OBSERVATION BOOK

Electronic Circuit Analysis Lab (EC408PC)

(For 2nd Year, ECE, II Semester)

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Affiliated to Jawaharlal Technological University, Hyderabad)
Department of ECE

This Observation Book belongs to

Name ……………………………………………………

Roll No ……………………………………………………

Class ……………………………………………………

Academic Year ……………………………………………………

Faculty

1 ____________________________

2 ____________________________

Lab Technician

1 ____________________________

2 ____________________________

WORK DAIRY

S.No	Date	Details of Practical done	Marks	Signature

LIST OF EXPERIMENTS

1. Common Emitter Amplifier (*)
2. Two Stage RC coupled Amplifier
3. Cascode Amplifier Circuit (*)
4. Darlington Pair Circuit
5. Current shunt feedback amplifier Circuit
6. Voltage series feedback amplifier Circuit (*)
7. RC Phase shift Oscillator Circuit (*)
8. Hartley & Colpitts's Oscillators Circuit
9. Class A Power Amplifier (Transformer less)
10. Class B Complementary Symmetry Amplifier (*)
11. Design a Monostable Multivibrator
12. The output voltage waveform of Miller Sweep Circuit

Note:

1. Experiments marked with * has to be designed, simulated and verified in hardware.
2. Minimum of 9 experiments to be done in hardware.

SOFTWARE LAB

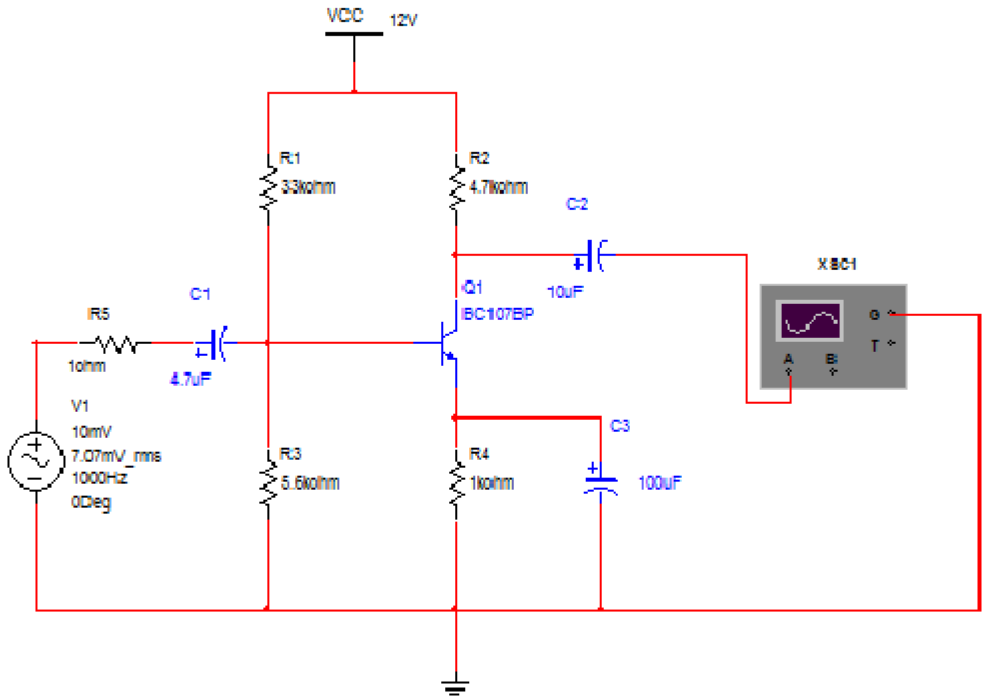
Experiment: 01

COMMON EMITTER AMPLIFIER

AIM: To find the voltage gain and plot the frequency response of a single stage CE amplifier using MULTISIM software and calculate the gain and bandwidth.

APPARATUS REQUIRED: PC & MULTISIM 7 / 2001

CIRCUIT DIAGRAM



PROCEDURE:

1. Start MULTISIM. A blank circuit window will appear on the screen along with a component tool bar.
2. Using component tool bar place all the components on the circuit window and connect the circuit.
3. Save the circuit file.
4. Without applying the input (Vs = 0), find the operating point V_{BE} for transistor Q using DC analysis. Ensure that the transistor is in active region.
5. Determine using multi-meter V_B, V_E, V_C, V_{BE}, V_{CE}, I_E, I_C by simulating the circuit using SIMULATE switch.

6. Set R_S = 1Ω and V_S = 10 mV (peak) at 1 KHz and determine the voltage gain A_V using CRO.
7. Using AC analysis obtain the frequency response for the frequency range 10Hz to 100MHz.
8. Compare the practical and theoretical values.

OBSERVATIONS :

1. Quiescent dc voltages: V_{CC} = ____________ V
   a. V_B = ____________ V
   b. V_E = ____________ V
   c. V_C = ____________ V
   d. V_{BE} = ____________ V
   e. V_{CE} = ____________ V
   f. I_C = ………..……mA
   g. I_E = ……….……. mA
   h. I_B = ………………µA

PARAMETERS	THEORITICAL	PRACTICAL
V_B		
V_E		
V_C		
V_{BE}		
V_{CE}		
I_C		
I_E		
Av		

RESULT : - Thus, the frequency response of CE amplifier is obtained and

Gain =

Lower cut-off frequency =

Upper cut-off frequency =

Band width =

Viva Questions

1. Define different operating regions of transistor.
2. Define α and β of a transistor.
3. What do you understand by DC and AC load lines?
4. What is the need of coupling capacitors in an amplifier?
5. What are the advantages of CE amplifier over CB and CC amplifiers?

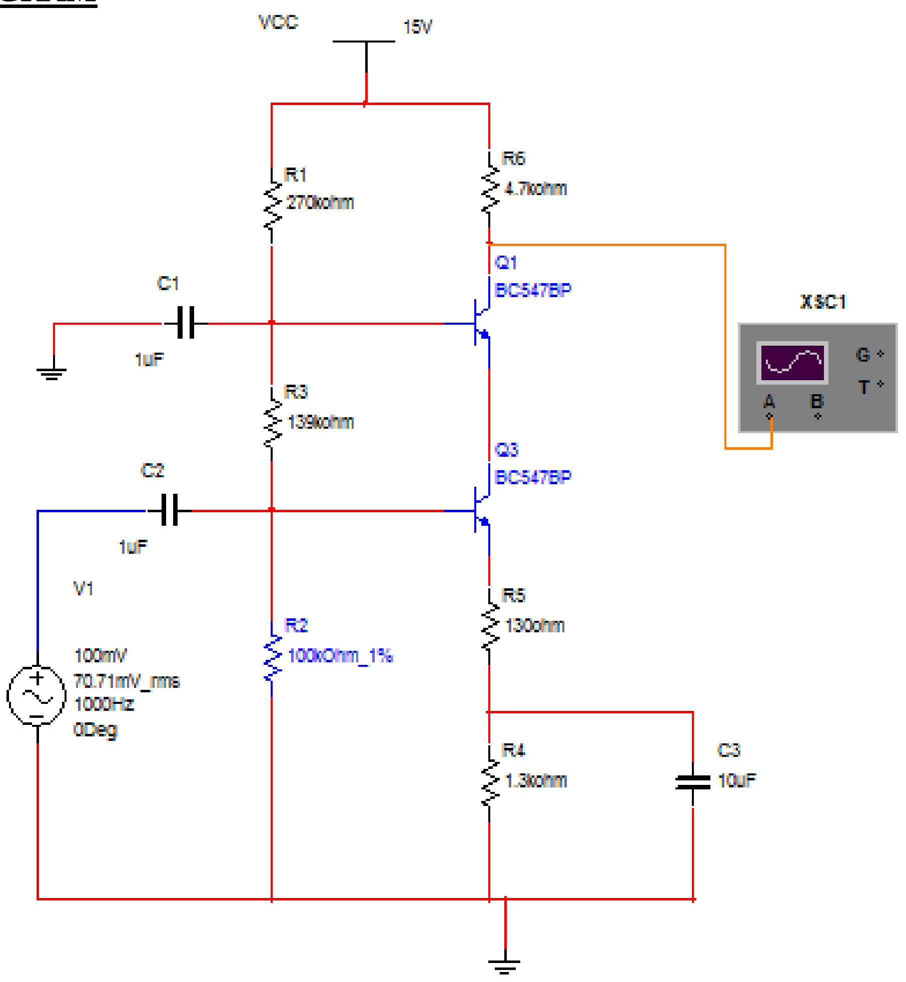
Experiment: 02

CASCODE AMPLIFIER

AIM: To find the voltage gain and plot the frequency response of a Cascode amplifier using MULTISIM.

APPARATUS REQUIRED: PC & MULTISIM 7 / 2001

CIRCUIT DIAGRAM



PROCEDURE:

1. Start MULTISIM. A blank circuit window will appear on the screen along with a component tool bar.
2. Using component tool bar place all the components on the circuit window and wire the circuit.
3. Save the circuit file.

4. Without applying the input (Vs = 0), find the operating point V_{BE1} for transistor Q_1 and V_{BE2} for transistor Q_2 using DC analysis. Ensure that both transistors are in active region.
5. To find the voltage gain A_V of the cascode amplifier, feed a low input signal (of order in mV) of 1 KHz to the input of amplifier.
6. Determine the gain of cascode amplifier.
7. Using AC analysis obtain the frequency response of the cascode amplifier.
8. Note down the 3 dB gain points i.e lower cut off (f_L) and higher cut off frequencies (f_H).
9. Determine bandwidth.

OBSERVATIONS:

10. Quiescent dc voltages: V_{CC} = ________ V.
    a. V_{BE1} = _____V & V_{BE2} = _____ V
11. Input voltage (V_s) =
12. Output voltage of Cascode amplifier (Vo) =
13. Voltage gain of Cascode amplifier =
14. Lower cutoff frequency of Cascode amplifier f_L =
15. Higher cutoff frequency of Cascode amplifier f_H =
16. Bandwidth =

RESULT:

Hence, the frequency response of cascode amplifier was obtained.

Voltage Gain =

Lower cut-off frequency =

Upper cut-off frequency =

Band width =

VIVA QUESTIONS:

1. What is the need of cascode amplifier?
2. Difference between cascade connection and cascode connection?
3. What are the stages is used in cascode amplifier.
4. Write the applications of cascode amplifier?
5. What is gain and bandwidth of cascode amplifier?

