Experiment 2: COMMON EMITTER AMPLIFIER

Aim/Objective: To Design and study the response of a common emitter amplifier using a given transistor.

Apparatus:

BC107 Transistor	1 No
Resistors	22k, 4.7k, 1.2k, 330 ohms
Capacitors	10uF, 10uF, 100uF
Function Generator	
Regulated Power Supply	
Oscilloscope	
CRO Probes	
Connecting Wires	

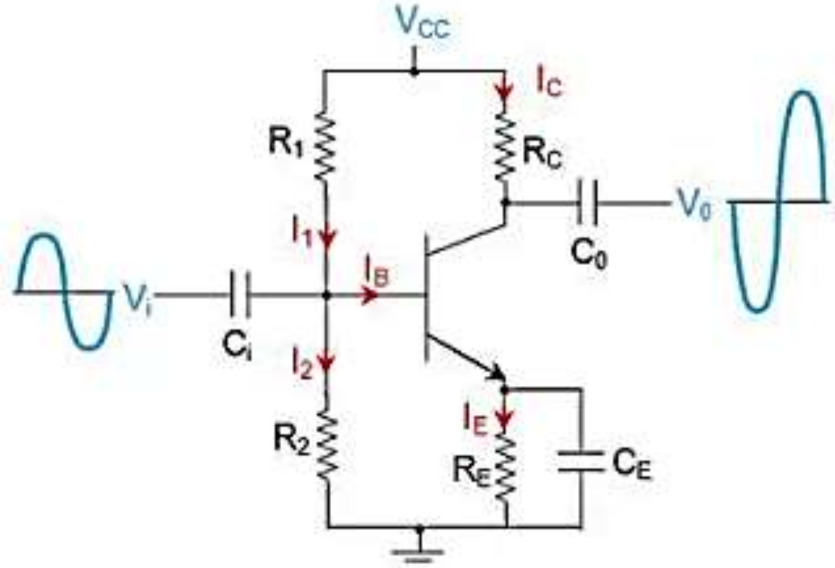
Description:

The CE configuration is the most widely used of all BJT amplifier circuits. To establish a signal ground (or an AC ground, as it is sometimes called) at the emitter, a large capacitor Ce ,usually in the µF or tens of µF range is connected between emitter and ground. This capacitor is required to provide a very low impedance to ground (ideally, zero impedance; i.e, in effect ,a short circuit) at all signal frequencies of interest. In this way , the emitter signal , current passes through Ce to ground and thus ***bypass*** the output resistance of the current source I (and any other circuit component that might be connected to the emitter); hence Ce is called a bypass capacitor. Obviously, the lower the signal frequency, the less effective the bypass capacitor. For our purposes here we shall assume that Ce is acting as a perfect short circuit and thus is establishing a zero signal voltage at the emitter.

In order not to disturb the DC bias currents and voltages, the signal to be amplified, shown as a voltage source Vs with an internal resistance RS, is connected to the base through a large capacitor Ci capacitor, Ci known as a coupling capacitor**,** is required to act as a perfect short circuit at all signal frequencies of interest while blocking DC. Here again we shall assume this to be the case and differ diffusion of imperfect signal coupling, arising as a result of the rise of the impedance of Cs, at low frequencies, At this junction, we should point out that in situations where the signal source can provide a DC path for the DC base current *IB* without significantly changing the bias point we may connect the source directly to the base, thus dispensing with Cs as well as Rs. Eliminating Rs has the added beneficial effect of rising the input resistance of the amplifier.

The voltage signal resulting the collector Vc, is coupled to the load resistance RL via another coupling capacitor C1. We shall assume that C1 also acts a perfect short circuit at all signal frequencies of interest; thus the output voltage Vo = Vc. Note that RL can be an actual load resistor to which the amplifier is required to provide its output voltage signal, or it can be the input resistance of a subsequent amplifier stage in cases where more than one stage of amplification is needed.

Circuit Diagram:



Pre-lab Session

1) Explain the role of the emitter bypass capacitor Ce in a CE amplifier. Why is it important for signal amplification?

2) What is the function of the coupling capacitor CS , and under what condition can it be omitted from the CE amplifier circuit?

3) Why do we assume coupling and bypass capacitors to act as perfect short circuits at signal frequencies? What practical limitation arises at low frequencies?

In-Lab Session

Procedure:

1. Connect circuit as per circuit diagram.

2. Set the Input = 20 mv (sine wave), using the Function generator and then connect at the input terminals.

3. Connect the C.R.O at output terminals i.e Output (Vo).

4. Keep the input voltage constant, Vary the frequency from 50 Hz to 1 MHz in regular steps and note down the corresponding output voltage.

