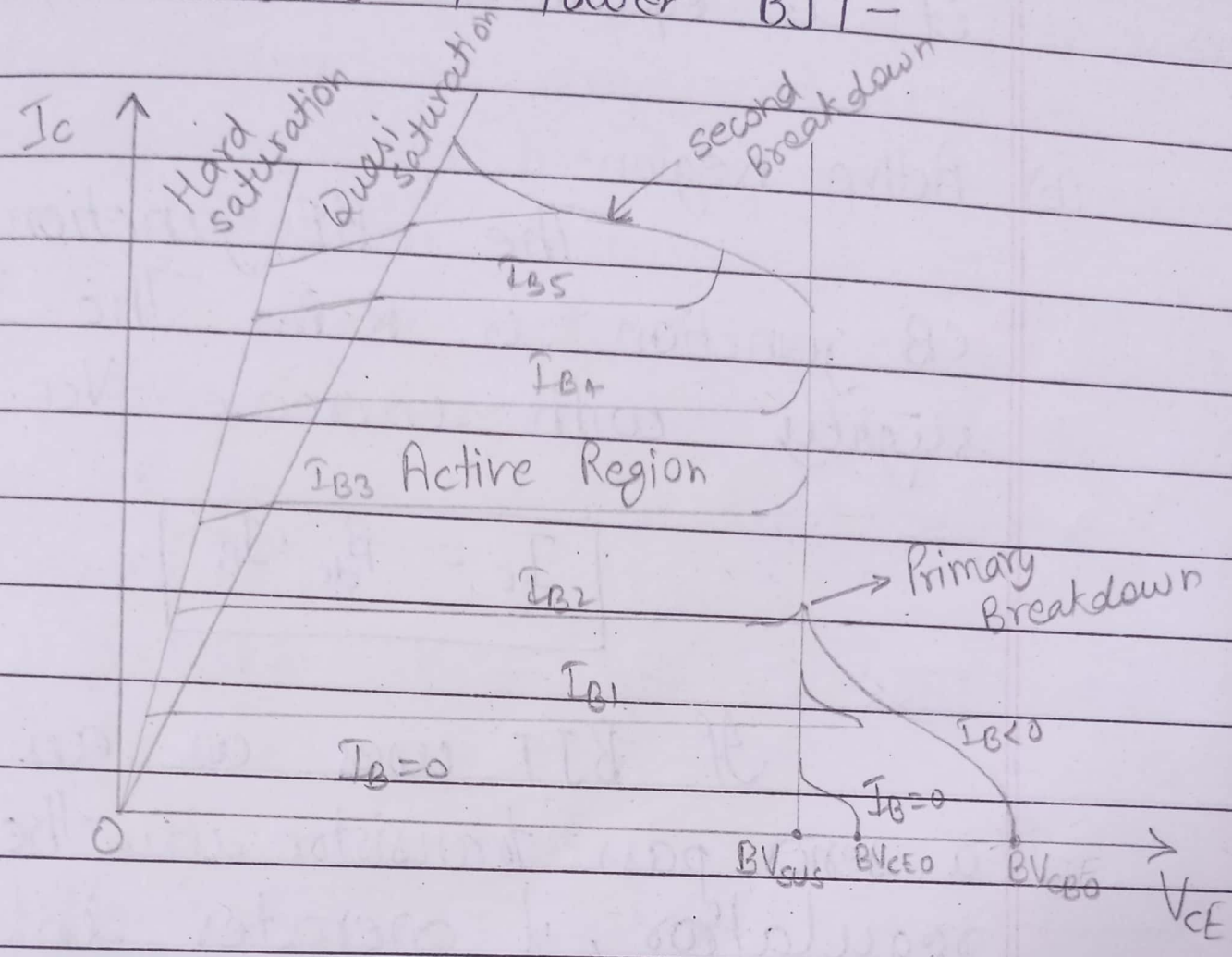
VI - Characteristics of Power BJT -



$$I_{B1} < I_{B2} < I_{B3} < I_{B4} < I_{B5}$$

There are two junctions BE & CB junctions.

The VI characteristics of power BJT divided into four regions-

(a) Cut-off region
(b) Active region
(c) Quasi-saturation region
(d) Hard-saturation region

(a) Cut-off region —

The both BE & CB junctions are R.B. The $I_B = 0$ & I_c is equal to the reverse leakage current I_{CEO}. The region below $I_B = 0$ is cut-off region. In this region BJT offers large resistance to the flow of current. Hence, it is equivalent to an open circuit.

(b) Active Region-

The BE junction is F.B. & CB junction is R.B. The I_c increases slightly with increase V_{CE}. if I_B increased.

$$I_c = \beta_{dc} \cdot I_B$$

If BJT uses as an amplifier or a series pass transistor in the voltage regulator, it operates in this region. The dynamic resistance in this region is large. The power dissipation is maximum.

(c) Quasi - Saturation Region -

This region is between the hard saturation & active region. This region exists due to lightly doped drift layer. In this region, BJT operated at high frequency.

Both CB & BE junctions are F.B. It has less resistance than active region. Power loss is less.

In this region, the device does not go into deep saturation. So, it can turn off quickly.

(d) Hard - Saturation Region —

The power BJT push into the hard saturation region by increasing I_B. This region is also known as deep saturation region. The resistance offers in this region is minimum. So, power dissipation is minimum.

The device acts as a closed switch in this region. It needs more time to turn off. This region is suitable for low frequency application.

In this region both CB & BE junctions are F.B.

—x—x——x——x—x——x—x—

Applications of power electronics devices -

(i) Aerospace -

Satellite power supplies, aircraft power supplies, space shuttle etc.

(ii) Industrial -

Heating, air-conditioning, cooking, pumps & compressors, lasers etc.

(iii) Residential -

Mixers, dryers, fans, lighting, vacuum cleaners etc.

(iv) Transportation - Subways, cars, buses etc.

(v) Telecommunication - Chargers, UPS etc.

(vi) Utility Systems - HVDC transmission, ckt. breakers, boilers, solar power system etc.