ANALOG ELECTRONIC CIRCUITS LABORATORY MANUAL

(CODE: EEE - 228)

PRAGNANAM BRAHMA

ANITS

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(Affiliated to AU, Approved by AICTE & Accredited by NBA)
SANGIVALASA-531 162, Bheemunipatnam Mandal, Visakhapatnam District
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANALOG ELECTRONIC CIRCUITS LABORATORY MANUAL (EEE-228)

(II/IV EEE 2nd Semester)

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COURSE OBJECTIVES:

The aim of this course is to

1. Analyze amplifiers for frequency response
2. Identify, select, and handle transistors.
3. Analyze feedback circuits , amplifier circuits and oscillator circuits
4. To provide an overview of amplifiers, feedback amplifiers and oscillators.
5. Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: Acquire a basic knowledge in solid state electronics including voltage transistor, power transistors and operational amplifier.

CO2: Design analog electronic circuits using discrete components.

CO3: Observe the amplitude and frequency responses of common amplification circuits.

CO4: Measure various parameters of analog circuits and compare experimental results in the laboratory with theoretical analysis.

CO5: Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers, oscillators.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	0	3	2	0	0	2	2	0	0	0
CO2	0	2	3	2	0	0	2	0	0	0	0
CO3	0	0	0	3	0	0	0	2	1	0	0
CO4	0	0	0	3	0	0	0	0	2	0	0
CO5	0	3	3	0	0	0	0	2	0	0	0

Mapping of course outcomes with program specific outcomes:

	PSO1	PSO2	PSO3
CO1	2	1	-
CO2	2	1	-
CO3	2	1	-
CO4	1	-	1
CO5	3	1	-

ANALOG ELECTRONIC CIRCUITS LABORATORY

(EEE-228)

LIST OF EXPERIMENTS

1. Frequency response of CE amplifier.

2. Frequency response of CC amplifier.

3. Frequency response of two stage -RC coupled amplifier.

4. Frequency response of Common source FET amplifier.

5.Parameter Calculation of Current series feedback amplifier.

6. Voltage shunt feedback amplifier.

7. Hartley oscillator.

8. Colpitt’s oscillator.

9. RC Phase - Shift Oscillator.

10. Wein - Bridge Oscillator.

11. Tuned Voltage Amplifier.

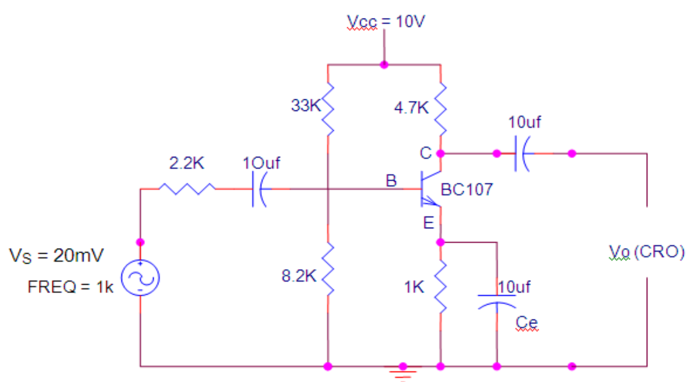
1. FREQUENCY RESPONSE OF CE AMPLIFIER

AIM: 1. To obtain the Frequency response characteristics of Common emitter amplifier and
2. To determine the Bandwidth.

APPARATUS:

S.No	Apparatus	Type	Range	Quantity
01	Transistor	BC107		01
02	Resistance		33KΩ,4.7 KΩ,2.2 KΩ 8.2 KΩ,1 KΩ	01
03	Regulated Power supply		(0-30V)	01
04	Capacitor		10µF	03
05	Signal Generator		10-1M Hz	01
06	CRO			01
07	Breadboard and Wires ,CRO Probes			

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.
2. A 10V supply is given to the circuit.
3. A certain amplitude of input signal (say 20mv at 1 kHz) is kept constant using signal generator and for different frequencies, the output voltage (V_0) from CRO are noted.
4. Gain for with and without feedback is calculated using $Gain(dB) = 20\log\frac{V_0}{V_i}$; Where V_o is output voltage, V_i is input voltage.
5. Plot the graph between Gain(in dB) and frequency.

TABULAR COLUMN:

S.no.	Input frequency (Hz)	o/p voltage(v_o) (mv)	voltage gain Av= $\frac{V_0}{V_i}$	$Gain(dB) = 20\log\frac{V_0}{V_i}$
	100Hz To 1MHz			

MODEL GRAPH:

