6. TO STUDY DC AND AC PERFORMANCE CB AMPLIFIER

1. Course, Subject & Experiment Details

Academic Year	2018 – 2019	Estimated Time	Experiment No.6– 02 Hours
Course & Semester	S.E. (COMP) – Sem. III	Subject Name	Basic Electronics Lab
Chapter No. & Unit	01 – Unit 1.1 Mapped with CO-1	Chapter Title	Bipolar Junction Transistor
Experiment Type	Hardware (Bread Board)	Subject Code	CSL 302

2. Aim & Objective of Experiment

To design common emitter configuration BJT small signal amplifier according to the given performance specifications using the values as obtained from the device (BJT) datasheet & also to calculate the mid-band voltage gain (A_v) under normal operating conditions. This experiment also aims at understanding choice of components & analyzing if designed circuit meets the required specifications.

3. Expected Outcome of Experiment

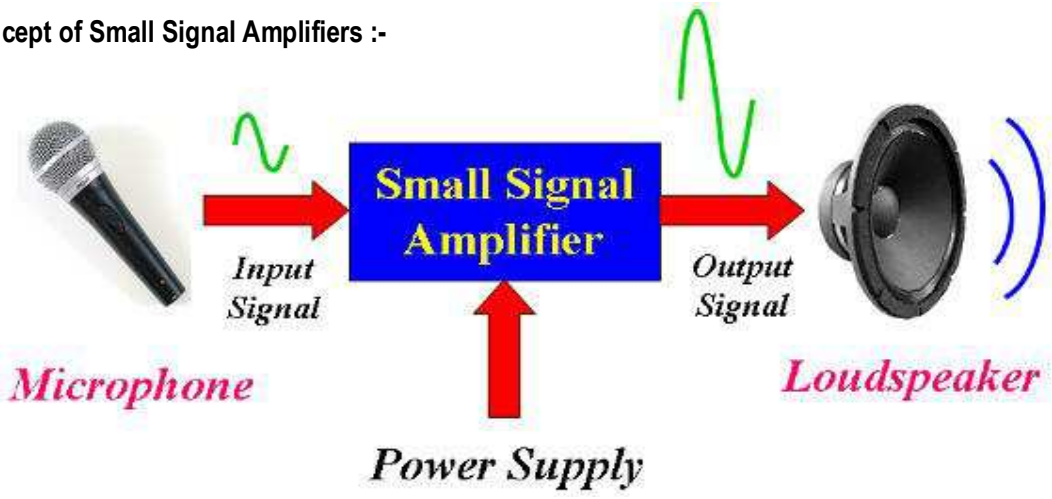
Being one of the major experiments in the curriculum, the expected outcome with the successful performance of this experiment is for the students to learn about the CB – BJT small signal amplifier designing procedures & to gain an insight into its operation. Computer simulation helps to verify the entire design process. Actually implementing will lead to an insight on how assumptions are made for it.

4. Problem Statement for Design

Design single stage CB – BJT amplifier to achieve a voltage gain of $|A_V| \geq 50$ to generate a peak output signal of $V_{out(peak)} = \pm 5$ V & employing BC 547B. Assume the lower cut-off frequency of $f_L = 20$ Hz & load resistance of $R_L = 10$ k8. Verify the designed & implement it.

5. Brief Theoretical Description

(a) Concept of Small Signal Amplifiers :-



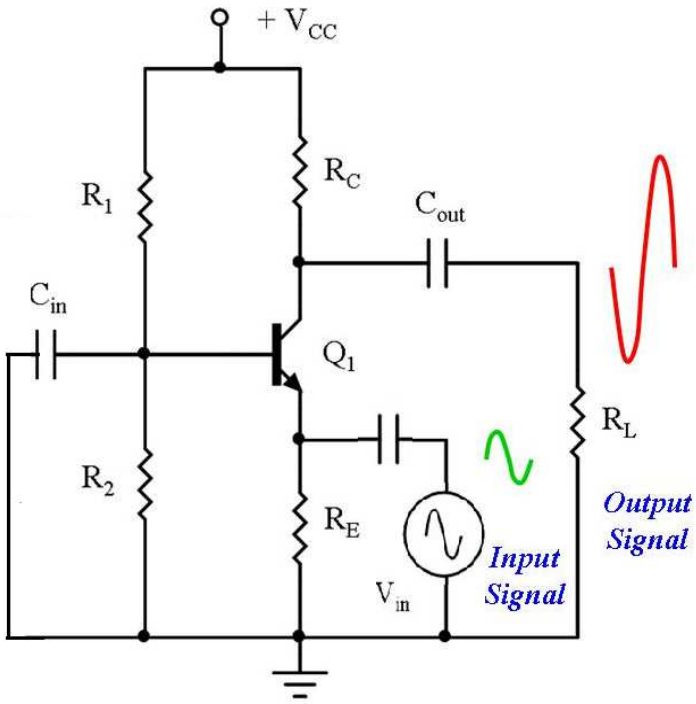
In CB configuration the base is made common to both the input & output. The input is given to emitter & the output is taken across the collector. In order to analyze the features of this configuration, let us determine the different gains of this circuit.

