Experimental Data:

The resistance that was required to fix the Q point (using potentiometer) was, $R = 172\,\Omega$

The peak value of V_{in} and V_{out} was,

$$V_{in} = 0.5\ V$$

$$V_{out} = 0.405\ V$$

gain, $A_V = \frac{V_{out}}{V_{in}} = \frac{0.405}{0.5}$

$= 0.81$

when the frequency was 5 KHz and the input signal was 0.5 V (P-P)

Scanned by CamScanner

After disconnecting Ch-2 and potentiometer and connecting Ch-1 accross 100 Ω, the peak value was, V = 7 mV.

The gain for different frequencies are as follows:

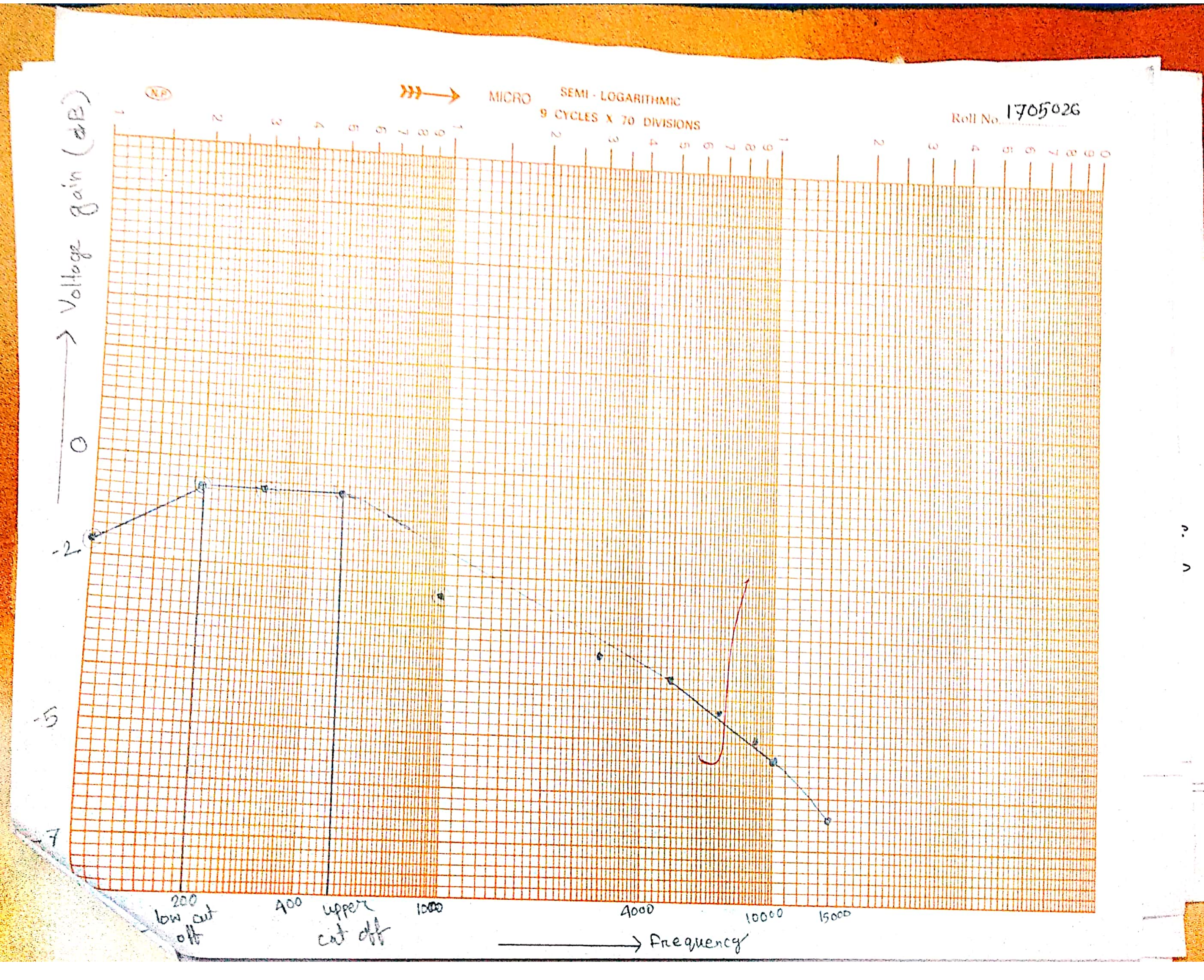
Frequency	V_{in} (V)	V_{out} (V)	Voltage gain A_v
50 Hz	0.5	0.405	0.81
100 Hz	0.5	0.45	0.91
200 Hz	0.5	0.42	0.84
500 Hz	0.5	0.42	~~0.80~~ 0.84
1000 Hz	0.5	0.38	0.76
2000 Hz	0.5	0.35	0.70
3000 Hz	0.5	0.32	0.64
5000 Hz	0.5	0.30	0.61
7000 Hz	0.5	0.29	0.59
9000 Hz	0.5	0.28	0.56
10 000 Hz	0.5	0.26	0.52
12 000 Hz	0.5	0.26	0.52
15 000 Hz	0.5	0.24	0.48