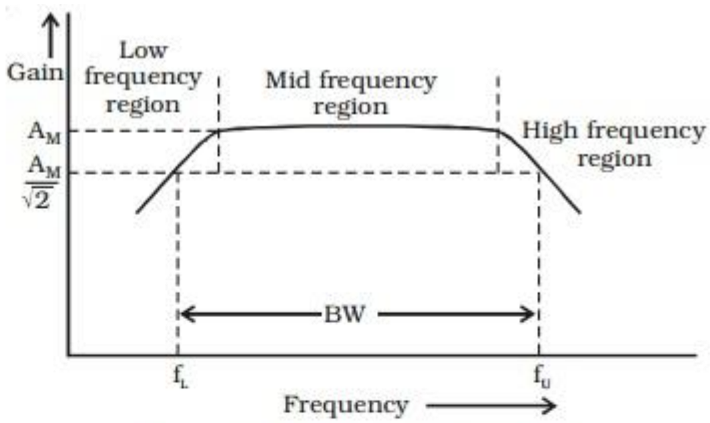


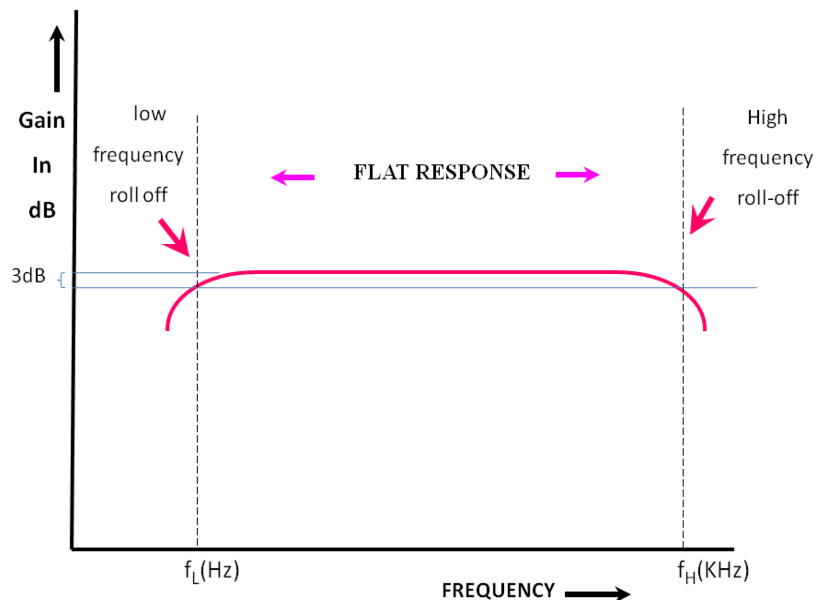
Fig Frequency response curve

Caluculations from Graph

1.Draw a line at maximum gain(dB) less than by 3dB parallel to the X-axis as shown in the figure

2.Draw two lines at the intersection of the characteristic curve and the 3dB line onto the X-axis which gives the (f_H) and (f_L)

3.The difference between f_H and f_L gives the Bandwidth of the amplifier.



PRECAUTIONS:

1. While doing the experiment do not exceed the ratings of the transistor. This may lead to damage the transistor.
2. Do not switch **ON** the power supply unless you have checked the circuit connections as per the circuit diagram.
3. Make sure while selecting the emitter, base and collector terminals of the transistor.

RESULT:

VIVA QUESTIONS:

1. What is an amplifier?
2. What is the need for an amplifier circuit?
3. Explain the effect of capacitors on frequency response?
4. How do you classify amplifiers?
5. What is the relation between bandwidth and gain?
6. What do you mean by frequency response of an amplifier?
7. What are gain, Bandwidth, lower cutoff frequency and upper cutoff frequency?
8. Why a 3db point is taken to calculate Bandwidth?
9. What is the merits of an CE amplifier circuit?
10. What is semi-log graph sheet? Why it is used to plot frequency response?

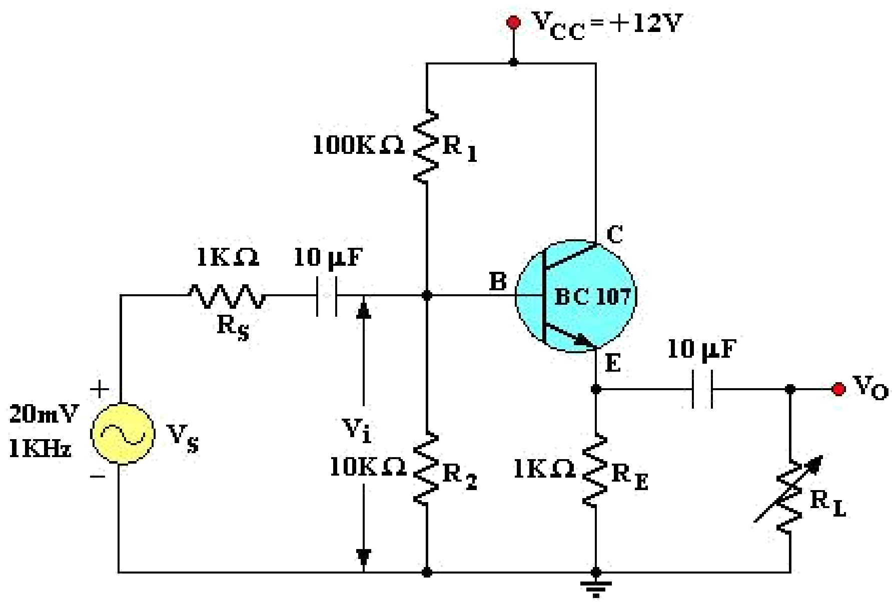
2. FREQUENCY RESPONSE OF CC AMPLIFIER

AIM: To find the frequency response of a Common Collector Transistor Amplifier and to find the Bandwidth from the Response, Voltage gain, Input Resistance, output resistance.

APPARATUS:

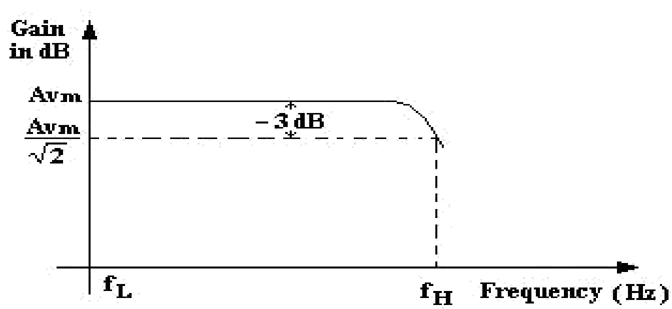
S.No	Name	Range / Value	Quantity
1	Dual Regulated D.C Power supply	0–30 Volts	1
2	Transistor	BC-107	1
3	Capacitors	10?f	2
4	Resistors	100k?, 10K?	Each 1
5	Resistors	1K?	2
6	Bread Board and connecting wires	-	1 Set
7	Signal Generator	(0 – 1MHz)	1
8	Dual Trace CRO	20MHz	1

CIRCUIT DIAGRAM:



Common Collector Transistor Amplifier

MODEL GRAPH:



PROCEDURE:

1. Connect the circuit as per the Fig., Apply Vcc of 12 Volts DC.
2. Apply I/P Voltage of 20mV at 1KHz from the Signal Generator and observe the O/P on CRO.
3. Vary the frequency from 100 Hz to 1MHz in appropriate steps and note down the corresponding O/P Voltage Vo in a tabular form .
4. Calculate the Voltage Gain Av = Vo/Vs and note down in the tabular form.
5. Plot the frequency (f) Vs Gain (Av) on a semi-log Graph sheet
6. Draw a horizontal line at 0.707 times Av and note down the cut off points and the Bandwidth is given by B.W = $f_2 - f_1$.

