TOPIC:- Different Current Components in a Transistor

The different current components that exist when the emitter-base junction (J_{EB}) is forward-biased and the collector-base junction (J_{CB}) is reverse-biased are depicted for a p-n-p transistor in fig (1).

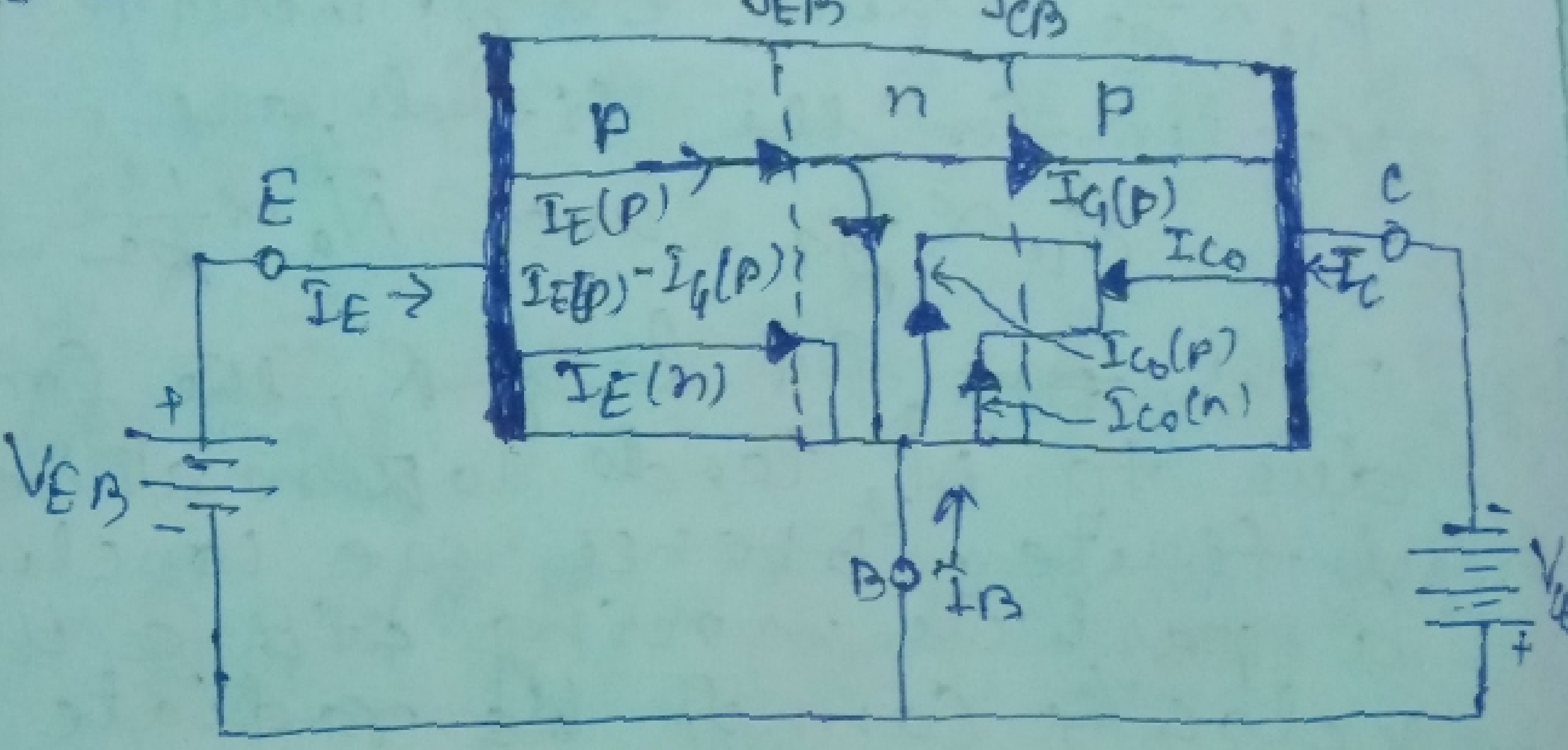

Fig (1)

The emitter current I_E consists of $I_E(n)$ due to electrons injected from the base into the emitter and $I_E(P)$ due to holes injected from the emitter into the base

i.e $I_E = I_E(n) + I_E(P)$ ⟶ (1)

Most of the holes injected into the base move to the junction J_{CB} giving rise to a collector current component $I_C(P)$, and the rest combine with the electrons in the base forming a recombination base current of magnitude $I_E(P) - I_C(P)$.

Let us now consider the case when the emitter-base junction is open i.e $I_E = 0$, and the base-collector junction is reversed biased. Under this condition, the collector current is the reverse saturation current I_{CO}. This current consists of two components: $I_{CO}(n)$ due to the electrons moving from p to n regions across J_{CB} and $I_{CO}(p)$ due to the holes passing from n to p across J_{CB}.

i.e $-I_{CO} = I_{CO}(n) + I_{CO}(p)$ ⟶ (2)

Hence from fig (1), we see that the total collector current is given by

$I_C = I_{CO} - I_G(p)$ ⟶ (3)

Generally I_{CO} is in microamperes or less and I_C is in milliamperes or more. Hence ignoring I_{CO} in eq^n (3), we obtain

$I_C \approx -I_G(p)$ ⟶ (4)

For a p-n-p transistor, I_E is positive but both I_C and I_{CO} are negative. For an n-p-n transistor, these currents are reversed.