Common Collector configuration:

For common collector configuration collector is common b/w input and output port.

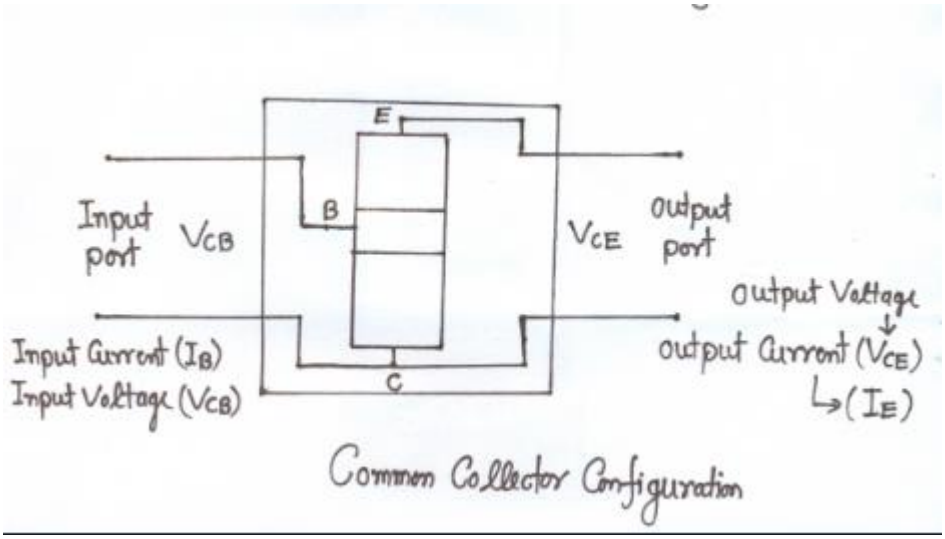

Fig-1

So for output characteristics

$I_E = f(I_B, V_{CE})$

Then by using $I_E = I_C + I_B$ and $V_{CE} = V_{BE} + V_{CB}$ in current equation of common base configuration

$I_C = \alpha I_E + I_{CBO}\ (1- e^{V_{CB}/\eta V_T})$

The equation for common collector will be

$(I_E - I_B) = \alpha\ I_E + I_{CBO}\,(1- e^{(V_{CE}-V_{BE})/\eta V_T})$

$I_E(1-\alpha) = I_B + I_{CBO}\,(1- e^{(V_{CE}-V_{BE})/\eta V_T})$

$$I_E = \frac{1}{1-\alpha} I_B + \frac{1}{1-\alpha} I_{CBO}\ (1- e^{(V_{CE}-V_{BE})/\eta V_T})$$

$I_E = (\beta+1) I_B (\beta+1) I_{CBO}\ (1- e^{(V_{CE}-V_{BE})/\eta V_T})$

From above equation we can see the slope of output characteristics graph will be greater than slope in common emitter and common base configuration .

Active Region:

As we have discussed for common emitter, in active region $I_E = (\beta+1) I_B + I_{CBO}$. And the graph between I_E & V_{CE} will be as follows (see figure-2)

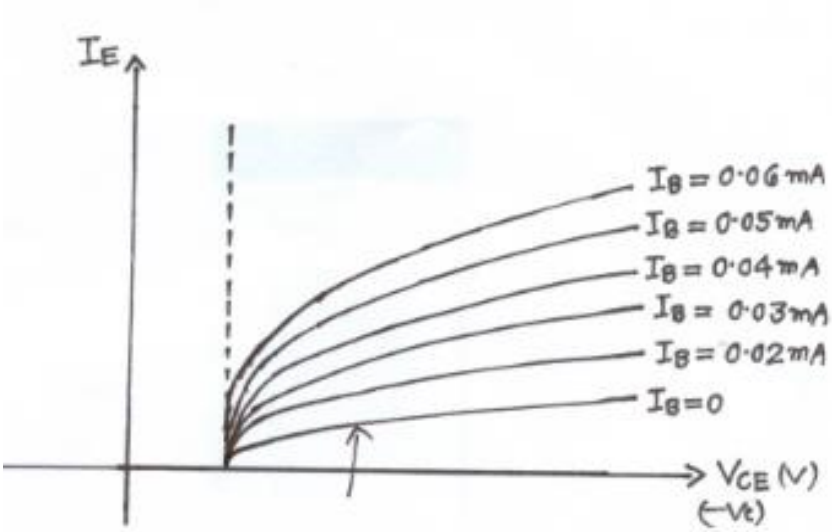

Fig.2 (Active region)

Saturation Region:

For saturation region the equation for common collector configuration will be

$I_E = (\beta+1) I_B - I_{CEO} (e^{(V_{CE}-V_{BE})/\eta V_T})$

Means I_E will be dependent on V_{CE} exponentially and will be independent of I_B. means I_E will be saturated w.r.t. I_B. so called saturation region. (See figure-3)

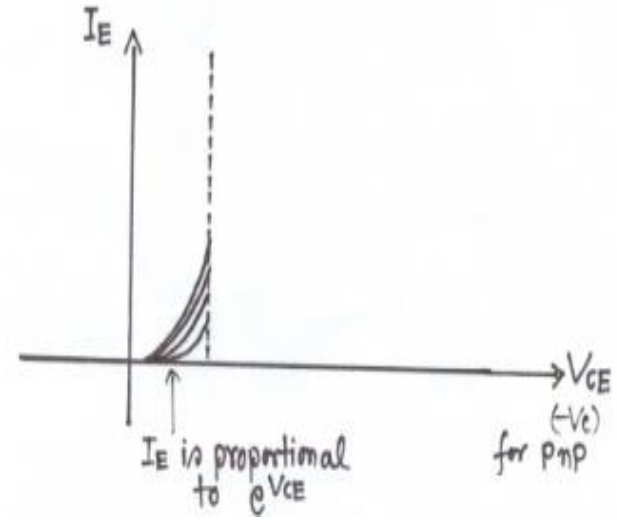

Fig .3(Saturation region)

