Transistor Biasing

The proper flow of zero signal collector current and the maintenance of proper collector emitter voltage during the passage of signal is known as **Transistor Biasing**. The circuit which provides transistor biasing is called as **Biasing Circuit**.

Need for DC biasing

If a signal of very small voltage is given to the input of BJT, it cannot be amplified. Because, for a BJT, to amplify a signal, two conditions have to be met.

- The input voltage should exceed **cut-in voltage** for the transistor to be **ON**.
- The BJT should be in the **active region**, to be operated as an **amplifier**.

Transistor Biasing is the process of setting a transistor's DC operating voltage or current conditions to the correct level so that any AC input signal can be amplified correctly by the transistor. Transistors are one of the most widely used semiconductor devices which are used for a wide variety of applications, including amplification and switching. However, to achieve these functions satisfactorily, a transistor must be supplied with a certain amount of current and/or voltage. The process of setting these conditions for a transistor circuit is referred to as transistor biasing. Transistor biasing can be accomplished by various techniques that give rise to different kinds of biasing circuits. However, all of these circuits are based on the principle of providing the right amount of base current, IB, and, in turn, the collector current, IC from the supply voltage, VCC when no signal is present at an input.

Moreover, the collector resistor RC has to be chosen so that the collector-emitter voltage, VCE, remains greater than 0.5V for transistors made of germanium and greater than 1V for the transistors made of silicon. If appropriate DC voltages and currents are given through BJT by external sources, so that BJT operates in active region and superimpose the AC signals to be amplified, then this problem can

be avoided. The given DC voltage and currents are so chosen that the transistor remains in active region for entire input AC cycle. Hence DC biasing is needed.

The below figure shows a transistor amplifier that is provided with DC biasing on both input and output circuits.

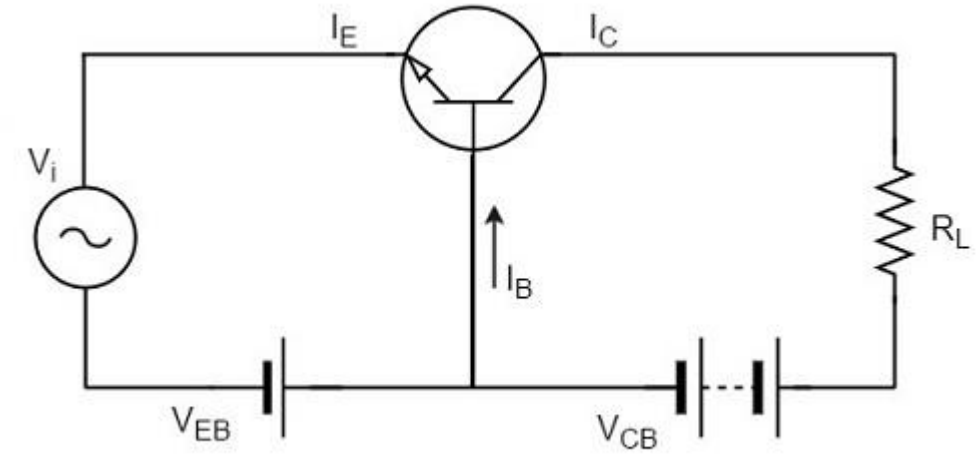

Figure 1.2.1 Transistor amplifier provided with DC biasing on both input and output circuits.

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For a transistor to be operated as a faithful amplifier, the operating point should be stabilized. Let us have a look at the factors that affect the stabilization of operating point.

Factors affecting the operating point

The main factor that affect the operating point is the temperature. The operating point shifts due to change in temperature.

As temperature increases, the values of I_{CE}, β, V_{BE} gets affected.

- I_{CBO} gets doubled (for every 10^o rise)
- V_{BE} decreases by 2.5mv (for every 1^o rise)

So the main problem which affects the operating point is temperature. Hence operating point should be made independent of the temperature so as to achieve stability. To achieve this, biasing circuits are introduced.