TABULAR FORMS:

I/P Voltage, V_s =20mV

S.No	**Frequency (Hz)**	**O/P Voltage, Vo (V)**	**Voltage Gain** **Av =Vo/Vi**	**Av in dB** **= 20 log (Av)**
1	100			
2	200			
3	300			
4	500			
5	700			
6	1K			
7	3K			
8	5K			
9	7K			
10	10K			
11	30K			
12	50K			
13	70K			
14	100K			
15	300K			
16	500K			
17	700K			
18	1M			

RESULT:

Band Width B.W = f2 – f1 = Hz

Voltage Gain Av =

PRECAUTIONS:

1. Check the wires for continuity before use.
2. Keep the power supply at Zero volts before Start
3. All the contacts must be intact

VIVA QUESTIONS:

1. What is the other name for CC Amplifier?
2. What are the uses of CC Amplifier?
3. Why this amplifier has got the name Emitter Follower?
4. What is the maximum Voltage gain of an Emitter Follower?
5. Why it is used as a Buffer amplifier?

3. TWO STAGE R-C COUPLED AMPLIFIER

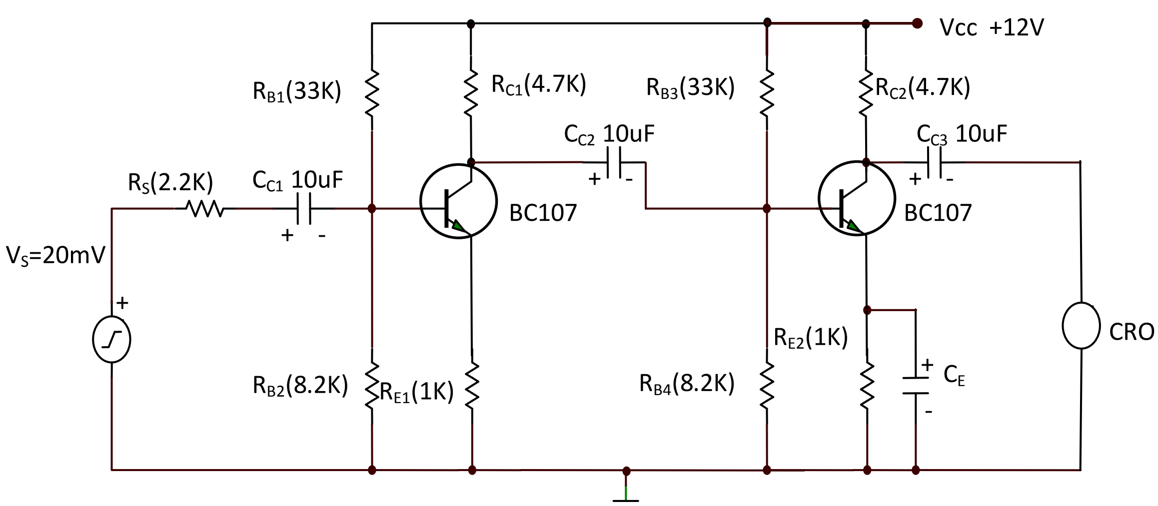
AIM:

1. To observe the frequency response of RC coupled amplifier and to find the bandwidth of the amplifier.
2. To observe that the total voltage gain is equal to the product of the individual gains.

APPARATUS:

Power supply	0-30V	1No.
CRO	20MHz	1No.
Signal generator	1-1MHz	1 No
Resistors	1kΩ, 4.7k, 8.2k, 33k	2 No
	2.2k	1 No
Capacitors	10µF	3 No
	100µF	1 No
Transistors	BC107	2 No

CIRCUIT DIAGRAM:



TWO STAGE RC COUPLED AMPLIFIER

PROCEDURE:

1. Connect the circuit as shown in the figure.
2. A 10V supply is given to the circuit and a certain amplitude of input signal is kept constant using signal generator.
3. Measure the output voltage (say V_{o2})and also output voltage at the output of 1st stage (say V_{o1}) from CRO.
4. Calculate total voltage gain and also individual voltage gain.
5. Now, by varying the input frequency note the output voltages from CRO and calculate the gain.

TABULAR FORM: V_{in}=

INPUT FREQUENCY (Hz)	**O/P Voltage(Vo) (V)**	**Voltage gain AV=Vo/Vi**	**Gain in dB = 20 log AV**
100 To 1M			

Model Graph:

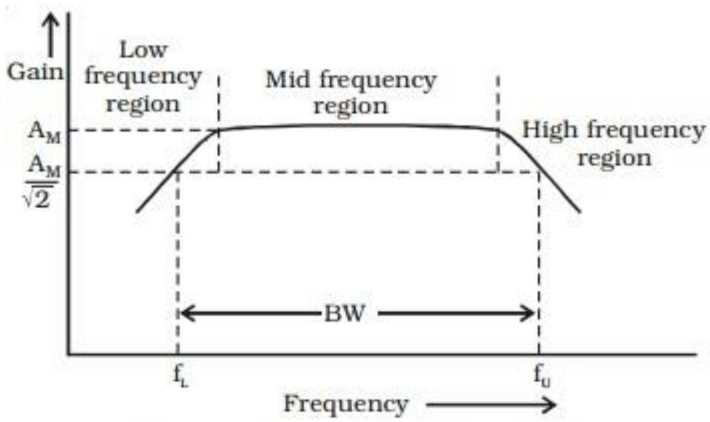


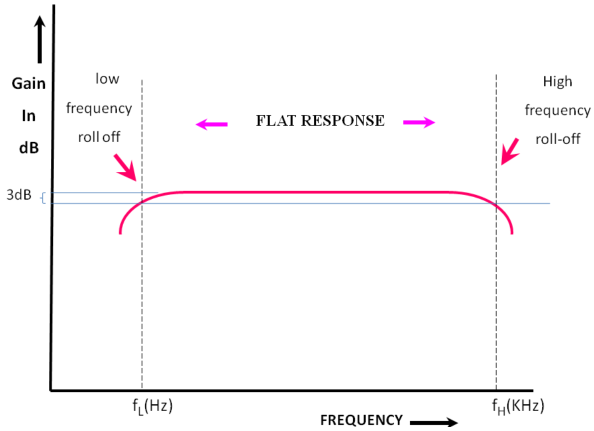
Fig Frequency response curve

Calculations from Graph

1.Draw a line at maximum gain(dB) less than by 3dB parallel to the X-axis as shown in the figure

2.Draw two lines at the intersection of the characteristic curve and the 3dB line onto the X-axis which gives the (f_H) and (f_L)

3.The difference between f_H and f_L gives the Bandwidth of the amplifier.