5. Calculate the gain & magnitude of the amplifier using the given formula.

   Max volage Gain = V_o/V_i

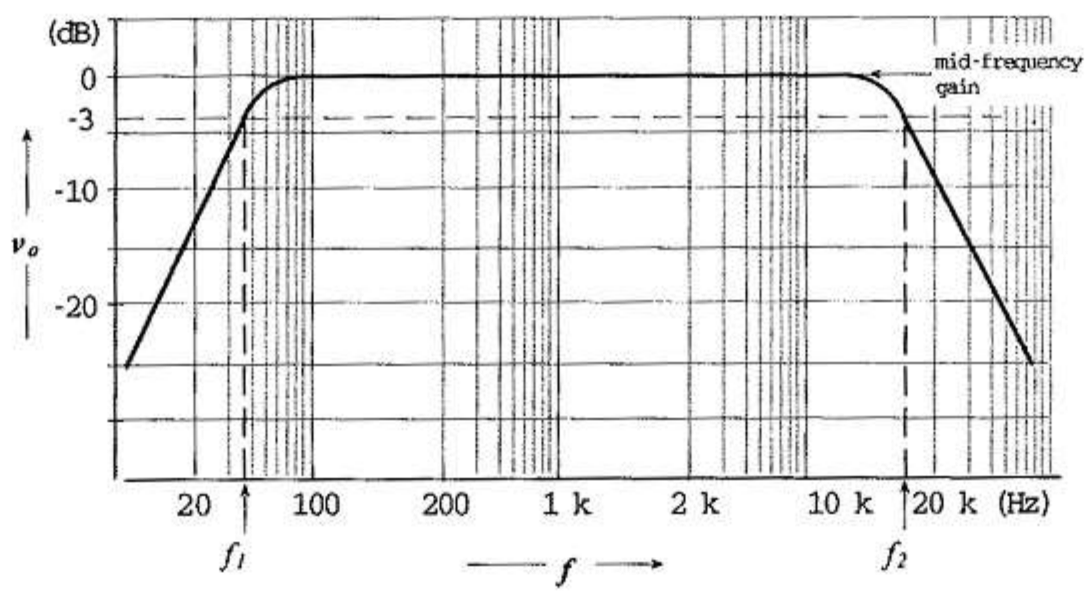
   Gain in dB= 20 log (V_o / V_i)

1. Plot the graph on semi-log sheet taking frequency(Hz) along X-axis and gain in (dB)along y-axis. Frequency response graph is as shown in fig. Below

2. Indicate the lower 3dB frequency (f_L) and upper3dB the bandwidth (f_H) the graph.

3. Calculate the bandwidth from the graph, BW= f_H-f_L(Hz)

Model Graph:



Tabular column:

Vi=20mv

Sl No.	Frequency	V_O (volts)	Gain = V_O/V_i	Gain (dB) =20log V_O/V_i

Calculations:

1) Maximum voltage gain =

2) Lower cut-off frequency (f_L) =

3) Upper cut-off frequency (f_H) =

4) Band width (f_H- f_L) =

Viva-Voce:

1. **What is the primary function of the bypass capacitor connected to the emitter in a CE amplifier?**
   A. To block DC current
   B. To improve thermal stability
   C. To provide a low-impedance path for signal frequencies
   D. To increase the DC gain

2. **The capacitor connected between the signal source and the base in a CE amplifier is known as:**
   A. Decoupling capacitor
   B. Coupling capacitor
   C. Bypass capacitor
   D. Tuning capacitor

3. **Why is a large capacitor connected between emitter and ground in a CE amplifier?**
   A. To increase power gain
   B. To reduce input resistance
   C. To bypass AC signal and stabilize the gain
   D. To isolate the emitter from ground

4. **What happens if the coupling capacitor between the source and the base is removed, and the source cannot provide a DC path?**
   A. The amplifier gain increases
   B. The base current increases
   C. The transistor may not get properly biased
   D. There is no effect on the amplifier

5. **In a CE amplifier, what is the effect of a bypass capacitor becoming ineffective at low frequencies?**
   A. The gain increases significantly
   B. The signal is amplified more efficiently
   C. The gain decreases due to emitter degeneration
   D. The transistor gets damaged

Analysis and Inference:

Result:

Evaluator Remark (if Any):	**Marks Secured: _____out of 50**
	Signature of the Evaluator with Date