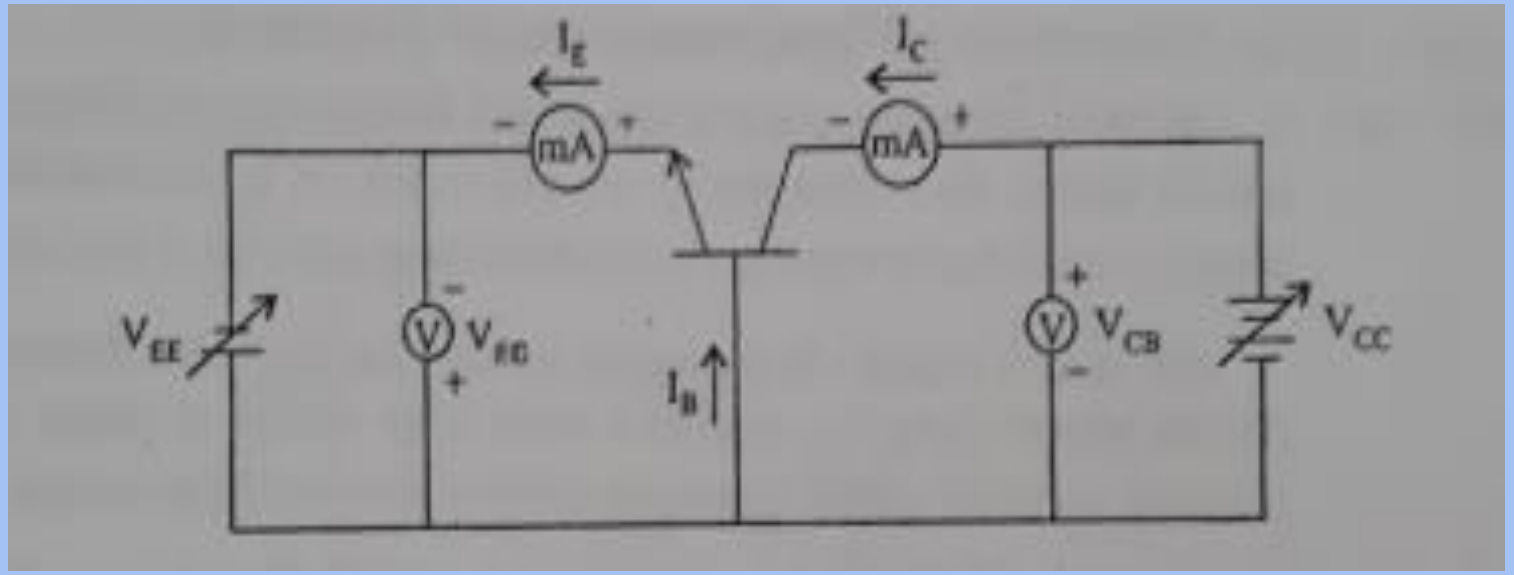
SUBJECT: BASIC ELECTRONICS

Common Base Configuration of Transistor Input/Ouput Characteristics

Elementrix Classes

Common Base Configuration Characteristics

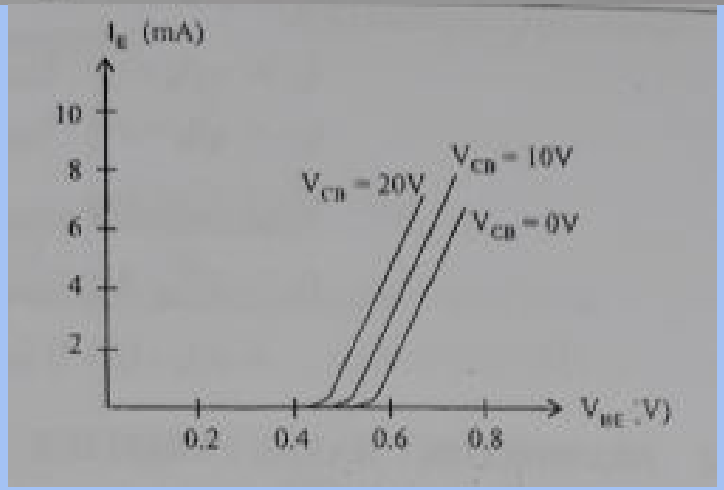


Input Characteristics

Input characteristics

It is the graph of input current I_E versus input voltage V_{BE} when output voltage V_{CB} is kept constant.

For a given V_{CB}, the input characteristic resembles the characteristic of forward biased diode. Input current I_E increases as input voltage V_{BE} increases for fixed value of V_{CB}. For a given value of V_{BE}, I_E increases with increase in V_{CB} due to early effect.



As V_{CB} increases, width of the depletion layer in the base increases. Hence the width of the base available for conduction decreases. The reduction in the width of the base due to increase in reverse bias is known as **early effect**. Due to early effect, the chances of recombination of electrons with the holes in the base decreases. Therefore, base current decreases but more electrons can travel from emitter to collector terminal. Therefore, collector current increases with increase in emitter current I_E.

As reverse bias voltage V_{CB} further increases, at one stage the depletion region completely occupies the base at which collector base junction breaks down. This phenomenon is known as punch-through.