OBSERVATIONS:

I/P Voltage V_{in} =

O/P Voltage V_{o2} =

O/P Voltage V_{o1}=

1st Stage voltage gain= $\frac{Vo1}{Vin} =$

2nd Stage voltage gain $\frac{Vo2}{Vo1} =$

Overall voltage gain $\frac{Vo2}{Vin} =$

Bandwidth = $f_h - f_l$ =

GRAPH:
A graph is plotted between gain (dB) and frequency (Hz) for both with and without feedback.

PRECAUTIONS :

1. Connections must be made with proper polarity.
2. Avoid loose and wrong connections.

RESULT:

VIVA QUESTIONS:

1. What are half power points in the frequency response of an amplifier?
2. What is the effect of coupling capacitor on output of amplifier?
3. Define cascading of amplifier
4. What are the advantages of RC coupled amplifier?

4. FREQUENCY RESPONSE OF COMMON SOURCE FET AMPLIFIER

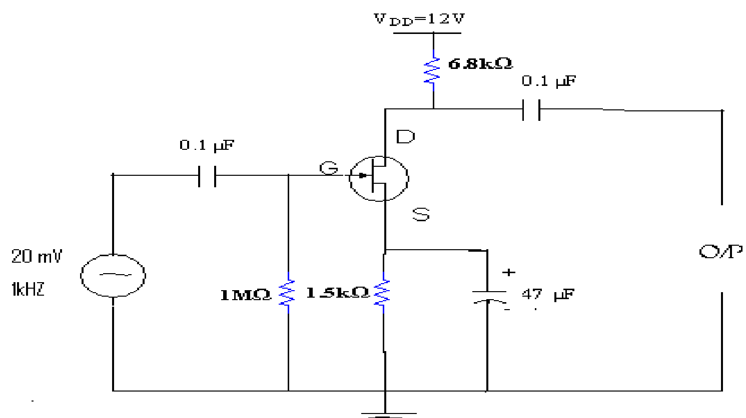
AIM:

1. To obtain the Frequency response characteristics of Common Source FET amplifier.
2. To determine the Bandwidth.

APPARATUS:

S.No	Apparatus	Type	Range	Quantity
01	N-Channel FET	BFW10		01
02	Resistance		(6.8KΩ, 1MΩ, 1.5KΩ)	01
03	Regulated Power supply		(0-30V)	01
06	Capacitor		(0.1µF, 0.1µF, 47µF)	01
07	Signal Generator		10-1M Hz	01
08	CRO			01
09	Breadboard and Wires ,CRO Probes			

CIRCUIT DIAGRAM:



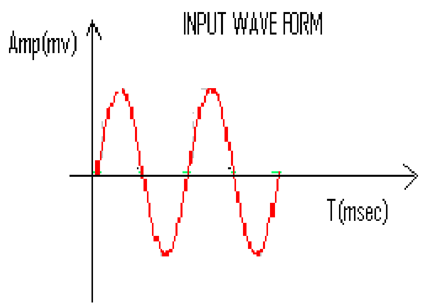
PROCEDURE:

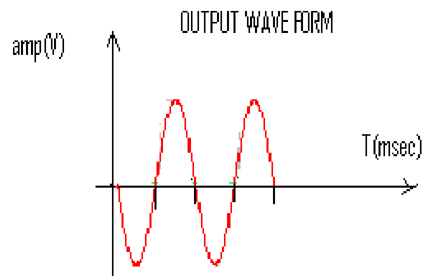
1. Connections are made as per the circuit diagram.
2. A 10V supply is given to the circuit.
3. A certain amplitude of input signal (say 20mv at 1 kHz) is kept constant using signal generator and for different frequencies, the output voltage (V_0) is taken at Drain from CRO .
4. Gain of the amplifier is calculated using $Gain(dB) = 20\log\frac{V_0}{V_i}$ Where V_o is output voltage, V_i is input voltage.
5. Plot the graph between Gain in dB and frequency.

TABULAR COLUMN: **V_{in}=**

S.no.	Input frequency (Hz)	O/p voltage(V_O) (mv)	voltage gain Av= $\frac{V_0}{V_i}$	$Gain(dB) = 20\log\frac{V_0}{V_i}$
	10Hz To 1MHz			

Model Graph





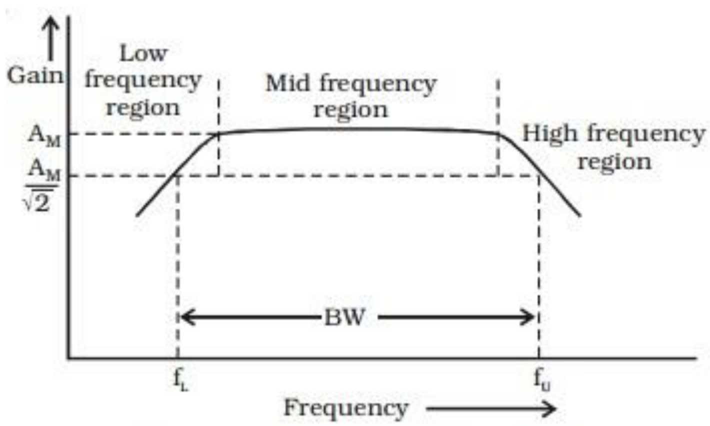


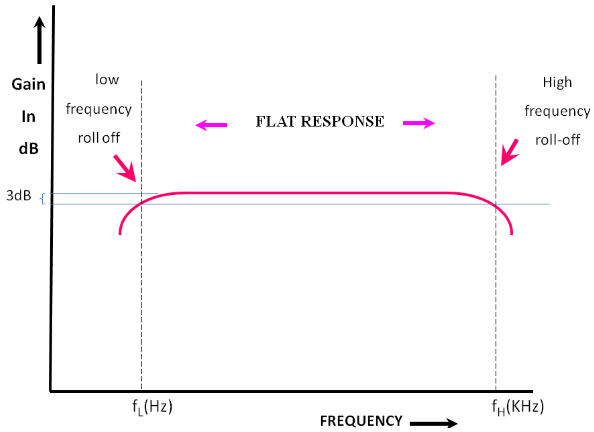
Fig Frequency response curve

Calculations from Graph

1.Draw a line at maximum gain(dB) less than by 3dB parallel to the X-axis as shown in the figure

