(3) COMMON COLLECTOR CONFIGURATION (CC)

In this configuration input signal is applied between base and collector and output voltage is taken across emitter collector voltage.

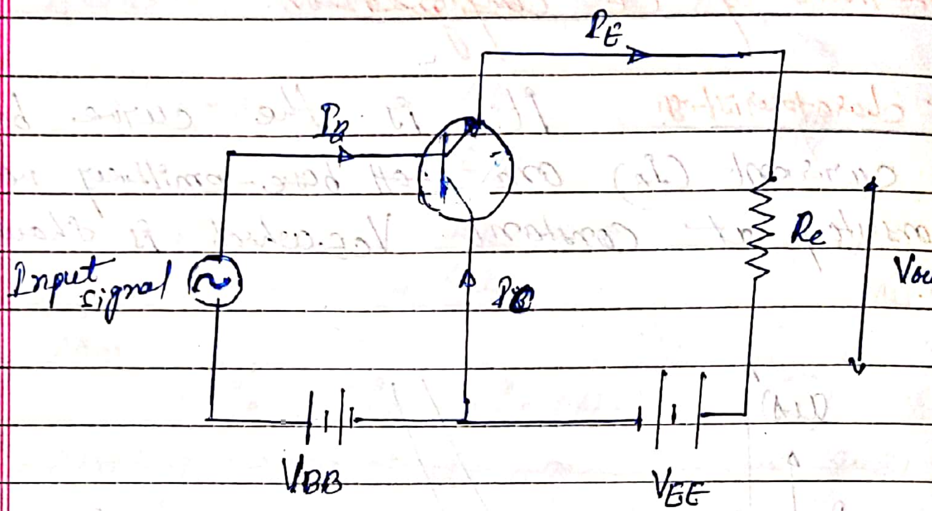

Fig: Common collector configuration

~~Input c/s~~

Current amplification factor (γ):— It is the ratio of change in emitter current (ΔI_E) to change in base current (ΔI_B). i.e

$$\gamma = \frac{\Delta I_E}{\Delta I_B} \longrightarrow (1)$$

Relation between γ and α

$$\because \alpha = \frac{\Delta I_C}{\Delta I_E}$$

also $$\beta = \frac{\Delta I_C}{\Delta I_B}$$

$$\because I_E = I_B + I_C$$

$$\Delta I_E = \Delta I_B + \Delta I_C$$

or $$\Delta I_B = \Delta I_E - \Delta I_C$$

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putting the value of ΔI_B in equation (1) we get:

$$\gamma = \frac{\Delta I_E}{\Delta I_B}$$

$$\gamma = \frac{\Delta I_E}{\Delta I_E - \Delta I_C}$$

On dividing R.H.S by ΔI_E we get:-

$$\gamma = \frac{\frac{\Delta I_E}{\Delta I_E}}{\frac{\Delta I_E}{\Delta I_E} - \frac{\Delta I_C}{\Delta I_E}} = \frac{1}{1-\alpha}$$

$$\therefore \gamma = \frac{1}{1-\alpha}$$

Input characteristics:- It is the curve between base current (I_B) and base collector voltage at constant emitter-collector voltage (V_{EC}), as shown below.

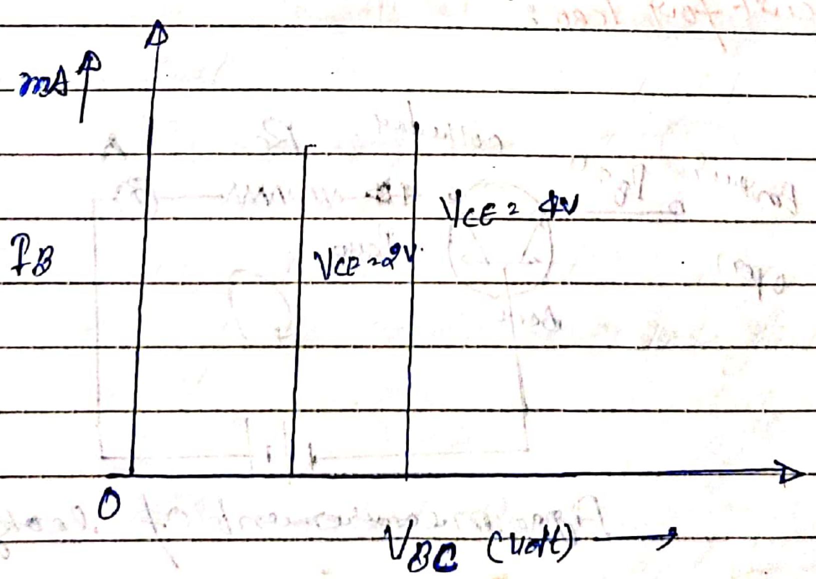

Fig: I/P characteristics of CC configuration

Output characteristics:- It is the curve between emitter current (I_E) and emitter-collector voltage (V_{EC}) at constant base current (I_B) as shown below:-