Dynamic input resistance $$r_i = \left.\frac{\Delta V_{BE}}{\Delta I_E}\right|_{V_{CB} = \text{constant}}$$

Output Characteristics

Output characteristics

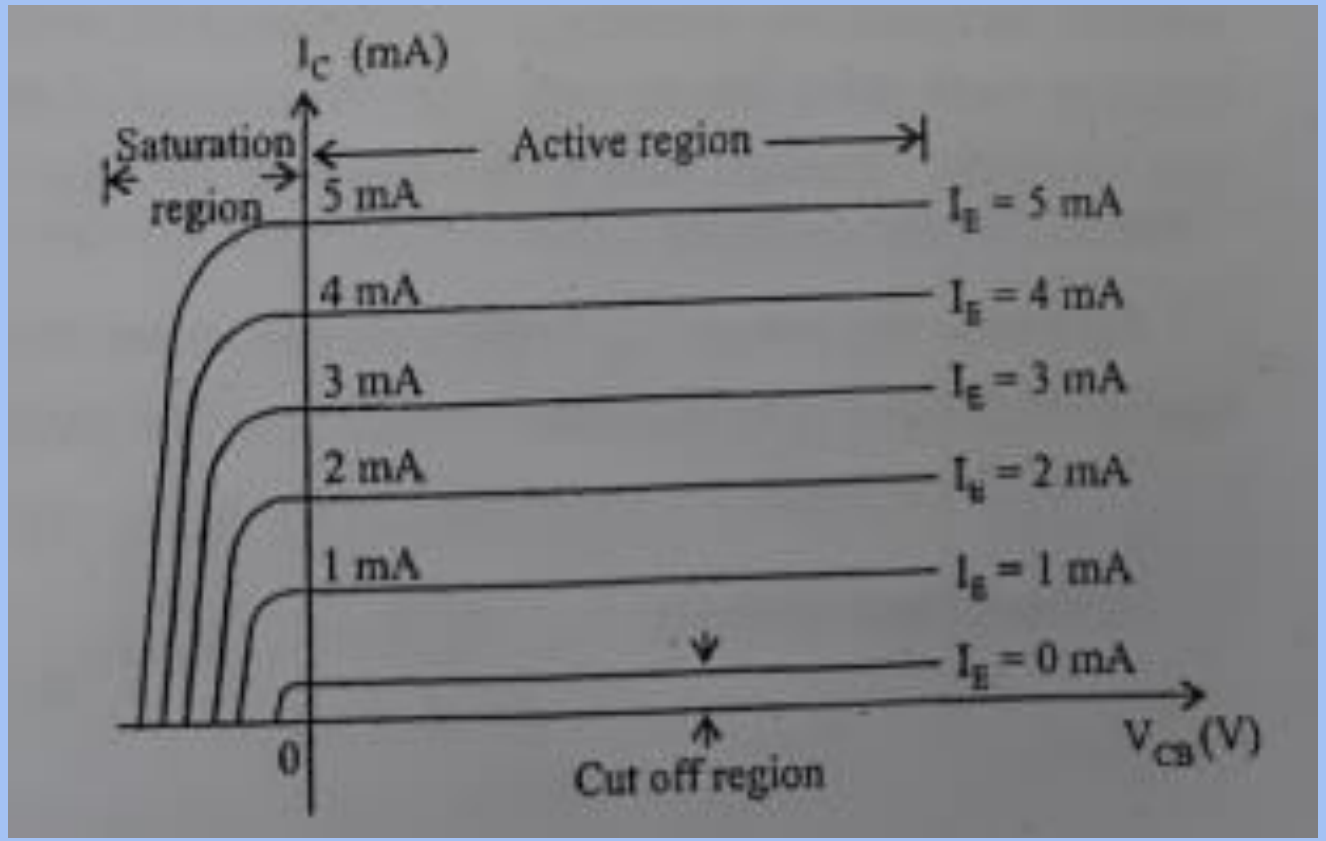
It is the graph of output current I_C versus output voltage V_{CB} for given values of I_E.

There are three different regions in output characteristics :

(i) Cut-off region : In this region, both the junctions are reverse biased. When emitter-base junction is reverse biased, the current due to majority carrier i.e. I_E is zero. Since collector-base junction is reverse biased, current due to minority carriers flows from collector to base which is represented as I_{CBO}.

(ii) Active region : In this region, emitter-base junction is forward biased and collector base junction is reverse biased. Once V_{CB} reaches a value large enough to ensure a large portion of electrons enter the collector, collector current I_C remains constant as shown by horizontal lines. As I_E increases, I_C increases.

(iii) Saturation region : In this region, both the junctions are forward biased. When V_{CB} is negative, collector base junction is actually forward biased. Thus the graphs are drawn on negative side of V_{CB}. In this region, there is large change in collector current with small increase in voltage V_{CB}.


I_C (mA)
Saturation region
Active region
5 mA
4 mA
3 mA
2 mA
1 mA
I_E = 5 mA
I_E = 4 mA
I_E = 3 mA
I_E = 2 mA
I_E = 1 mA
I_E = 0 mA
0
Cut off region
V_{CB}(V)

Output resistance $$r_o = \left.\frac{\Delta V_{CB}}{\Delta I_C}\right|_{I_E = \text{constant}}$$

Current gain $$\alpha_{ac} = \left.\frac{\Delta I_C}{\Delta I_E}\right|_{V_{CB} = \text{constant}}$$

पढ़िए और पढ़ाइये

SUBSCRIBE, SHARE, COMMENT