2.Draw two lines at the intersection of the characteristic curve and the 3dB line onto the X-axis which gives the (f_H) and (f_L)

3.The difference between f_H and f_L gives the Bandwidth of the amplifier.



PRECAUTIONS:

1. While doing the experiment do not exceed the ratings of the transistor. This may lead to damage of the transistor.
2. Do not switch **ON** the power supply unless you have checked the circuit connections as per the circuit diagram.
3. Transistor terminals must be identified properly.

RESULT:

VIVA QUESTIONS:

1. What is an amplifier?
2. Explain the effect of capacitors on frequency response?
3. Why gain is constant in mid frequency region?
4. What is bandwidth?
5. What is the relation between bandwidth and gain?
6. How do you test a diode, transistor, FET?
7. How do you identify the terminals of Diode, Transistor& FET?
8. Define FET parameters and write the relation between them.
9. Explain the construction and working of FET\
10. What are the merits of an FET amplifier circuit?

5. PARAMETERS CALCULATION OF A CURRENT SERIES FEEDBACK AMPLIFIER

AIM: To calculate the input impedance, output impedance and voltage gain of current series feedback amplifier with and without feedback.

APPARATUS :

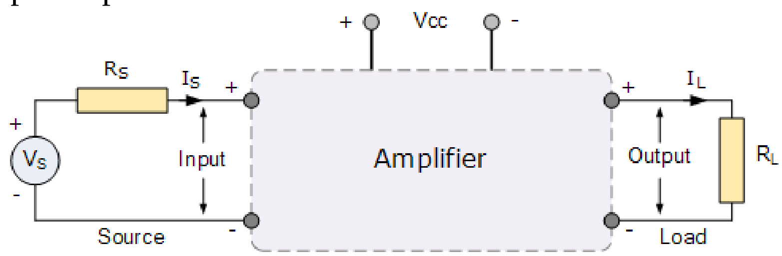
Power supply	0-30V	1No.
CRO	20MHz	1No.
Signal generator	1-1MHz	1 No
Resistors	1kΩ, 4.7k, 8.2k	1 No
	2.2k,33k,10K	1 No
Capacitors	10µF	3 No
Transistors	BC107	1 No
Bread board		
CRO Probes		

THEORY:

An amplifiers impedance value is particularly important for analysis especially when cascading individual amplifier stages together one after another to minimize distortion of the signal.

The input impedance of an amplifier is the input impedance "seen" by the source driving the input of the amplifier. If it is too low, it can have an adverse loading effect on the previous stage and possibly affecting the frequency response and output signal level of that stage. But in most applications, common emitter and common collector amplifier circuits generally have high input impedances.

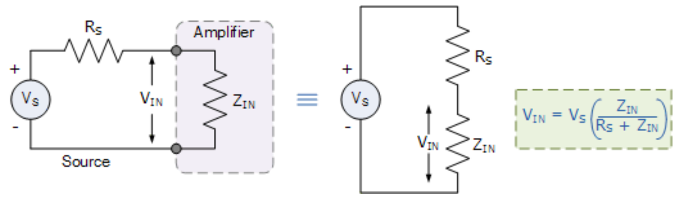
Output and Input Impedance Model



Where, VS is the signal voltage, RS is the internal resistance of the signal source, and RLis the load resistance connected across the output. We can expand this idea further by looking at how the amplifier is connected to the source and load.

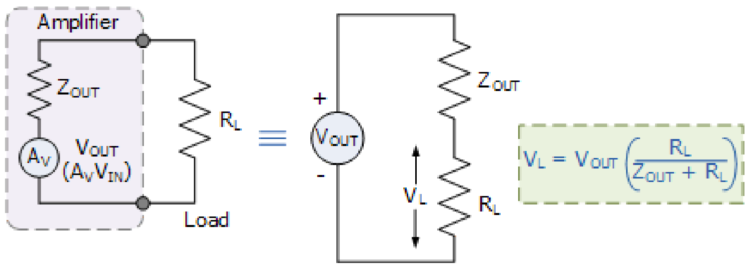
When an amplifier is connected to a signal source, the source "sees" the input impedance, Zin of the amplifier as a load. Likewise, the input voltage, Vin is what the amplifier sees across the input impedance, Zin. Then the amplifiers input can be modelled as a simple voltage divider circuit as shown.