Report

1/ Plot the frequency response of the circuit on semilog graph paper.

— Attached graph

2/ What is the input impedance, output impedance, phase relationship and gain of the emitter follower circuit. How do these quantities compare with those of a CE amplifier?

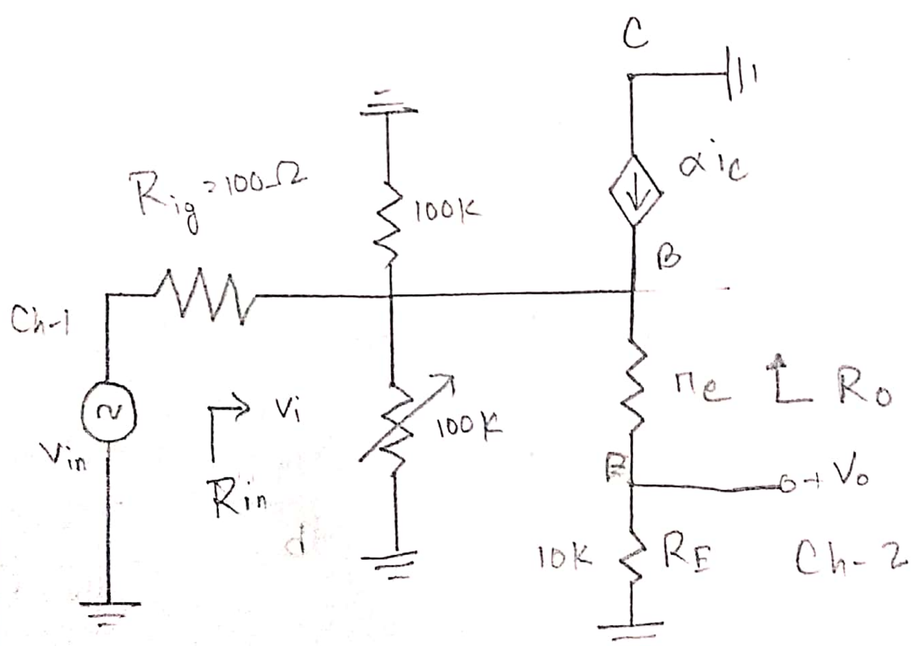


Scanned by CamScanner

Answer:

An emitter follower circuit is basically a common collector circuit. It is a transistor circuit where the emitter voltage follows the input voltage.

The equivalent circuit using T-model is like this:



Input impedance:

The parallel equivalent resistance of the base resistors and the transistor input impedance is known as the input impedence.

So, $$i_e = \frac{V_{in}}{r_e + R_E}$$

and $$\frac{i_b}{i_e} = \frac{1}{\beta+1}$$

$$\therefore i_b = \frac{i_e}{\beta+1}$$

So, input impedance,

$$R_{in} = \frac{V_{in}}{i_b} = \frac{V_{in}}{\frac{\frac{V_i}{r_e+R_E}}{\beta+1}}$$

Scanned by CamScanner

So, R_{in} or the input impedance

is $= \dfrac{V_{in}}{\dfrac{V_{in}}{r_e + R_E}} \times (\beta+1)$

$= (\beta+1)(r_e + R_E)$

We know,

$r_e = \dfrac{V_T}{I_E}$

Through DC analysis we have,

$I_E = 0.007\ V$

$\therefore r_e = 371.4\ \Omega$ where $V_T = 0.26\ V$

Input impedence, $R_{in} = R_B \parallel R_i$

For the circuit,

$R_B = (100k \parallel 100k)$

$= 50K$

Output Impedence :

From the circuit we can see that,

$$R_{out} = r_e + \frac{(100\,\Omega \parallel R_B)}{\beta + 1}$$

Phase Difference :

From the Oscilloscope it was seen that the phase difference of the input and output voltage is 0°.