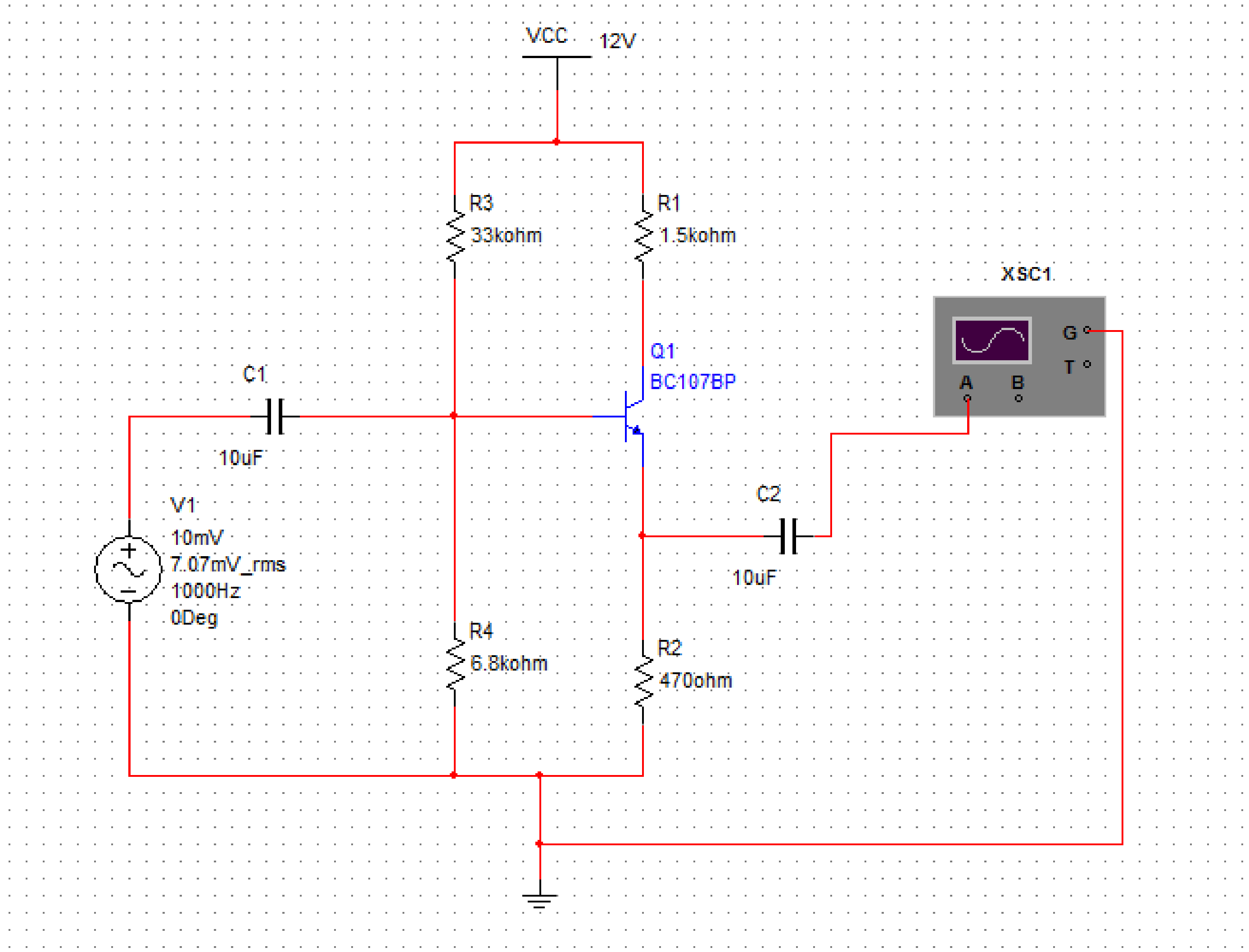
Experiment: 03

VOLTAGE SERIES FEEDBACK AMPLIFIER

AIM: To find the voltage gain and plot the frequency response of a voltage series feedback amplifier.

APPARATUS REQUIRED: PC & MULTISIM 7 / 2001

CIRCUIT DIAGRAM



PROCEDURE:

1. Start MULTISIM. A blank circuit window will appear on the screen along with a component tool bar.
2. Using component tool bar place all the components on the circuit window and wire the circuit.
3. Save the circuit file.

4. Without applying the input (Vs = 0), find the operating point and make sure the circuit in active region.

<u>To find the voltage gain:</u>

(a) Without Feedback:

5. To find the voltage gain A_V of the amplifier without feedback, disconnect emitter and feed a low input signal (of order in mV) of 1 KHz to the input of amplifier.
6. Connect the oscilloscope channel 'A' to input and channel 'B' to output i.e at V_o. Ensure that the colors of two (input and output) wires connected to oscilloscope are different. Reduce the input signal if the output is distorted.
7. Determine the gain A_v of the amplifier without feedback.

(b) With Feedback:

8. To find the voltage gain of the amplifier with feedback A_{Vf}, connect emitter resistance. Connect CRO channel 'B' at V_o to find the output voltage.
9. Determine the gain A_{Vf} of the amplifier with feedback.

<u>To find the frequency response:</u>

(a) Frequency response of amplifier without feedback :

10. For plotting the frequency response of the amplifier without feedback, remove the feedback resistance R_E.
11. Apply input signal (**V_s**) of **mV, 1 KHz** to the amplifier and connect a CRO at $V_{o.}$
12. Using AC analysis, obtain the frequency response of the amplifier with frequency range 1Hz to 100 MHz.
13. Note down the -3 dB gain points i.e lower cut off (f_L) and higher cut off frequencies (f_H).
14. Determine the bandwidth of the amplifier without feedback. BW = f_H - f_L

(b) Frequency response of amplifier with feedback :

15. For plotting the frequency response of the voltage series feedback amplifier connect the feedback resistance R_E. Connect a CRO at V_o.
16. Repeat steps 12&13 for amplifier with feedback and determine bandwidth.

OBSERVATIONS:

1. Quiescent dc voltages: V_{CC} = ____________V
   V_{BE} = _____________V
2. Input voltage (V_s) =

Without Feedback (disconnect Emitter resistance R_E):

3. Output voltage Vo =
4. Voltage gain (A_V) =
5. Lower cutoff frequency f_L =
6. Higher cutoff frequency f_H =
7. Bandwidth =

With Feedback (connect Emitter resistance R_E):

8. Output voltage Vo =
9. Voltage gain (A_{Vf}) =
10. Lower cutoff frequency f_{Lf} =
11. Higher cutoff frequency f_{Hf} =
12. Bandwidth =

RESULT:

Hence, the frequency response of voltage series feedback amplifier is obtained.

With Emitter resistor	Without Emitter resistor
Gain =	Gain =
Lower cut-off frequency =	Lower cut-off frequency =
Upper cut-off frequency =	Upper cut-off frequency =
Band width =	Band width =

Viva Questions

1. What is the input and output impedance of voltage series feedback amplifier?
2. Which is the sample and mixer outputs in voltage series feedback amplifier?
3. Give the circuit example of voltage series feedback amplifier?
4. What is the other names of voltage series feedback amplifier?
5. Draw the topologies of voltage series and voltage shunt feedback.

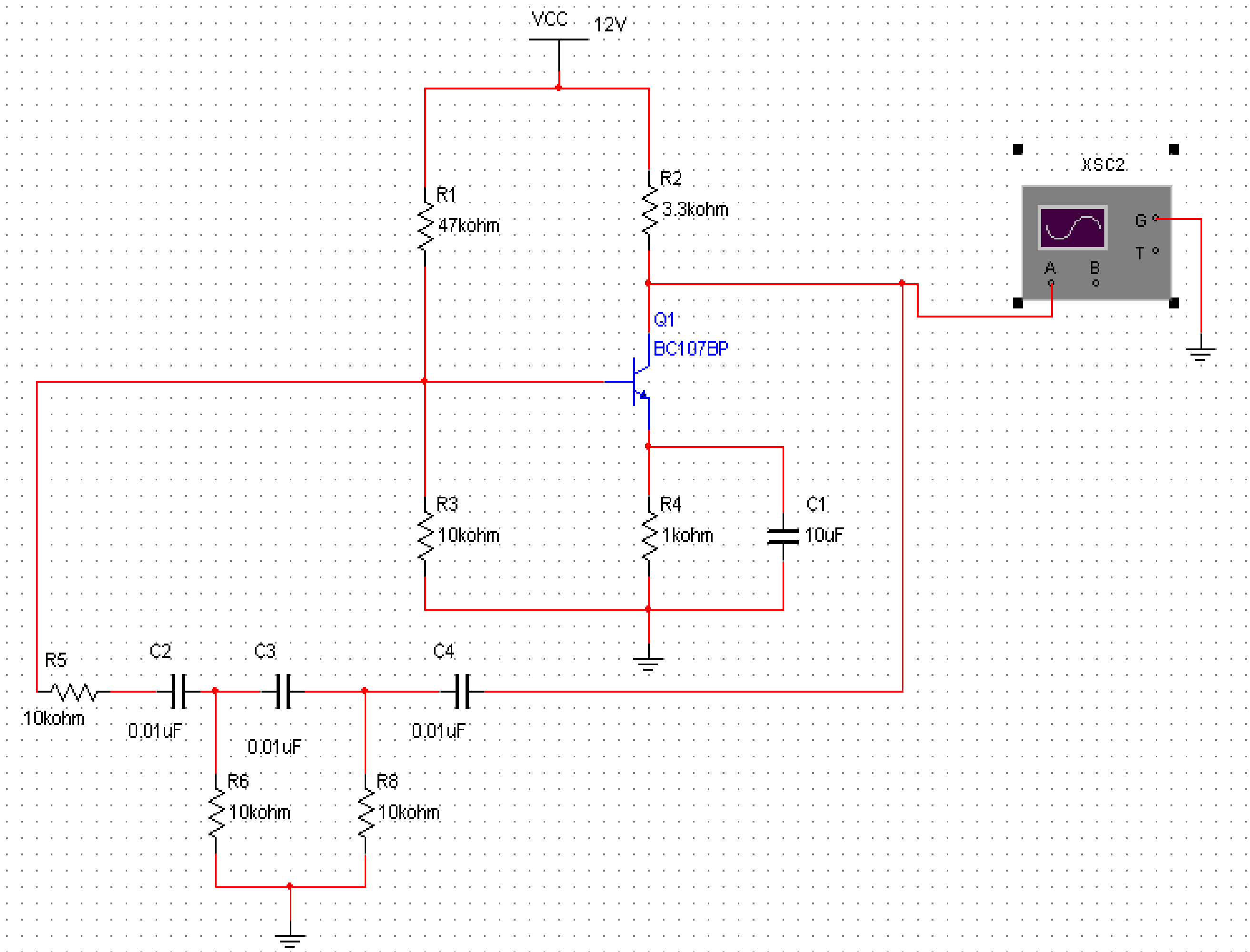
Experiment: 04

RC PHASE SHIFT OSCILLATOR

AIM: To find the frequency of oscillations of a RC phase oscillator using MULTISIM and compare with the theoretical value.