Amplifier Input Circuit Model



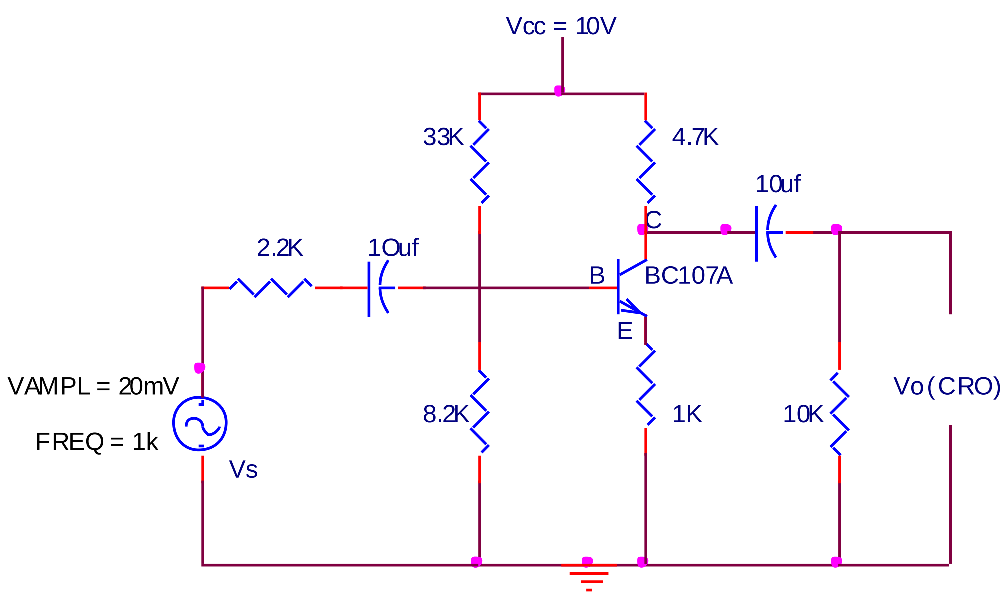
The same idea applies for the output impedance of the amplifier. When a load resistance, RL is connected to the output of the amplifier, the amplifier becomes the source feeding the load. Therefore, the output voltage and impedance automatically becomes the source voltage and source impedance for the load as shown.

Amplifier Output Circuit Model

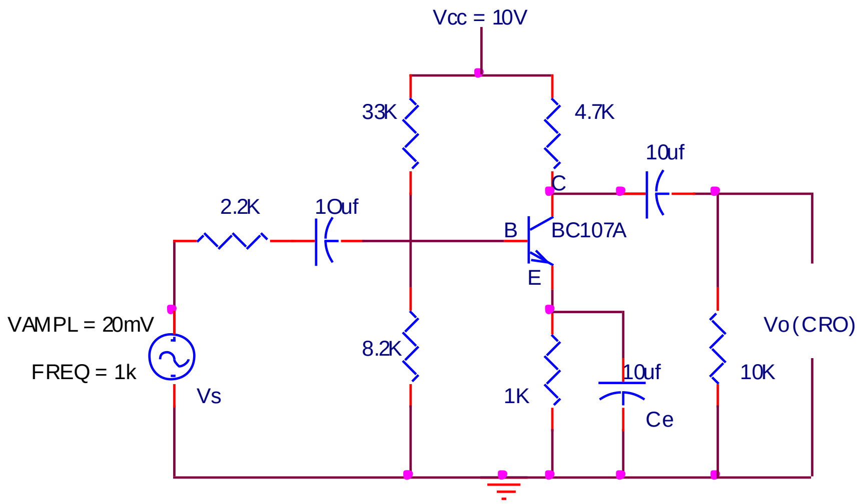


Then we can see that the input and output characteristics of an amplifier can both be modelled as a simple voltage divider network. The amplifier itself can be connected inCommon Emitter (emitter grounded), Common Collector (emitter follower) or inCommon Base configurations. In this tutorial we will look at the bipolar transistor connected in a common emitter configuration seen previously.

CIRCUIT DIAGRAMS:-



CURRENT SERIES AMPLIFIER WITH FEEDBACK



CURRENT SERIES AMPLIFIER WITHOUT FEEDBACK

Theoretical Calculations:

Calculation of h_{ie}= h_{fe}x r_e

h_{fe}= using multimeter calculate hfe value for the given transistor

r_e= 26mV/I_E

I_E=V_E/R_E(calculate drop across R_E using multimeter for DC bias circuit)

Input impedancae without Feedback:

$$Z_{IN} = R_1 // R_2 // h_{ie}$$

Output impedancae without Feedback:

$$Z_O = R_C // R_L$$

Voltage gain without feedback:

$$A_V = -hfe\frac{Z_O}{Z_{IN}}$$

Input impedancae with Feedback:

$$Z_{IN} = R_1 // R_2 // (h_{ie} + (1 + hfe)R_e)$$

Output impedancae with Feedback:

$$Z_O = R_C // R_L$$

Voltage gain with feedback:

$$A_V = -hfe\frac{Z_O}{Z_{IN}}$$

Practical Observations (with and without feedback):

1. Vs = _______V (using CRO)
2. Vin = _______V (using CRO)
3. V_L= _________V (using CRO / multimeter)
4. V_{NL}= ________V (using CRO / multimeter)

Calculate:

Without feedback:	With feedback :
$Z_{IN} = Rs\left[\frac{V_{IN}}{V_S - V_{IN}}\right] =$	$Z_{INf} = Rs\left[\frac{V_{IN}}{V_S - V_{IN}}\right] =$
$Z_O = R_L\left[\frac{V_{NL} - V_L}{V_L}\right] =$	$Z_{Of} = R_L\left[\frac{V_{NL} - V_L}{V_L}\right] =$
$A_V = \frac{V_L}{V_{IN}} =$	$A_{Vf} = \frac{V_L}{V_{IN}} =$

PROCEDURE:

1. Connections are made as per the circuit diagram. Without input source, Ce and load i.e in DC bias
2. A 10V DC supply is given to the circuit for biasing
3. Calculate emitter voltage across Re and find emitter current Ie
4. Circuit is connected as per circuit diagram without feedback i.e., without Ce.
5. A certain amplitude of input signal (say 20mV) is kept constant using the function at a constant frequency of 1KHz
6. Note down the V_{IN} ,V_L , V_{NL} using multimeter
7. Now the Circuit is connected as per circuit diagram with feedback i.e keeping Ce
8. Note down the V_{IN} ,V_L , V_{NL} using multimeter
9. Calculate input impedance Z_{IN} ,output impedance Z_O ,and voltage gain A_V and compare with theoretical values.