Gain :

For the circuit in the experiment,

the voltage gain, $A_V = \frac{V_{out}}{V_{in}}$

$= \frac{0.5}{0.5} = 1$ (almost)

In emitter follower circuit the input impedence is very high and output impedence is very low. But in common emitter both impedence are average.

The phase difference in emitter follower circuit is 0° whereas it is 180° in common emitter configera-tion.

3/ What is the application of emitter follower circuit.

Answer:

An emitter follower circuit has many applications. But one of the main application is that it can be used as impedance matching.
Impedance matching means designing a circuit with high input resistance or low output resistance to maximize the power or minimize signal reflection from the load. In emitter follower, it is seen that

P.T.O

it has high input impedance and low output impedance. So, it is a good circuit for impedance matching.

As the emitter follower circuit has a huge current gain and around unity voltage gain, it can be used as a voltage buffer circuit.

The emitter follower circuit can be used for circuit isolation and it is also used as a switching circuit.

4/

What are the advantage and disadvantage of emitter follower circuit.

Answer :

The advantages of emitter follower are as follows :

- It has high current gain.
- Other amplifiers have more higher output impedance than the emitter follower circuit.
- This circuit can be used for impedance matching

- It can be used as isolation amplifier or switching circuit.

The disadvantages are as follows:

- It has voltage gain which is almost 1.
- Where voltage gain is necessary, this circuit cannot be used.

5/ Explain the reason why voltage gain is less than unity?

Answer:

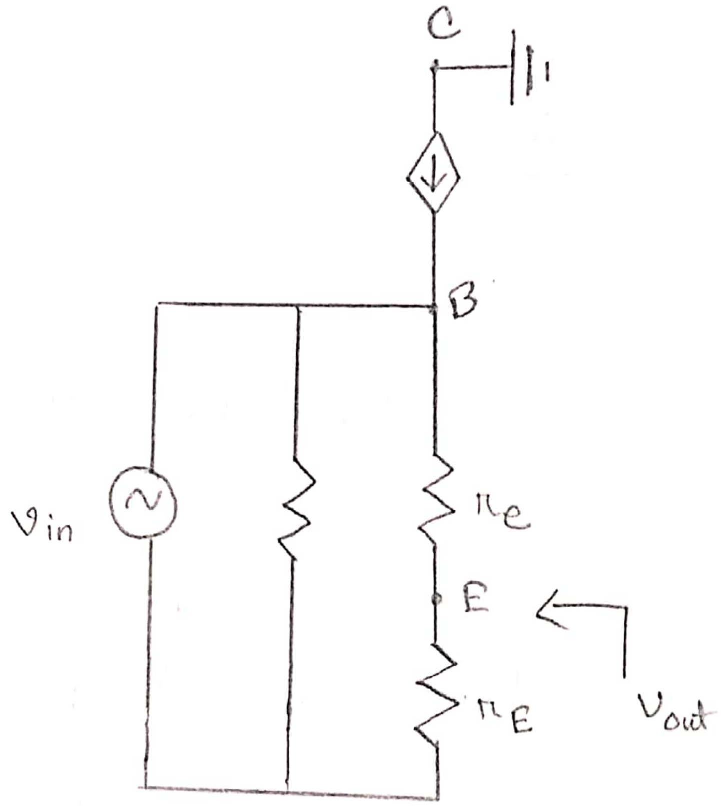
We know,

$$\text{voltage gain, } A_V = \frac{V_{out}}{V_{in}}$$

For emitter follower circuit the voltage gain always less than unity. At low frequency it is near to unity because V_{out} is always less or equal to V_{in}.

0.5

The circuit of emitter follower can be represented in T- model like this.



Here, $A_v = \frac{r_E}{r_e + r_E}$ (r_E is $R_E \parallel R_L$)

As $r_e + r_E > r_E$, So, the voltage gain is less than unity.

In practical $r_e << r_E$. Then $A_v \simeq 1$.