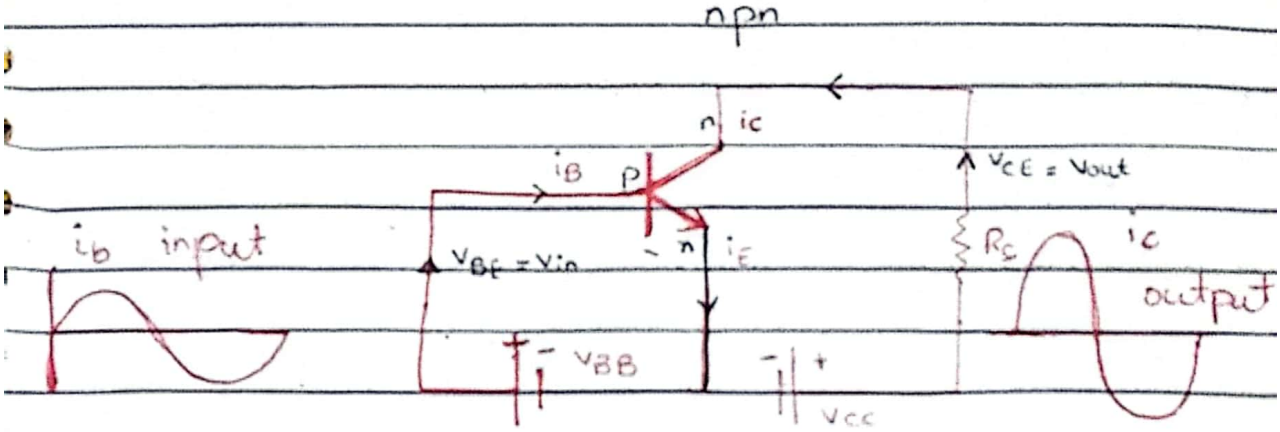
- Transistor can act as amplifier in active region.
- Region b/w cutoff and saturated region is called active region
- CE configuration provides large value of current gain, v gain and power gain.



1) Configuration => Common - Emitter

2) Input loop => V_{BE} Voltage across Emitter-Base
I_B Current across EB

$$I_B = \frac{V_{BE}}{R_{ie}}$$ Input Current

3) Output loop => V_{CE} Voltage across Emitter-Collector
I_C Current across EC

$$\beta = \frac{I_C}{I_B} \Rightarrow I_C = \beta I_B$$

$$I_C = \frac{\beta V_{BE}}{R_{ie}}$$ output Current

4) Now we have to find voltage V_{CE}

By applying KVL

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

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

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

$$V_0 = V_{CC} - I_C R_C$$

Putting value of I_C

$$V_0 = V_{CC} - \frac{\beta V_{BE} R_C}{R_{ie}} \quad -(1)$$

"β or current gain is the ratio of collector and Base current $\beta = I_C / I_B$ and always more than 1"

Now we I will find change in input and output signals

$V_{BE} \rightarrow V_{BE} + \Delta V_{in}$

$V_o \rightarrow V_o + \Delta V_o$

$$V_o + \Delta V_o = V_{cc} - \frac{\beta (V_{BE} + \Delta V_{in}) R_c}{R_{ie}}$$

$$V_o + \Delta V_o = V_{cc} - \frac{\beta R_c V_{BE}}{R_{ie}} - \frac{\beta R_c \Delta V_{in}}{R_{ie}} \quad -(2)$$

Sub equation 1 and 2

$$V_o + \Delta V_o = V_{cc} - \frac{\beta R_c V_{BE}}{R_{ie}} - \frac{\beta R_c \Delta V_{in}}{R_{ie}}$$

$$V_o = V_{cc} - \beta V_{BE} R_c + R_{ie}$$

$$\Delta V_o = -\frac{\beta R_c \Delta V_{in}}{R_{ie}}$$

$$\frac{\Delta V_o}{\Delta V_{in}} = -\frac{\beta R_c}{R_{ie}}$$