PRECAUTIONS :

1. Avoid loose and wrong connections.
2. Avoid parallax error while taking readings.

RESULT:

VIVA QUESTIONS:

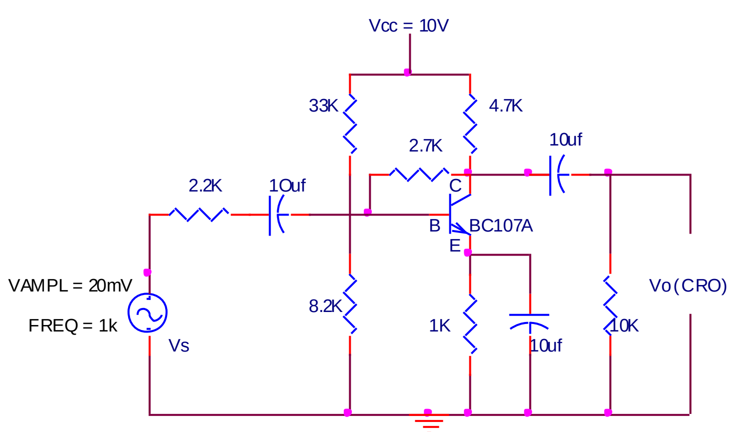
1. What is the relationship between the transfer gain with feedback A_f and that without feedback
2. What are the advantages of negative feedback?
3. How is the i/p impedance and o/p impedance of a voltage shunt feedback amplifier
4. What are the types of feedback amplifiers?

6. VOLTAGE SHUNT FEEDBACK AMPLIFIER

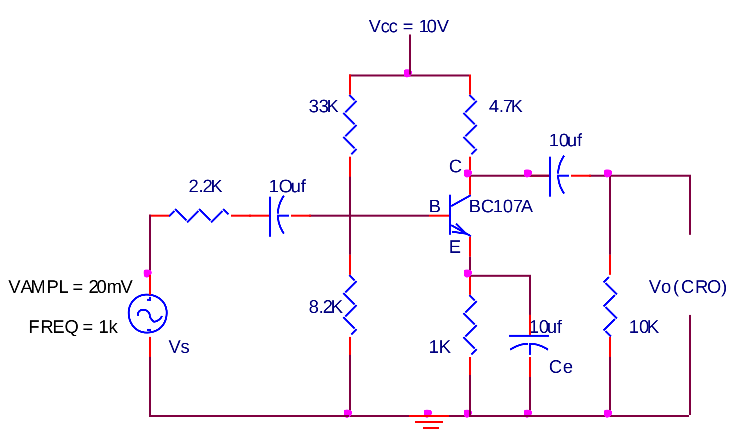
AIM: To obtain the frequency response characteristics of a Voltage shunt amplifier with and without feedback and determine the upper and lower cut off frequencies.

APPARATUS:
1. Transistor BC 107
2. Resistors – 33KΩ (1), 4.7KΩ (1), 2.2KΩ (1), 8.2KΩ (1), 1KΩ (1), 2.7KΩ (1) and 10KΩ (1),
3. Capacitors – 10µf (3),
4. Signal Generator,
5. Regulated Power Supply,
6. Bread Board with connecting wires,
7. CRO with probes.

CIRCUIT DIAGRAMS:



VOLTAGE SHUNT AMPLIFIER WITH FEEDBACK



VOLTAGE SHUNT AMPLIFIER WITHOUT FEEDBACK

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. A 10V DC supply is given to the circuit for biasing.
3. The circuit is connected without feedback i.e., without R_F
4. At certain amplitude of input signal (say 20mV at 1 kHz) is kept constant using the function generator and for Different Frequencies the output voltage from CRO is noted.
5. Now, the circuit is connected with feedback i.e., with R_F.
6. By keeping the input signal constant the output voltages for different frequencies are noted from CRO.
7. Gain with and without feedback is calculated from the

Formula

Gain = 20 log Vo / Vi (dB)

Where V_O is output voltage, V_I is input voltage.

TABULAR FORM :

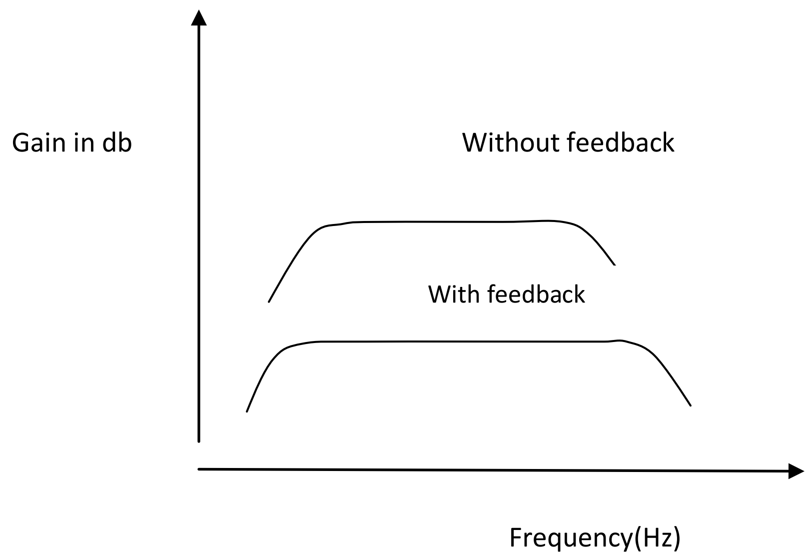
WITH FEEDBACK: **I/P VOLTAGE V_i = 20mV =0.02V**

S.NO.	**FREQUENCY (Hz)**	**O/P VOLTAGE (Vo)**	**Gain in dB = 20 log Vo / Vi**
	100Hz **TO** **1MHz**		

WITHOUT FEEDBACK: **I/P VOLTAGE V_i = 20mV =0.02V**

S.NO.	**FREQUENCY (Hz)**	**O/P VOLTAGE (Vo)**	**Gain in dB = 20 log Vo / Vi**
	100Hz **TO** **1MHz**		

MODEL GRAPH :



GRAPH: A graph is plotted between gain (dB) and frequency (Hz) which is frequency response of voltage shunt feedback amplifier for without feedback and with feedback.

PRECAUTIONS:
1. Avoid loose and wrong connections.
2. Avoid parallax error while taking readings.

RESULT: The frequency response of the given voltage shunt amplifier with & without feedback are obtained.