APPARATUS REQUIRED: PC & MULTISIM 7 / 2001

CIRCUIT DIAGRAM:



PROCEDURE:

1. Start MULTISIM. Wire the circuit as per the circuit diagram with the three capacitors C=0.01μF as shown in the circuit diagram.
2. Find the operating point V_{BE} for transistor Q using DC analysis. Ensure that the transistor is in active region.
3. Save the circuit file.
4. Connect the output of the RC Phase shift oscillator to the CRO.
5. Find the frequency of oscillations f_o by measuring the time period of the output waveform.

6. Compare with the theoretical value.
7. The theoretical value of frequency is given by $f_o = \dfrac{1}{2\pi RC\sqrt{6+4K}}$ where K = $\dfrac{R_C}{R}$
8. Repeat steps 1 through 6 for other set of values for capacitors C = 0.0033µF and 0.0022µF.

OBSERVATIONS & CALCULATIONS:

Quiescent DC voltages: V_{CC} = _______________ V.

V_{BE} = ________________V

R = 10 KΩ

S.No.	Capacitor	Theoretical frequency	Practical frequency Time period (T)	Frequency (f)
1.	0.0022µF			
2.	0.0033µF			
3.	0.01µF			

RESULT: Hence Frequency of oscillation for the given oscillator is determined.

For C = 0.0022µF C = 0.0033µF C = 0.01µF

Frequency of oscillations 'f_o' =

Viva Questions

1. What is the major difference between RC oscillators and LC oscillators?
2. Why RC oscillators are not suitable for high frequency generation?
3. Obtain the condition for oscillations in a RC phase shift oscillator?
4. Write the formula for frequency of oscillations?
5. What is the phase shift produced by RC phase shift network?

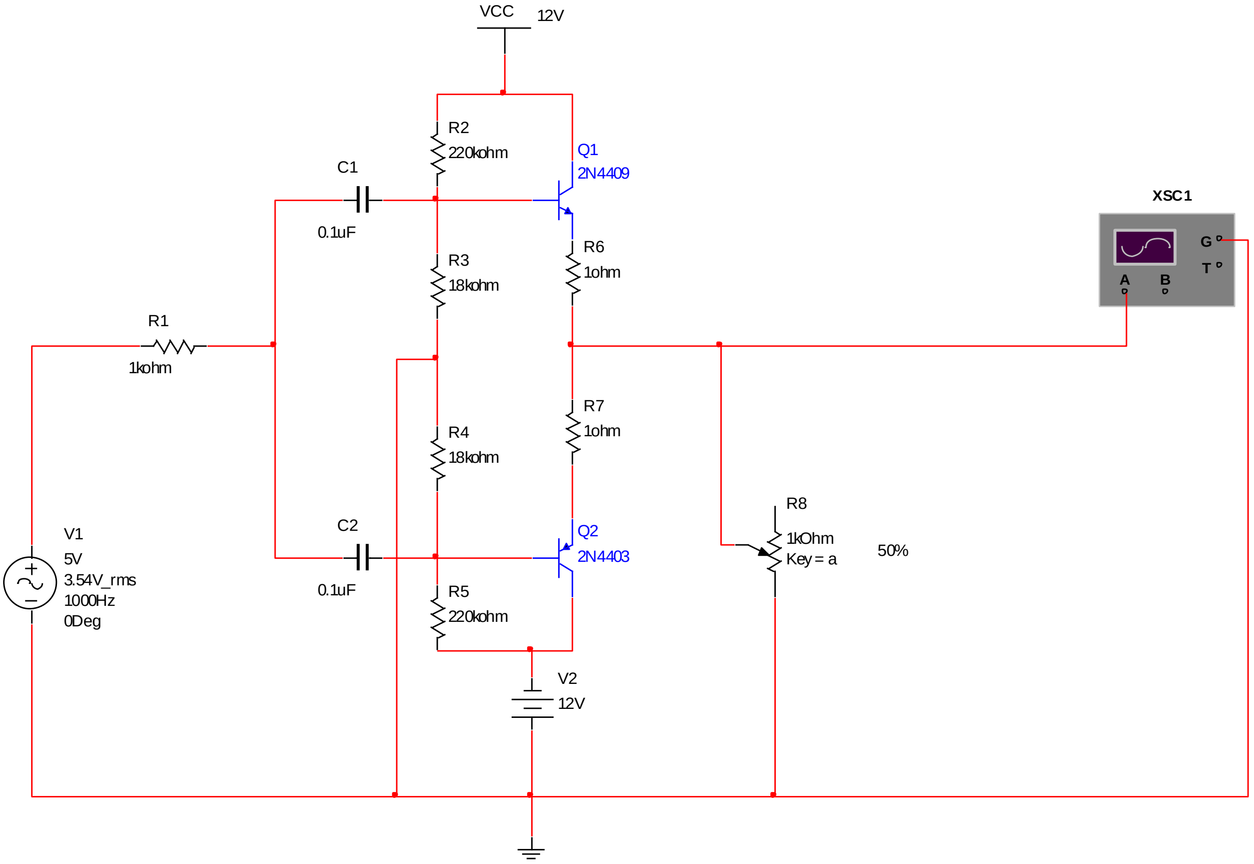
Experiment: 5

CLASS B COMPLEMENTARY SYMMETRY POWER AMPLIFIER

AIM: To determine efficiency of class B complementary symmetry power amplifier.

APPARATUS REQUIRED: PC & MULTISIM 7 / 2001

CIRCUIT DIAGRAM:



PROCEDURE:

1. Start MULTISIM. A blank circuit window will appear on the screen along with a component tool bar.
2. Using component tool bar place all the components on the circuit window and wire the circuit and save the circuit file.
3. Measure the supply voltage $\mathbf{V_{CC}}$ and the base to emitter voltage $\mathbf{V_{BE}}$ of transistors Q_1 and Q_2 using DC analysis. Ensure that both the transistors are in active region.
4. Using a signal generator apply the signal of 5V, 1KHz to the input terminals as (V_S).

5. Connect a CRO across the load resistance R_L of 1KΩ. Increase the input voltage till distortion sets in. Measure the output voltage V_O. (change the load resistance R_L to get crossover distortion if required).
6. Using an ammeter in ac mode measure the ac current '**I_{rms}**' through the load resistance (R_L)

OBSERVATIONS & CALCULATIONS:

1. Quiescent dc voltages:

V_{CC} = ________ V

- V_{CC} = ___________V.

V_{BE1} of transistor Q_1 = __________ V

V_{BE2} of transistor Q_2 = __________ V

2. Output voltage: V_O = _____________Volts p to p.

3. AC current through R_L I_{rms} = __________ mA.

4. a) AC output power $P_{ac} = \dfrac{{V_O}^2}{8R_L}$ = __________

b) DC input power $P_{dc} = 2 \times I_{dc} \times V_{CC}$

$$= 2 \times \frac{\mathrm{Im}}{\pi} \times V_{CC} = 2\times \frac{I_{rms} \times \sqrt{2}}{\pi} \times V_{CC} = \left(\frac{2\sqrt{2}I_{rms}}{\pi}\right) \times V_{CC}$$

=

$$\therefore \text{Efficiency } \eta = \frac{P_{ac}}{P_{dc}} \times 100\ \% =$$

RESULT:

Hence determined the efficiency (η) of class – B complementary symmetry power amplifier.

Efficiency (η) =

Viva Questions

1. Classify Power Amplifiers?
2. Define cross over distortion?
3. What is the difference between class B push pull & complementary symmetry amplifier?
4. What is the maximum power dissipation in class B power amplifier?
5. What is the maximum conversion efficiency of class B complementary symmetry power amplifier?

HARDWARE LAB

Experiment: 01

COMMON EMITTER AMPLIFIER

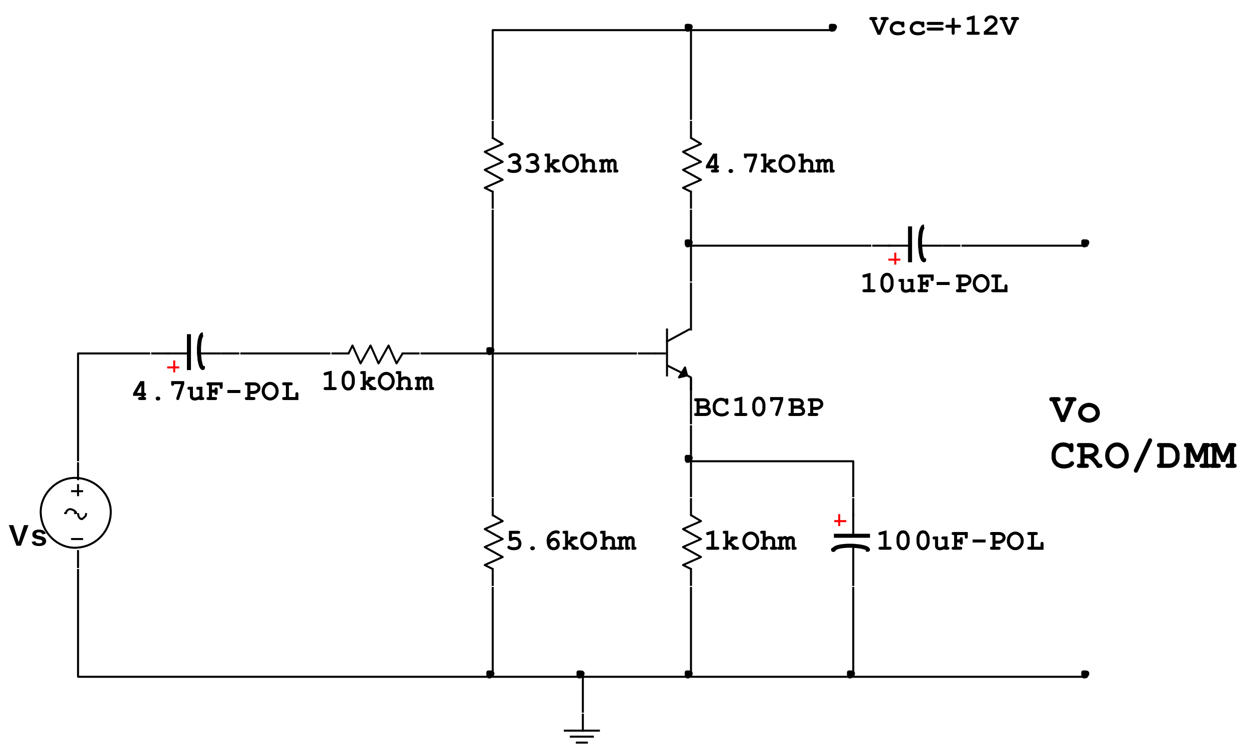
AIM:

To study the frequency response of a CE amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30)V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM
5. Experimental kit with components as per circuit diagram
6. Connecting wires.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit as shown in circuit diagram.

