Temperature Dependence of I_C

As the expression for collector current I_C is

IC=βIB+ICEO

=βIB+(β+1)ICBO

The collector leakage current I_{CBO} is greatly influenced by temperature variations. To come out of this, the biasing conditions are set so that zero signal collector current I_C = 1 mA. Therefore, the operating point needs to be stabilized i.e. it is necessary to keep I_C constant.

Individual Variations

As the value of β and the value of V_{BE} are not same for every transistor, whenever a transistor is replaced, the operating point tends to change. Hence it is necessary to stabilize the operating point.

Thermal Runaway

As the expression for collector current I_C is

IC=βIB+ICEO

=βIB+(β+1)ICBO

The flow of collector current and also the collector leakage current causes heat dissipation. If the operating point is not stabilized, there occurs a cumulative effect which increases this heat dissipation.

The self-destruction of such an unstabilized transistor is known as **Thermal run away**.

In order to avoid **thermal runaway** and the destruction of transistor, it is necessary to stabilize the operating point, i.e., to keep I_C constant.

Stability Factor

It is understood that I_C should be kept constant in spite of variations of I_{CBO} or I_{CO}. The extent to which a biasing circuit is successful in maintaining this is measured by **Stability factor**. It denoted by **S**.

By definition, the rate of change of collector current I_C with respect to the collector leakage current I_{CO} at constant β and I_B is called **Stability factor**.

S=dICd/ICO at constant I_B and β

Hence we can understand that any change in collector leakage current changes the collector current to a great extent. The stability factor should be as low as possible so that the collector current doesn't get affected. S=1 is the ideal value.