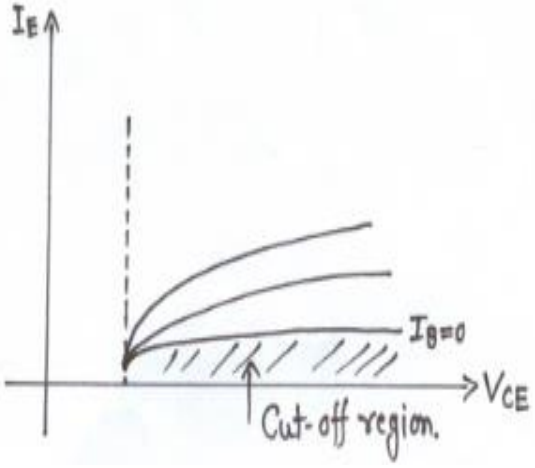

Fig. 4(Cut-off region)

Cut off:

E_J & C_J both are in reverse biased condition so the equation will be

$I_E = I_{CEO}$, means I_E is cut off from base and collector current (i.e. IB & IC) so called cut off region.(See figure-4)

So finally the output characteristics graph for common collector configuration will be as shown in figure-5 below.

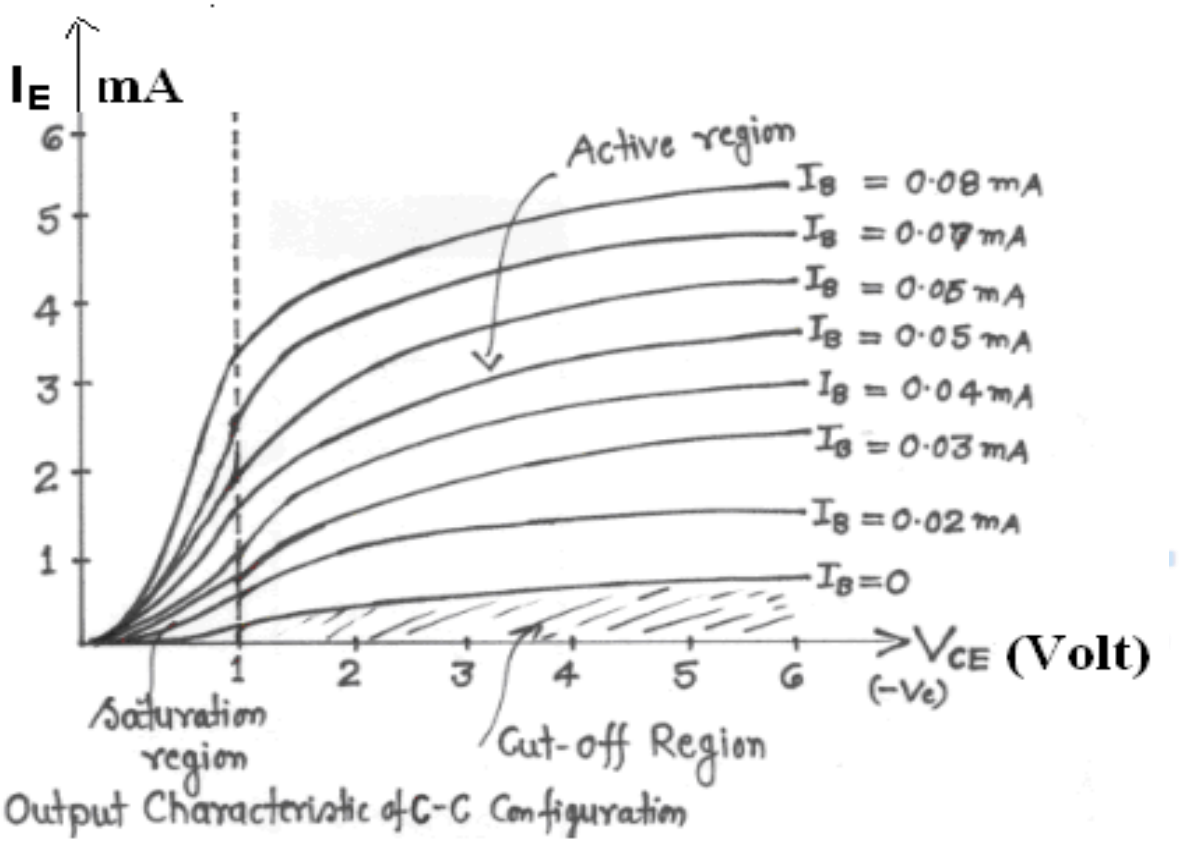

Fig. 5(Out put Characteristic of Common collector)

From above discussion we can say the slope of graph of output characteristics in common collector is greater than common emitter. For common emitter slope is greater than common base.

For common base, graph is present on left and right both side of vertical (current) axis. But in case of common emitter and common collector graph is present only on the right side of the graph. From graph it can be seen that current gain in common collector case is highest and lowest in common base configuration.