2. Switch on the power supply V_{CC}. With the help of DMM measure the quiescent voltages V_{BE} and V_{CE} and note down. Ensure that the transistor is in active region.

Amplifier gain measurement 'A_V':

2. Apply an input signal of 1 KHz to get an undistorted output V_O. Observe the output waveform on a CRO.

3. Using CRO measure the voltage V_{in} and V_o.

4. Evaluate A_V, voltage gain using the equation $A_V = \frac{V_O}{V_{in}}$ and record the gain of amplifier.

To find frequency response:

5. Apply an input signal Vin of 1KHZ to the amplifier to get an undistorted output V_O. Observe the output waveform on a CRO.

6. To obtain the frequency response, vary the frequency of the audio signal generator from 10 HZ to 1MHz in suitable steps. Measure the output V_o at each step using CRO.

7. Take more readings in low frequency and high frequency regions of the frequency response.

8. Tabulate the readings. Calculate the gain in dB using the relation

   Gain in dB = 20 log $\frac{V_O}{V_{in}}$.

9. Plot the frequency response i.e. Gain A_V in dB versus frequency on a semi log paper.

OBSERVATIONS:

1. Quiescent Voltages:

   V_{BE} = ----------------- volts

   V_{CE} = ---------------- volts

2. Amplifier gain A_V

   Input voltage V_{in} = -------------------------- volts

   Output voltage V_o = ------------------------- volts.

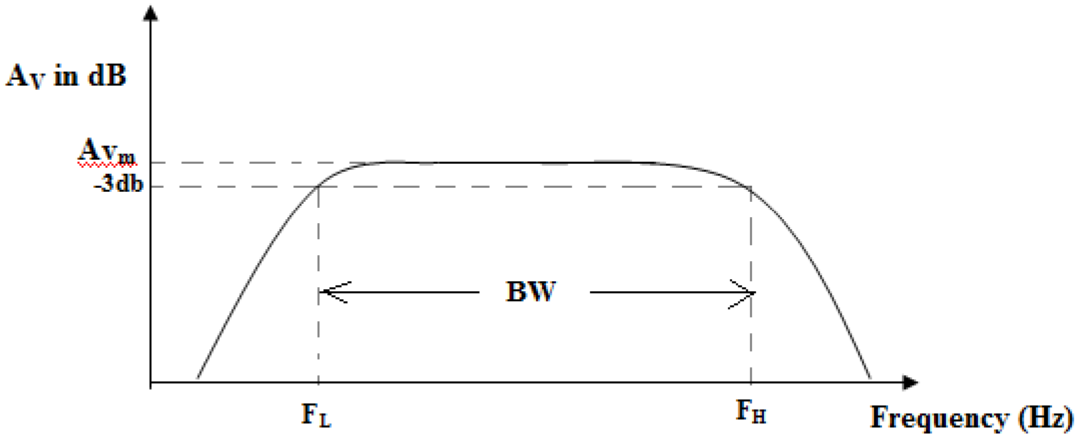
   Amplifier gain $A_V = \frac{V_O}{V_{in}}$

Frequency response:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

EXPECTED GRAPH:



RESULT:

(i) Mid Band gain Avm = --------------------

A_{Vm} in dB = -------------------- dB

(ii) Lower cut of frequency f_L = ------------- Hz

(iii) Upper cut of frequency f_H = -------------- Hz

(iv) Bandwidth of amplifier ($f_H - f_L$) = ------------Hz

Viva Questions:

1. Draw the small signal equivalent model of CE amplifier with R_E.
2. What are the advantages of voltage divider bias?
3. Compare CE, CB and CC amplifiers.
4. What is the unit of gain? Why is measured in dB?
5. What is effect on gain and input resistance in CE amplifier with R_E?

Experiment: 02

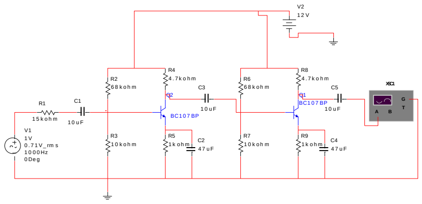
TWO STAGE RC COUPLED AMPLIFIER

AIM: To find the voltage gain and plot the frequency response of a single stage and two-stage RC coupled amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30) V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM (Digital Multimeter)
5. Experimental kit with components as per circuit diagram.
6. Connecting wires.

CIRCUIT DIAGRAM



PROCEDURE:

1. Connect the circuit as shown in circuit diagram.

2. Switch on the power supply V_{CC}. With the help of a DMM measure the voltages V_{BE1} and V_{BE2} and note down.

3. Switch ON the audio signal generator and connect to the input of the amplifier. Set the frequency at 1KHz and signal at minimum (30mV).

To find the voltage gain:

4. To find the voltage gain A_{V1} of the first stage disconnect the second stage and vary the input frequency, keeping input voltage V_{in} is constant and note down the output voltage using DMM/CRO.
5. Calculate A_{v1}, voltage gain using below equation and record the gain of the amplifier.
$$A_V = \frac{V_O}{V_{in}}$$
6. Draw a graph between frequency and gain in dB.
7. To find the voltage gain of two-stage amplifier A_{V2} connect the second stage and vary the input frequency, keeping input voltage same and note down the output voltage using DMM/CRO.
8. Determine the gain of two stages (overall) using $A_V = \frac{V_O}{V_{in}}$ and draw a graph between frequency and gain in dB.

OBSERVATIONS:

1. Quiescent dc voltages: V_{CC} = _________ V.
V_{BE1} = ____________V
V_{BE2} = __________ V

Frequency response of Single stage Amplifier:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H - f_L$) = ------------Hz

Frequency response of Two stage Amplifier:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

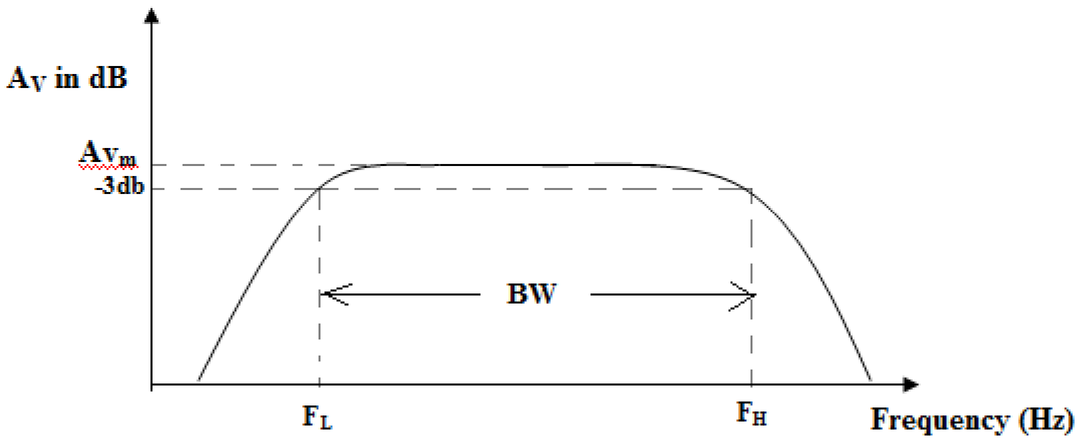
A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H - f_L$) = ------------Hz

EXPECTED GRAPH:



RESULT:

Hence, the frequency response of a single stage and two-stage RC coupled amplifier obtained.

Single Stage	Two Stage
Gain =	Gain =
Band width =	Band width =

Viva Questions:

1. How total decibel gain is determined from a cascade amplifier?
2. What is meant by a bypass capacitor and what is its importance in the circuit?
3. What is meant by a coupling capacitor and what is its importance in the circuit?
4. Which mode of transistor configuration is suitable for cascading? Why?
5. What is the need of coupling amplifier stages?

Experiment: 03

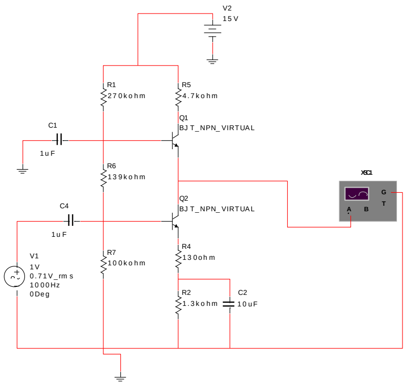
CASCODE AMPLIFIER CIRCUIT

AIM: To study the frequency response Cascode amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30)V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM
5. Experimental kit with components as per circuit diagram
6. Connecting wires.

CIRCUIT DIAGRAM



PROCEDURE:

1. Connect the circuit as shown in circuit diagram.
2. Switch on the power supply V_{CC}. With the help of DMM measure the quiescent voltages V_{BE} and V_{CE} and note down. Ensure that the transistor is in active region.

Amplifier gain measurement 'A_V':

3. Apply an input signal of 1 KHz to get an undistorted output V_O. Observe the output waveform on a CRO.
4. Using CRO measure the voltage V_{in} and V_o.
5. Evaluate A_V, voltage gain using the equation $A_V = \frac{V_O}{V_{in}}$ and record the gain of amplifier.

To find frequency response:

6. To obtain the frequency response, vary the frequency of the audio signal generator from 10 Hz to 1MHz in suitable steps. Measure the output V_o at each step using CRO.
7. Take more readings in low frequency and high frequency regions of the frequency response.
8. Tabulate the readings. Calculate the gain in dB using the relation Gain in dB = 20 log $\frac{V_O}{V_{in}}$.
9. Plot the frequency response i.e. Gain A_V in dB versus frequency on a semi log paper.

OBSERVATIONS:

1. Quiescent Voltages:

   V_{BE} = ----------------- volts

   V_{CE} = ---------------- volts

2. Amplifier gain A_V

   Input voltage V_{in} = -------------------------- volts

   Output voltage V_o = ------------------------ volts.

