SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : **19EC304 – ELECTRONIC CIRCUITS I**

II YEAR / III SEMESTER

Unit I- **BIASING OF DISCRETE BJT,FET**

Topic : Thermal stability &Stability factors

Thermal stability - Stability factors

Stability factor indicates the degree of change in operating due to variation in temperature. There are three variables which are temperature dependent. We can define three stability factors:

$$S = \left(\frac{\partial I_C}{\partial I_{CO}}\right) \longrightarrow \beta, V_{BE} \text{ Constant}$$

$$S' = \left(\frac{\partial I_C}{\partial V_{BE}}\right) \longrightarrow \beta, I_{CO} \text{ Constant}$$

$$S'' = \left(\frac{\partial I_C}{\partial \beta}\right) \longrightarrow I_{CO}, V_{BE} \text{ Constant}$$

Ideally, Stability factors should be zero to keep operating point stable and fixed.
Practically, Stability factors should have the value as minimum as possible.

Effect of change in I_{CO}, is more dominant over the change in β and V_{BE}. Hence S is calculated here.

$$S = \left(\frac{\partial I_C}{\partial I_{CO}}\right)$$

Rate of change of collector current w.r.t reverse saturation current

$$I_C = \beta I_B + (1+\beta) I_{CO}$$

$$1 = \beta \left(\frac{\partial I_B}{\partial I_C} \right) + (1+\beta) \frac{\partial I_{CO}}{\partial I_C}$$

$$\frac{\partial I_{CO}}{\partial I_C} = \left[\frac{(1 - \beta \left(\frac{\partial I_B}{\partial I_C} \right)}{1+\beta} \right]$$

$$\Longrightarrow \boxed{S = \frac{\partial I_C}{\partial I_{CO}} = \left[\frac{1+\beta}{1 - \beta \left(\frac{\partial I_B}{\partial I_C} \right)} \right]}$$

The Stability Factor (S) of a transistor circuit is a measure of its ability to maintain the biasing conditions despite variations in temperature, transistor parameters, and other factors. A higher Stability Factor indicates better stability and less sensitivity to variations.

Transistor Biasing

Transistors can be studied and analyzed with proper biasing. With the right biasing techniques, transistors can be studied and evaluated. This approach makes us understand that a transistor amplifier works within the specified linear range just by adjusting the DC operating point, This is also known as the bias point. Biasing is crucial because it establishes the amplifier's quiescent conditions, which have an impact on the circuit's AC performance.

The transistor type being utilized and the individual circuit requirements determine the biasing method to be used. Temperature, variations in transistor properties, and component aging are additional variables that might impact biasing. To ensure that the transistor functions in the desired region and that the bias point remains stable over time and under various operating situations, it is crucial to properly design the bias circuits.

Need for Transistor Biasing

If the transistor is not biased correctly, it would,

•Works inefficiently

•Produce distortion in the output.

To produce distortion-free output in amplifier circuits, the transistor must operate in the active region. The basic purpose of transistor biasing is to keep the base-emitter junction in proper forward bias and the collector-base junction in proper reversed biased then the transistor is operated in the active region. In a transistor, with normal bias, the emitter junction has a low resistance.

The process of raising the strength of a weak signal without any change in its general shape is known as **faithful Amplification**. The key factor for achieving faithful amplification is that the "base-emitter junction of the transistor remains forward biased and collector junction reverse biased" this is known as **transistor biasing.**

Essentials of Transistor Biasing

The biasing is required for faithful amplification. The biasing network associated with the transistor should meet the following requirements:

•It should ensure proper zero signal collector current.

•

Establish the operating point in the center of the active region of the characteristics. Stabilize the collector current against temperature variations.

•Make the operating point independent of the transistor parameters.

Any Query????

Thank you……