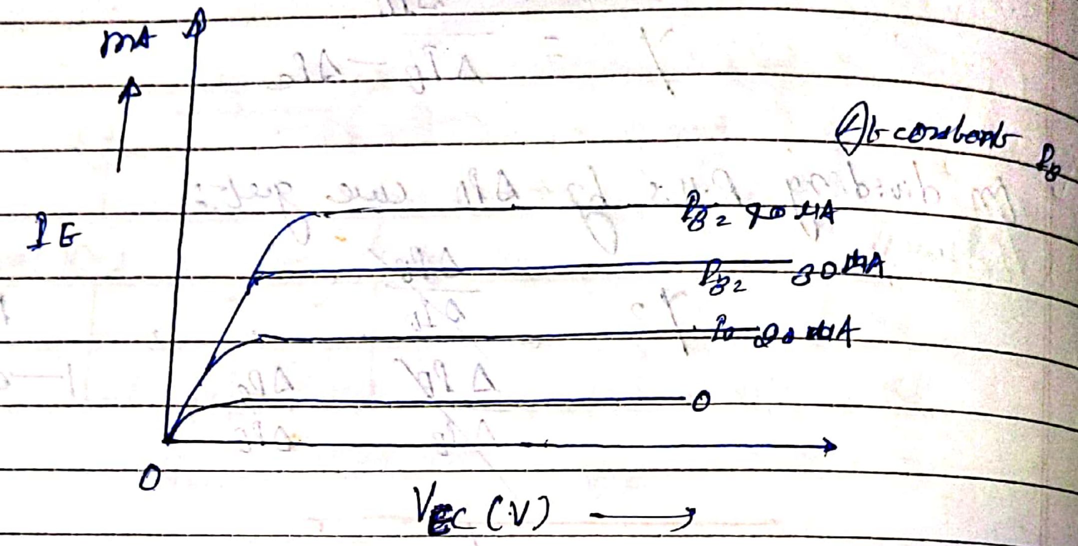

Fig: Output characteristics of CE configuration

Leakage currents in a Transistor.

Leakage current:- It is the reverse current flow through a reverse biased PN junction. The magnitude of leakage current is ~~small~~ very small.

Circuit for I_{CBO}:

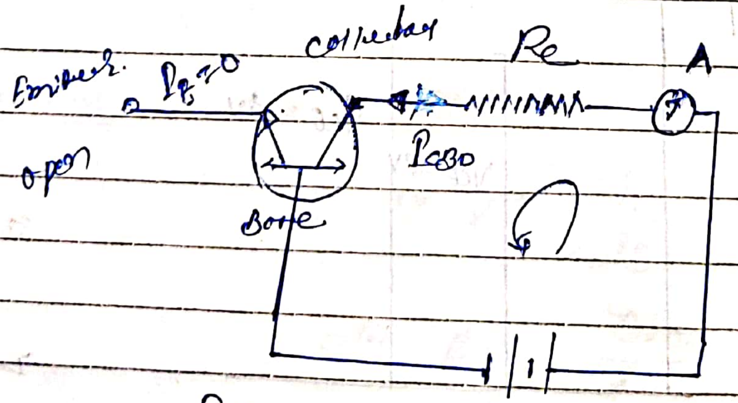

Fig: Measurement of leakage current

I_{CBO} In a CB circuit, I_{CBO} is the amount of current ~~that~~ that flow in the

collector circuit due to minority charge carriers shown in fig(a) when emitter is open.
It is temperature dependent current for I_{CE} it doubles for every 10°c rise temperature which is 10 to 100 times greater than I_C.

I_C = 0.01 uA to 1uA

I_{CE} = 9 to 15 uA

circuit for I_{CEO}

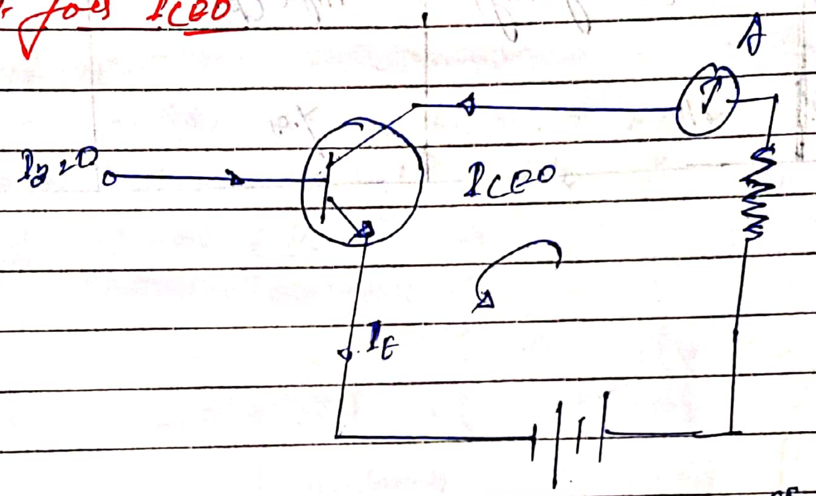

Fig. Measure of leakage current in CE circuit.

Expression for ~~collector~~ collector/emitter current for cc mode operation:

∴ we know that

$$I_C = \alpha I_E + I_{CBO} \quad \text{--- (I)}$$

Also $I_E = I_B + I_C$ --- (II)

putting the value of I_C in equation (II) we get:

$$\therefore I_E = I_B + I_C$$

$$I_E = I_B + \alpha I_E + I_{CBO}$$

or,

$$I_E - \alpha I_E = I_B + I_{CBO}$$

$$I_E(1-\alpha) = I_B + I_{CBO}$$

$$I_E = \frac{1}{(1-\alpha)} I_B + \frac{I_{CBO}}{(1-\alpha)}$$

$\because I_C \approx I_E$

$$\therefore I_C = \frac{1}{(1-\alpha)} I_B + \frac{I_{CBO}}{(1-\alpha)}$$

$$I_C = (\beta+1) I_B + (\beta+1) I_{CBO}$$

Performance comparison among the configuration (CB, CE, CC)

Characteristics	Common Base (CB)	Common emitter (CE)	Common Collector (CC)
i) Input impedance	lowest	moderate	Highest
ii) Output impedance	Highest	moderate	lowest
iii) Voltage gain	High	very high	nearly unity
iv) Current gain	α (nearly unity)	High (β)	Highest (β+1)
v) phase reversal	No	Yes	No.