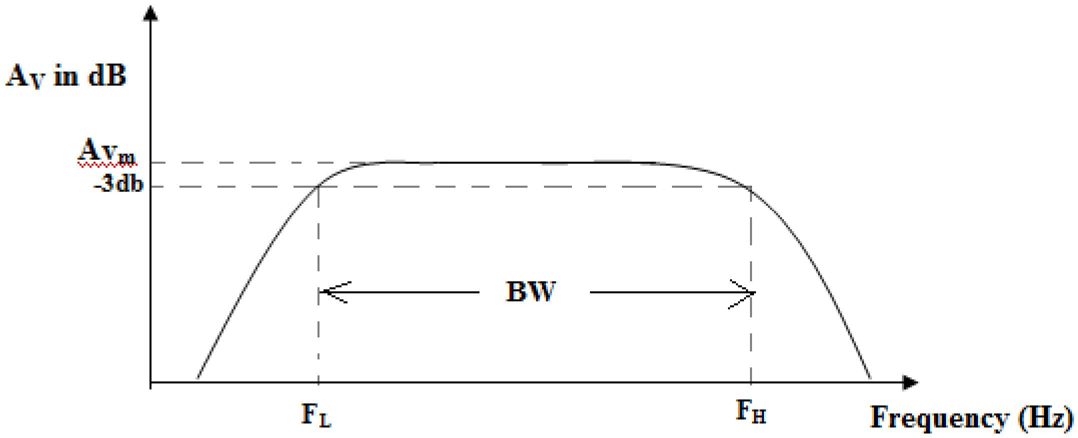
   Amplifier gain $A_V = \frac{V_O}{V_{in}}$

Frequency response:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

EXPECTED GRAPH:



RESULT:

(i) Mid Band gain Avm = --------------------

A_{Vm} in dB = -------------------- dB

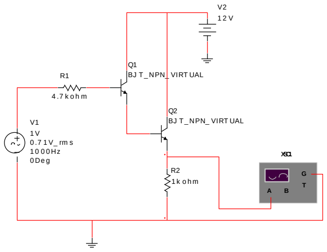
(ii) Lower cut of frequency f_L = ------------- Hz

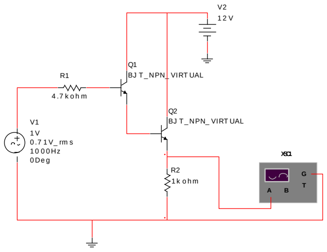
(iii) Upper cut of frequency f_H = -------------- Hz

(iv) Bandwidth of amplifier ($f_H - f_L$) = -----------Hz

VIVA QUESTIONS:

1. What is the use of multistage amplifiers?
2. What is darlington pair?
3. Write the advantages of darlington amplifer.
4. Write the expression for f_L and f_H of multistate amplifiers.
5. Write the different types of coupling schemes used in multistage amplifiers.


V2
12 V
Q1
BJT_NPN_VIRTUAL
R1
4.7kohm
V1
1V
0.71V_rms
1000Hz
0Deg
Q2
BJT_NPN_VIRTUAL
XSC1
R2
1kohm
G
T
A B


V2
12 V
Q1
BJT_NPN_VIRTUAL
R1
4.7kohm
V1
1V
0.71V_rms
1000Hz
0Deg
Q2
BJT_NPN_VIRTUAL
XSC1
R2
1kohm
G
T
A B

Procedure:

1. Connect +12V variable dc power supplies at their indicated position from external source or Connect +5V dc at Vin' terminal and connect a patch cord between socket a and socket b.

2. Connect a patch cord between socket e and f.

3. Now measure the dc voltage between base of transistor T1 and using multimeter.

4. Calculate the input current (Ii) by substituting the value in eq.2

5. Now connect +5V directly at the base terminal of transistor T1.

6. Remove the patch cord between socket e and f and connect a multimeter between these sockets to measure the output current (Io).

7. Calculate the input impedance by using eq.3

8. Calculate the ratio of output current to input current.

9. Ratio of output current to input current gives the overall b of Darlington pair.

10. Individual b of transistors can be calculated by considering the transistors having identical b and substituting in eq.1

Result:

Current Gain of Darlington Pair [Io / Ii] = ………

Individual β of transistor =.........

Experiment: 05

CURRENT SHUNT FEEDBACK AMPLIFIER

AIM: To find the voltage gain and plot the frequency response of a current shunt feedback amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30) V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM (Digital Multimeter)
5. Experimental kit with components as per circuit diagram.
6. Connecting wires.

CIRCUIT DIAGRAM

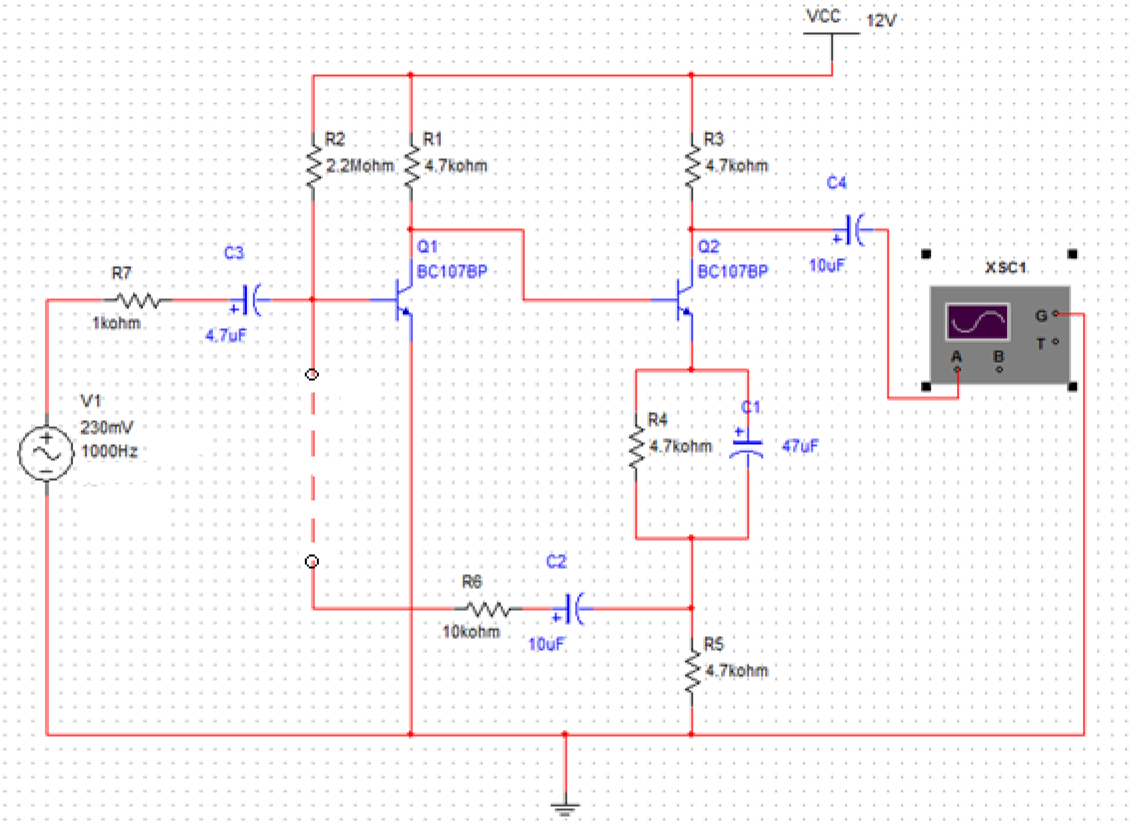


Fig. Current Shunt Feedback Amplifier

PROCEDURE:

1. Connect the circuit as shown in circuit diagram.
2. Switch ON the audio signal generator and connect to the input of the amplifier. Set the frequency at 1KHz and 230mV signal.

To find the voltage gain:

3. To find the voltage gain A_V of without feedback circuit, disconnect the feedback circuit and vary the input frequency, keeping input voltage V_{in} is constant and note down the output voltage using DMM/CRO.
4. Calculate A_v, voltage gain using below equation and record the gain of the amplifier.
$$A_V = \frac{V_O}{V_{in}}$$
5. Draw a graph between frequency and gain in dB.
6. To find the voltage gain of with feedback circuit $A_{Vf,}$ connect the feedback network and vary the input frequency, keeping input voltage same and note down the output voltage using DMM/CRO.
7. Determine the gain of feedback amplifier using $A_V = \frac{V_O}{V_{in}}$ and draw a graph between frequency and gain in dB.

OBSERVATIONS:

Frequency response of with out feedback Amplifier:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H – f_L$) = ------------Hz

<u>Frequency response of current shunt feedback Amplifier</u>:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

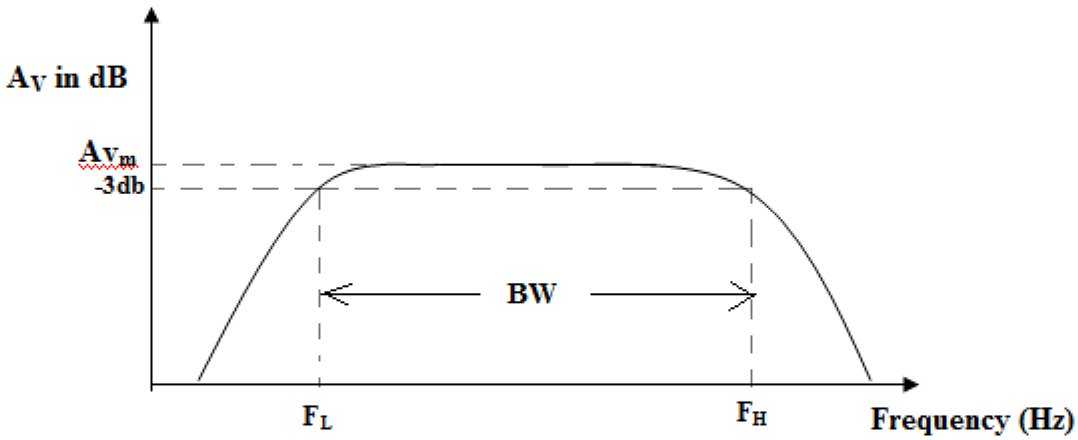
A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H – f_L$) = ------------Hz

EXPECTED GRAPH:



RESULT:

Hence, the frequency response of current shunt feedback amplifier is obtained.

Without feedback	With feedback
Gain =	Gain =
Band width =	Band width =

Viva Question:

1. Draw the topologies of current series and current shunt feedback.
2. What is the sample and mixer outputs in current shunt feedback amplifier?
3. What is the effect of feedback on distortion and stability?
4. Give the circuit example of current shunt feedback amplifier?
5. What is the other names of current shunt feedback amplifier?

Experiment: 06

VOLTAGE SERIES FEEDBACK AMPLIFIER CIRCUIT

AIM: To study the frequency response voltage series feedback amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30)V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM
5. Experimental kit with components as per circuit diagram
6. Connecting wires.