Current gain is defined as the ratio of the output current to the input current. Hence Ai = ic/ iE, We know that iE = ic + iB & so here the current gain is less than unity. Similarly, the voltage gain is the ratio between output & input voltage & so Av = Vc/ VE. Though i E > ic; Rc the reverse resistance of collector junction is greater than RE the forward resistance of emitter junction & so ic Rc >> iERE. Hence the voltage gain is high. Due to the high voltage gain the power gain also high.

(b) The CB – BJT Small Signal Amplifier:-

The common-base amplifier can provide a reasonable level of voltage gain but suffers from low input impedance and a current gain of less than one. However, this circuit is used in high-frequency applications because its terminal characteristics at high frequencies are better than those of a common-emitter configuration using the same transistor. The low input impedance of the common base amplifier will limit its use to specialized RF applications.

6. Circuit Diagram & Experimental Setup



7. Apparatus Required

(a) Software :- MultiSim 10 by National Instruments (NI) OR CircuitMaker 2000 Professional Edition

(b) Components :-

Type of Component	Symbolic Notation	Component Value & Specification
Resistors	R_1	68 K, ¼ W
	R_2	12 K, ¼ W
	R_C	4.7K, ¼ W
	R_E	1.2K, ¼ W
Capacitors	C_{in}	1 µF, 63 V
	C_{out}	1 µF, 63 V
	C_E	100 µF, 63 V
BJT	Q_1	BC 547B

(c) Instruments :-

- Single DC Power Supply : 0-30 V
- Digital Multimeter (DMM)
- Function Generator: 0-10 MHz, 20 Vpp Max.
- Cathode Ray Oscilloscope (CRO) : 0-30 MHz
- Bread Board & Connecting Wires

8 Designing Steps & Procedure

Students should systematically explain the entire design procedure in this section, thereby justifying the selection of different component values according to given design specifications & draw circuit diagram

9. Experimental Procedure

1. Connect the circuit as per the circuit diagram.
2. Switch on power supply & adjust its output for Vcc =12V.
3. Find Q point of the circuit.
4. Set Vin =50mV, using signal generator.
5. Find voltage gain, current gain, input impedance, and output impedance.
6. Keeping input voltage constant; vary the frequency from 0 Hz to 1 MHz and note down the corresponding output voltage.
7. Plot the graph Gain (db) Vs Frequency (Hz).
8. Calculate the bandwidth from the graph

10. Observation Table

1. Q Point of the Amplifier

Vcc	Vc	V_B	**Ic= Vcc-Vc/Rc**	**V_{CB} = Vc- V_E**

Q point = (V_{CE}, Ic)

2. Voltage gain :

Vin= , Vo= , Av = Vo/Vin

3.Current gain :

Ii = , Io= , Ai = Io/ Ii

4.Input impedance Ri= **, Output impedance** Ro=

5. Frequency response curve:

Input voltage, Vi= 20mV

Frequency	**Vo**	**Gain = Vo/ Vin**	**Gain in db**

Experiment analysis the Common Base amplifier using a NPN transistor. The following results have been found

Operating point =

Voltage gain Av=

Current gain Ai=

Input Impedance Ri=

Output Impedance Ro=

The frequency response of the amplifier has been plotted. The bandwidth of the amplifier =

11. Conclusions & Inferences

Students should explain in brief the concluded outcome from the experiment & its inference, as obtained from the observation table & nature of the graph which explains the circuit behavior as per the conditions

12. Practical & Real Life Applications

- Public Address Systems (PAS)
- Audio & Music Equipment
- CD & Cassette Players
- Microphone Pre-amplification Stage
- TV & Radio Receivers
- Communication Systems & Equipment

13. Post Lab Questions

1. Explain why it is necessary to do DC analysis first than AC analysis of an amplifier?
2. Why BJT has large bandwidth in CB amplifier?
3. Compare CB & CE amplifier.

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