CIRCUIT DIAGRAM:

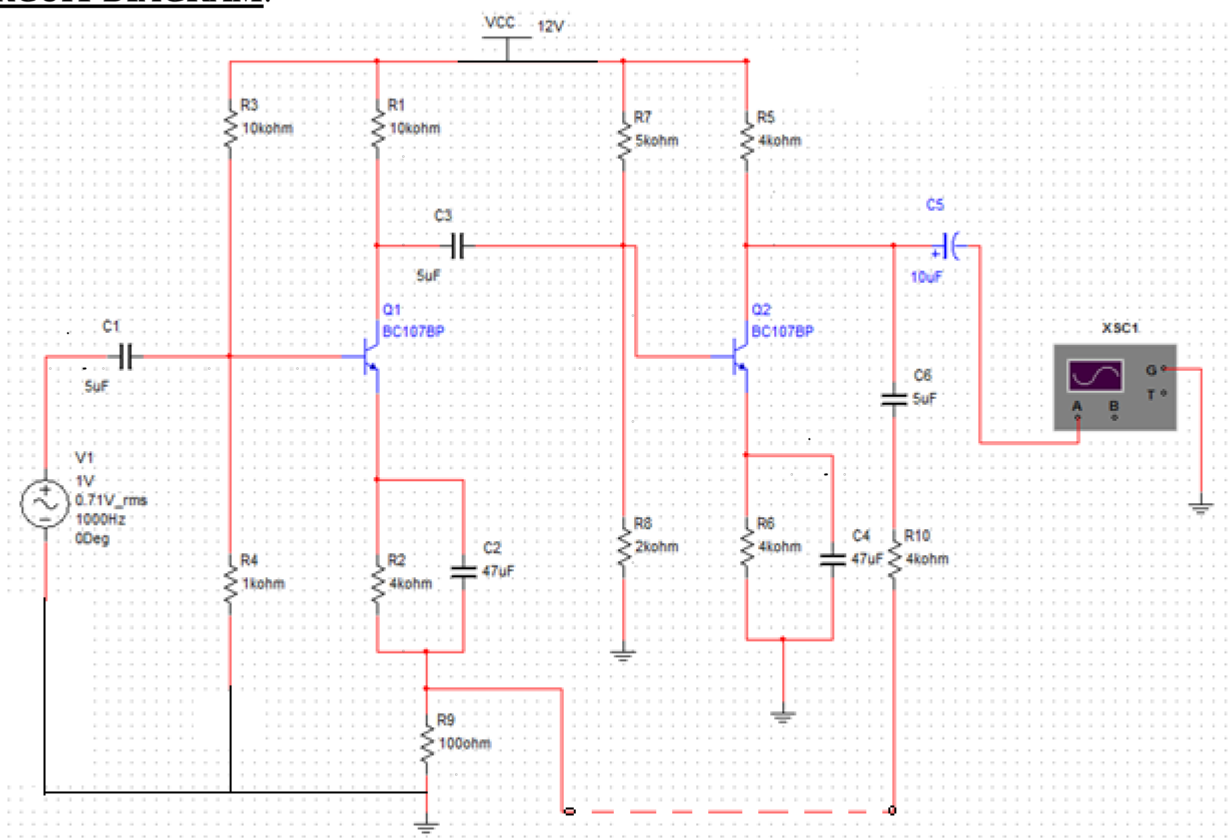


Fig. Voltage Series Feedback Amplifier

PROCEDURE:

1. Connect the circuit as shown in circuit diagram.

2. Switch ON the audio signal generator and connect to the input of the amplifier. Set the frequency at 1KHz and 200mV signal.

To find the voltage gain:

3. To find the voltage gain A_V of without feedback circuit, disconnect the feedback circuit and vary the input frequency, keeping input voltage V_{in} is constant and note down the output voltage using DMM/CRO.
4. Calculate A_v, voltage gain using below equation and record the gain of the amplifier.

$$A_V = \frac{V_O}{V_{in}}$$

5. Draw a graph between frequency and gain in dB.
6. To find the voltage gain of with feedback circuit $A_{Vf,}$ connect the feedback network and vary the input frequency, keeping input voltage same and note down the output voltage using DMM/CRO.
7. Determine the gain of feedback amplifier using $A_V = \frac{V_O}{V_{in}}$ and draw a graph between frequency and gain in dB.

<u>OBSERVATIONS:</u>

<u>Frequency response of with out feedback Amplifier</u>:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H - f_L$) = ------------Hz

Frequency response of voltage series feedback Amplifier:

Input voltage V_i = ---------------- volts

S.No.	Frequency of input signal	Output voltage V_o in volts	Voltage gain $A_V = \frac{V_O}{V_i}$	Voltage gain A_V in dB = 20 log(Av)
1.				
2.				
3.				

Mid Band gain Avm = --------------------

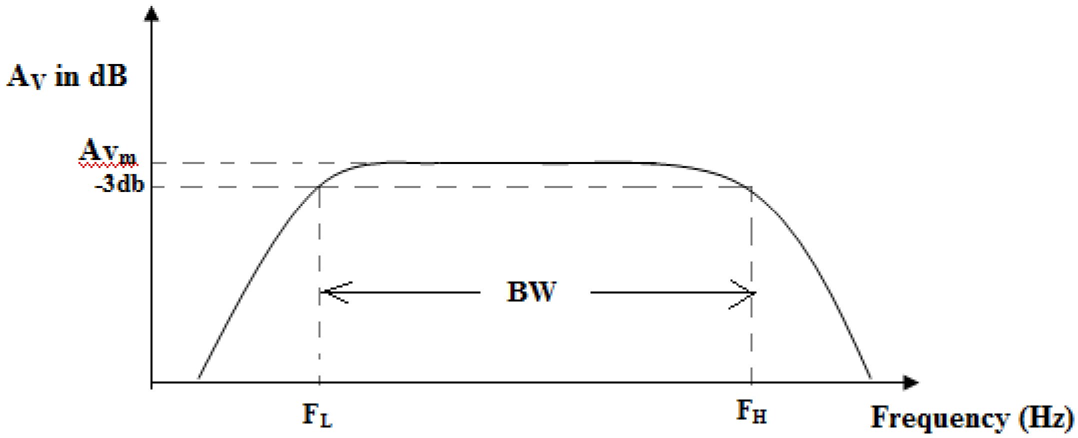
A_{Vm} in dB = -------------------- dB

Lower cut of frequency f_L = ------------- Hz

Upper cut of frequency f_H = -------------- Hz

Bandwidth ($f_H - f_L$) = ------------Hz

EXPECTED GRAPH:



RESULT:

Hence, the frequency response of voltage series feedback amplifier is obtained.

Without feedback	With feedback
Gain =	Gain =
Band width =	Band width =

Experiment: 07

RC PHASE SHIFT OSCILLATOR CIRCUIT

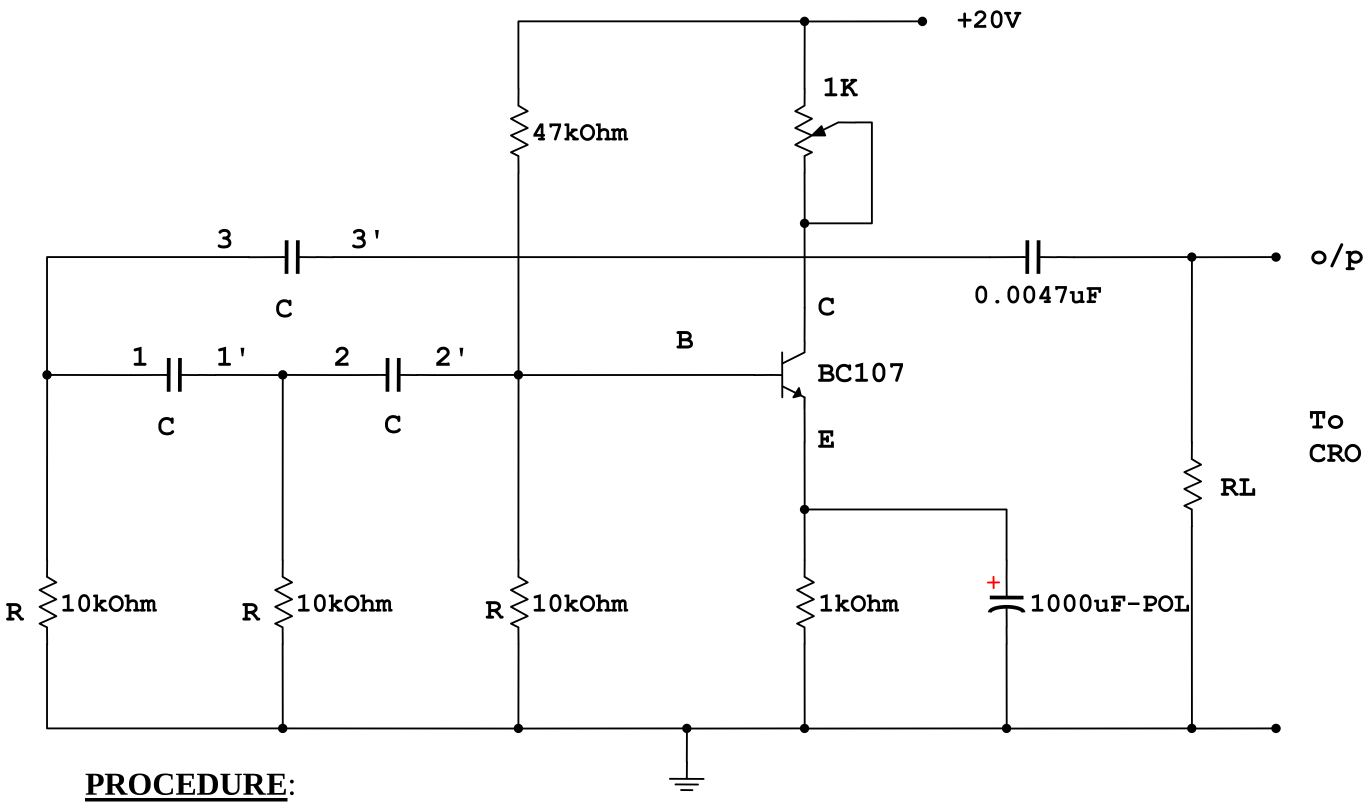
AIM:

To study the RC phase shift oscillator.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30) V
2. RC phase shift oscillator board.
3. Cathode ray oscilloscope (CRO).
4. Connecting wires.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the Circuit as shown in the circuit diagram.
2. Connect the three capacitors of value C = 0.0022µf at pts 1-1', 2-2' and 3-3' as shown in the Circuit diagram.
3. Switch 'ON' the power supply and connect the output of the R-C Phase shift oscillator to the CRO.
4. Observe the waveform on the CRO.
5. Find the frequency of oscillations by measuring the time period of the output waveform.
6. Compare with the theoretical value.

7. The theoretical value of frequency is given by $f_0 = \dfrac{1}{2\pi RC\sqrt{6}}$
8. Repeat steps 1 through 6 for other sets of values for capacitors

   C = 0.0033μf and 0.01μf.

OBSERVATIONS: **R = 10 KΩ**

S.No.	Capacitor value in μF	Theoretical frequency	Practical frequency Time period = T	Frequency f =
1.	0.0022			
2.	0.0033			
3.	0.01			

RESULT:

C = 0.0022μF C = 0.0033μF C = 0.01μF

Frequency of oscillations 'f_o' =

Viva Questions:

1. Classify different types of oscillators?
2. Explain briefly the oscillatory action in tank circuit?
3. What are the factors affecting the frequency stability for an oscillators. Discuss?
4. Which amplifier is used for an oscillator and why?
5. Which oscillators are more stable either LC or RC?

Experiment: 08

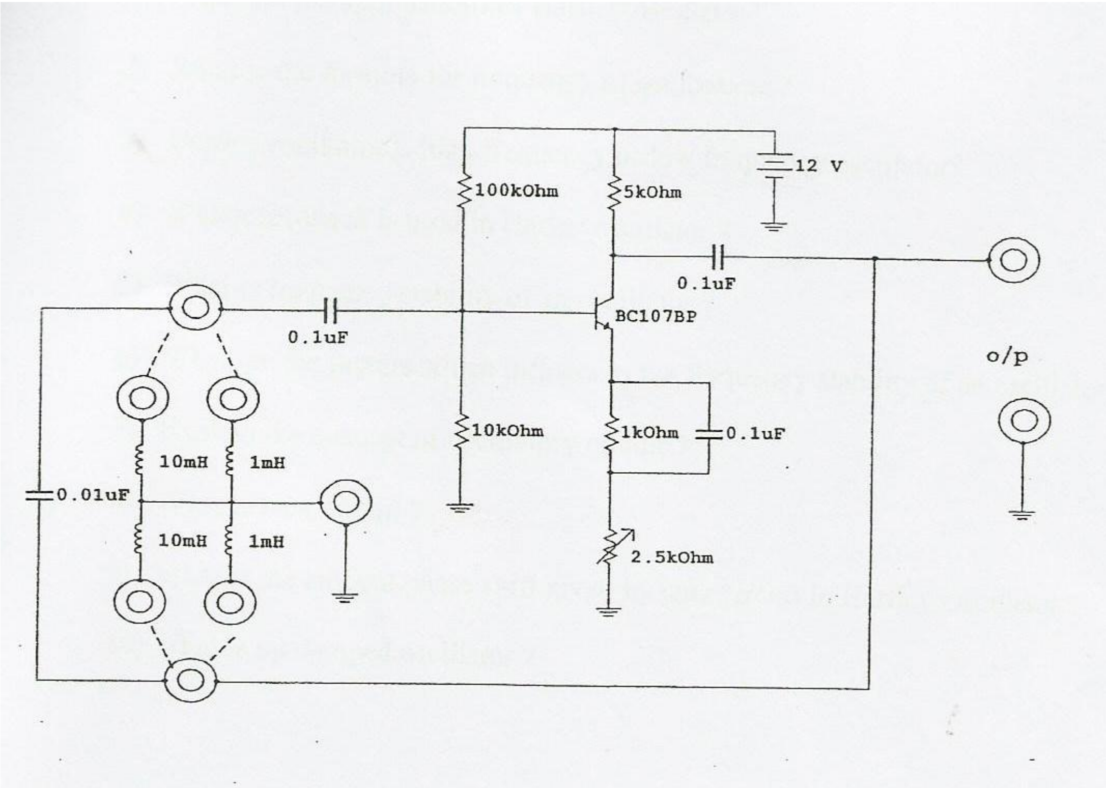
HARTLEY OSCILLATOR

AIM: To study Hartley oscillator and calculate frequency of oscillations.

COMPONENTS & EQUIPMENT REQUIRED:

1. Hartley oscillator trainer kit
2. Cathode ray oscilloscope (CRO)
3. Connecting wires.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Switch on the experimental kit and measure the dc voltage of the power supply.
2. Connect L_1 and L_2 = 1mH to form a Hartley oscillator circuit.
3. Observe the output of the Hartley oscillator on CRO.
4. Adjust the Emitter resistor R_E to get an undistorted sine wave output.
5. Find the frequency of oscillations by measuring the time period of output waveform.
6. Compare the frequency with the theoretical frequency using the following equation

$$f = \frac{1}{2\pi\sqrt{L_{eq}C}}$$

Where C = 0.01 µF and $L_{eq} = L_1 + L_2$

7. Now disconnect 1mH inductors and connect L_1 and L_2 = 10mH to the Hartley oscillator circuits.
8. Find the frequency of the output wave form by measuring time period of the output wave form using CRO.
9. Compare the practical frequency with the theoretical frequency using the above equation.

OBSERVATIONS:

1. DC supply voltage = ___________________ volts
2. Frequency of oscillations

S.NO	Capacitor	Inductor	$L_{eq} = L_1+L_2$	Theoretical frequency	Practical frequency	
					Time period	Frequency
1	0.01 µF	L_1=L_2=1mH				
2		L_1=L_2=10mH				

RESULT:

L = 1mH L = 10mH

Frequency of oscillations 'f' =

Viva Questions:

1. What are the factors which influences the frequency stability of an oscillator?
2. Explain the concept of oscillatory circuit?
3. What is tank circuit?
4. What is the amount phase shift given by tank circuit in Hartley oscillatory?
5. What is un damped oscillator?

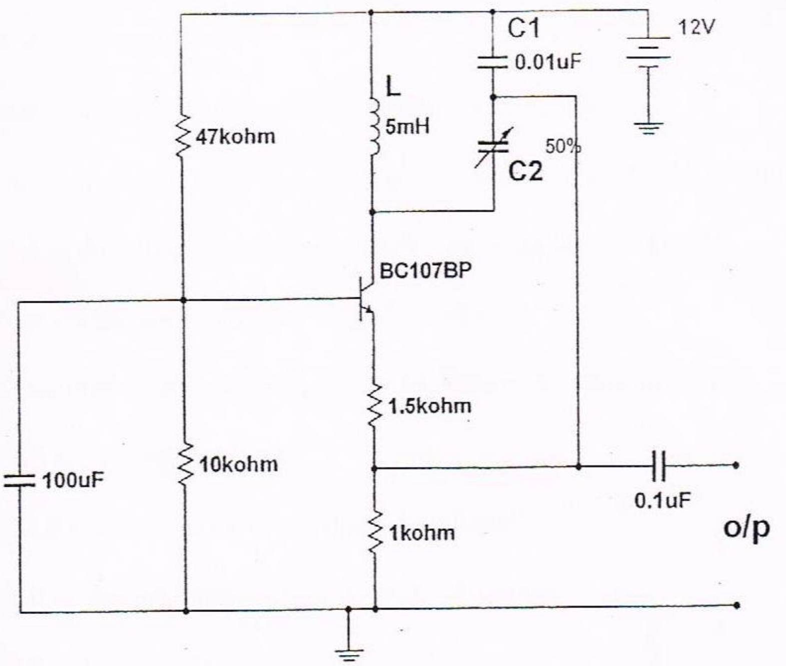
COLPITTS OSCILLATOR

AIM: To study Colpitts Oscillator and calculate frequency of oscillations.

COMPONENTS & EQUIPMENT REQUIRED:

1. Colpittts oscillator trainer kit
2. Cathode ray oscilloscope (CRO)
3. Connecting wires.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit as shown in the circuit diagram.
2. Connect the capacitor $C_1 = 0.0022\mu F$ and switch on the power supply.
3. Connect the output of colpitts oscillator to the CRO.
4. Observe the waveform on the CRO.
5. Find the frequency of oscillations by measuring the time period of output waveform.
6. Compare with the theoretical value.
7. The theoretical value of frequency given by $f = \frac{1}{2\pi\sqrt{LC_{eq}}}$

   $C_{eq}=C_1||C_2 = \frac{C_1 \; C_2}{C_1+C_2}$
8. Repeat step 1 through 6 for other values of capacitors $C_2 = 0.0033\ \mu F$ and $C_3 = 0.0047\mu F$.

OBSERVATIONS:

S No	Inductor	Capacitor	Theoretical frequency	Practical frequency	
				Time period(T)	Frequency (f)
1	5mH	0.0022 µF			
2		0.0033 µF			
3		0.0047 µF			

RESULT:

C = 0.0022 µF   C = 0.0033 µF   C = 0.0047 µF

Frequency of oscillations ‘f’ =

Viva Questions:

1. LC oscillator are low frequency or high frequency oscillators?
2. What is Damped oscillator?
3. Which feedback is used in Colpitts Oscillator?
4. What is the purpose of RFC in Colpitts Oscillator?
5. What is Barkhausen criterion for Oscillations?

Experiment: 9

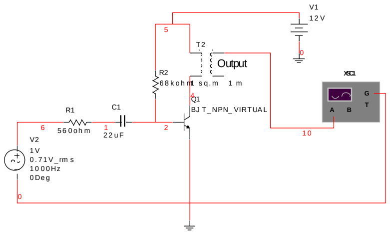
CLASS – A POWER AMPLIFIER

AIM: To obtain the efficiency (η) of a series fed class A power amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30)V
2. Audio Signal generator
3. Cathode ray oscilloscope
4. DMM
5. Components as per circuit diagram
6. Connecting wires.

CIRCUIT DIAGRAM



PROCEDURE:

1. Connect the circuit as per the circuit diagram.
2. Apply a voltage of 12V to the terminal of Vcc and measure the value of I_B using a DC ammeter. Calculate the value of I_{CQ} and V_{CEQ} using the DC analysis and ensure that the transistor is operating in class A operation.
3. Apply an input signal V_S of (mV) at 1KHz and increase its amplitude value until distortion starts appearing in output waveform.

4. Measure the V_o (p-p) using the CRO.
5. Find the efficiency of the class A power amplifier using the formula

$$\text{Efficiency } \eta = \frac{P_{ac}}{P_{dc}} \times 100\ \%$$

OBSERVATIONS & CALCULATIONS:

1. Quiescent dc voltages: V_{CC} = ________ V.

V_{BE} = ________ V.

V_{CE} = _________V.

I_B = __________μA

I_{CQ} = ________mA.

2. Efficiency (η):

a) Current I_{dc} = ______________ mA.

b) DC input power $P_{dc} = V_{CC} \times I_{dc}$ = _________.

c) Peak to peak output voltage V_O = ___________ volts.

d) AC output power $P_{ac} = \frac{V_o^{\,2}}{8R_L}$ = ____________.

$$\therefore \text{Efficiency } \eta = \frac{P_{ac}}{P_{dc}} \times 100\ \% \qquad = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_}\%$$

RESULT:-

Hence determined the efficiency (η) of a series fed class A power amplifier.

Efficiency η =

Viva Questions

1. Which class of operation results in highest efficiency?
2. What is the value of β for a power transistor compared normal transistor?
3. Write the condition to avoid thermal runaway?
4. What is thermal resistance? Give the expression?
5. What is the maximum power dissipation in class-A power amplifier?

Experiment: 10

CLASS B COMPLEMENTARY SYMMETRY POWER AMPLIFIER

AIM: To determine efficiency of class B complementary symmetry power amplifier.

COMPONENTS & EQUIPMENT:

1. D.C Regulated Power supply (0-30)V
1. Audio Signal generator
2. Cathode ray oscilloscope
3. DMM
4. Ammeter (0-100mA)
5. Experimental kit with components as per circuit diagram
6. Connecting wires

CIRCUIT DIAGRAM:

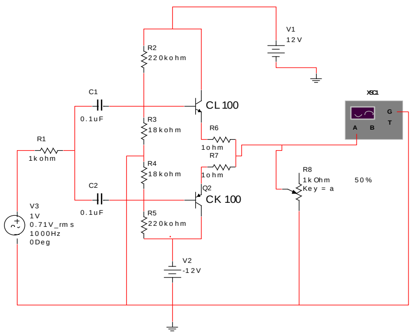


Fig. Class-B Complementary Symmetry Power Amplifier

PROCEDURE:

1. Measure the supply voltage $\mathbf{V_{CC}}$ and the base to emitter voltage $\mathbf{V_{BE}}$ of transistors Q_1 and Q_2 using DMM and note down the readings. Ensure that both the transistors are in active region.
2. Switch 'ON' the signal generator and set the signal to 5V, 5KHz and apply it to the input terminals(V_S).
3. Connect a CRO across the load resistance R_L of 1KΩ. Increase the input voltage till distortion sets in. Measure the output voltage V_O. (change the load resistance R_L to get crossover distortion if required).
4. Using an ammeter in ac mode measure the ac current '$\mathbf{I_{rms}}$' through the load resistance (R_L)

OBSERVATIONS & CALCULATIONS:

1. Quiescent dc voltages:

V_{CC} = ________ V

- V_{CC} = ___________V.

V_{BE1} of transistor Q_1 = __________ V

V_{BE2} of transistor Q_2 = __________ V

2. Output voltage: V_O = _____________Volts p to p.

3. AC current through R_L I_{rms} = __________ mA.

4. a) AC output power $P_{ac} = \frac{V_O{}^2}{8R_L}$ = __________

b) DC input power $P_{dc} = 2 \times I_{dc} \times V_{CC}$

$$= 2 \times \frac{\text{Im}}{\pi} \times V_{CC} = 2 \times \frac{I_{rms} \times \sqrt{2}}{\pi} \times V_{CC} = \left(\frac{2\sqrt{2}I_{rms}}{\pi}\right) \times V_{CC}$$

=

$$\therefore \text{Efficiency } \eta = \frac{P_{ac}}{P_{dc}} \times 100\ \% =$$

RESULT:

Hence determined the efficiency (η) of class – B complementary symmetry power amplifier.

Efficiency (η) =

Viva Questions:

1. What is the need of complementary symmetry arrangement is required in Class B.
2. Tuned amplifiers make use of which class amplifiers?
3. What is meant by thermal resistance? What is the unit of it?
4. List out the types of distortions?
5. On which bases power amplifiers are classified?

Experiment: 11

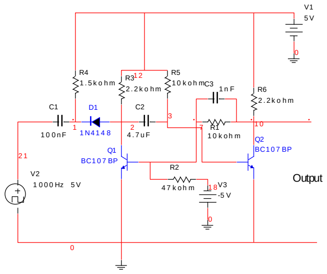
MONOSTABLE MULTIVIBRATOR

AIM: To construct and study the operation of collector coupled Monostable Multivibrator.

EQUIPMENT & COMPONENTS REQUIRED:

1. D.C Regulated power supply(0-30V/1A)------1No
2. Cathode Ray Oscilloscope
3. Bread board
4. Components as per circuit diagram
5. Probes & connecting wires ……etc

CIRCUIT DIAGRAM:



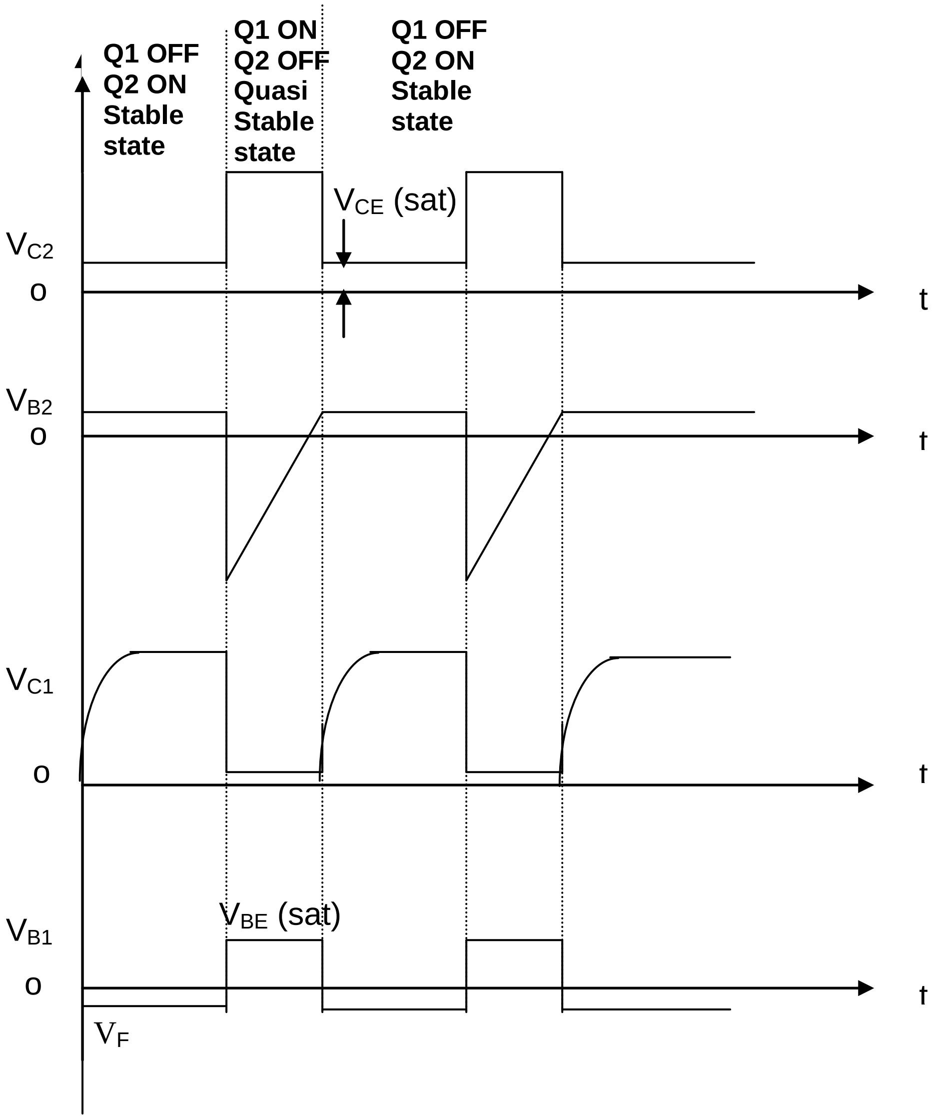
Procedure:

1) Connect the circuit as shown in the circuit diagram.

2) Before applying trigger input, check the D.C condition for T1 OFF and T2 ON T1 OFF ∴Vc1=12V and T2 ON ∴Vc2≅0.2V($V_{ce\,(sat)}$)
3) Connect a signal generator to C.R.O to obtain a square wave of 8V peak to peak amplitude and frequency 20KHz after checking using CRO apply it to the circuit as shown.

4) Observe 'Vo' using a CRO measure its pulse width verify it with the theoretical value as Tp = 0.69RC, for different values of 'c'
5) Vary the trigger frequency and see that the pulse width is not changing for a particular value of 'c'.
6) Note down the waveforms at V_{c1}, V_{c2}, V_{B1}, and V_{B2} to scale
7) Choose C=4.7Kpf and 10Kpf

EXPECTED WAVEFORMS:



In stable state

$$Vb = Vf = \frac{-VbbR1}{R1+R2} + \frac{Vce(sat)R2}{R1+R2}$$

In quasi stable state

$$Vc2 = Vc2 = \frac{VccR1}{R1+R2} + \frac{Vbe(sat)Rc}{R1+Rc}$$

VIVA QUESTIONS:

1. Define monostable multivibrator?
2. What are the other names of monostable multivibrator?
3. Write two applications of monostable multivibrator?
4. How the time duration of pulse is decided?
5. Why –VBB is applied to one of the transistors of monostable multivibrator?
6. Calculate the base voltage of "off" transistors when no trigger is applied?
7. Draw the equivalent circuit to find out over shoot (o) voltage?
8. What happens to pulse width if trigger frequency is changed?
9. What is the technique used to give the trigger signal?
10. Why monostable multivibrator is called as voltage to time converter?

EXPERIMENT:12

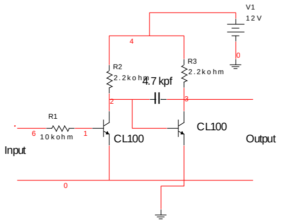
MILLER VOLTAGE SWEEP CIRCUIT

AIM: to study the operation of Miller voltage sweep circuit.

EQUIPMENTS & COMPONENTS REQUIRED:

1. D.C Regulated power supply-------0-30V
2. Function Generator
3. CRO
4. Components as per circuit diagram

Circuit Diagram:



PROCEDURE:

1) Connect the circuit as shown in diagram.

2) Without applying the input square wave switch on the dc supply and check the D.C condition [T_1 on T_2 on i.e V_{CE1} (sat)≅0.2V V_{BE} (sat) ≅0.7V]

3) Feed the input square wave of frequency 1KHz and peak to peak amplitude 4 volts (see the peak to peak amplitude not crossing 4 volts) using a signal generator. Before feeding check the input signal using CRO.

4) Note down the output waveforms to scale using CRO for different values of C [1µF ,(0.047+0.022) =0.069µF and 10Kpf.]

Considering the effect of capacitance C_1, the slope speed or sweep speed error is given by

es=Vs V(1−A+RRi+CCi)es=Vs V(1−A+RRi+CCi)

Applications:

Miller sweep circuits are the most commonly used integrator circuit in many devices. It is a widely used saw tooth generator.