Bandwidth withfeed back =

Bandwidth withoutfeed back =

VIVA QUESTIONS:

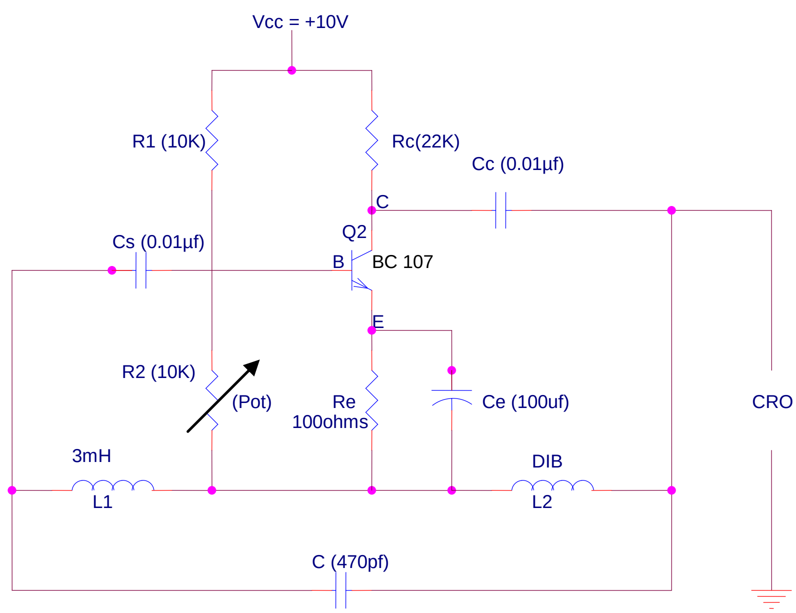
1. What is meant by voltage shunt feedback?
2. Draw the circuit diagram of a voltage shunt feedback?
3. What is the difference between voltage series and voltage shunt feedback
4. What is another name for voltage shunt amplifier?
5. What is the effect of voltage shunt feedback on input and output impedance?

7. HARTLEY OSCILLATOR

AIM: To determine the frequency of oscillations of Hartley oscillator.

APPARATUS: 1. BC 107 Transistor,
2. Potentiometer 10KΩ (1),
3. Resistors – 10KΩ (1), 22KΩ (1) & 100Ω (1),
4. Capacitors –10µf(2), 100µf(1) & 470pf(1),
5. Inductor 100µH (1),
6. Decade Inductance Box (2),
7. TRPS,
8. Bread Board and connecting wires,
9. CRO with probes

CIRCUIT DIAGRAM :



HARTLEY OSCILLATOR

PROCEDURE:

1. Connections are made as shown in circuit diagram.
2. The inductor ‘L_2’ is up to some value, keeping inductor ‘L_1’ constant.
3. The potentiometer ‘R_2’ is adjusted until sinusoidal waveform is observed on CRO.
4. The time period and hence the frequency are calculated for the wave obtained which is nearly equal to the theoretical frequency.
5. The experiment is repeated for different values of ‘L_2’ and each time the time period is noted.

TABULAR FORM:

C	Inductance			Theoretical	Time	PRACTICAL
	L_1	L_2	$L_{eq} = L_1 + L_2$	$f = 1 / 2\Pi\sqrt{L_{eq} C}$	T (Sec)	f = 1 /T (Hz)
470pf	3mH	3mH				
470pf	3mH	4mH				
470pf	3mH	5mH				

GRAPH: A graph is plotted between time period on x-axis and Amplitude on y-axis to obtained a sinusoidal waveform at a particular value of L_2.

PRECAUTIONS:

1. Avoid loose contacts.
2. Avoid wrong connections.

RESULT:

VIVA QUESTIONS:

1. What is an oscillator?
2. Mention the condition for oscillations in Hartley oscillator?
3. What type of feedback is used in oscillator?
4. What is the range of frequencies?
5. What are the characteristics of positive feedback?

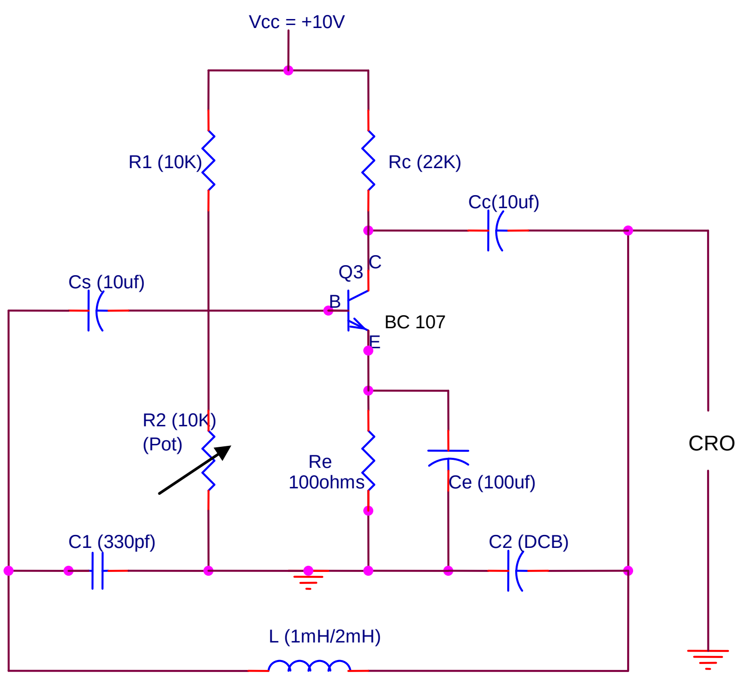
8. COLPITTS OSCILLATOR

AIM: To determine the frequency of oscillations of the Colpitts oscillator.

APPARATUS

1. Transistor BC 107,
2. Capacitors – 10μf (2) & 330pf (1) & 100uf (1),
3. Resistors – 10KΩ (1), 100Ω (1) & 22KΩ (1),
4. Inductor – 0.33mH (1),
5. Decade Capacitance Box,
6. Potentiometer – 10K (1),
7. Regulated Power Supply,
8. Bread Board & Connecting Wires.

CIRCUIT DIAGRAM :



COLPITTS OSCILLATOR

PROCEDURE :

1. The circuit is connected as shown in figure.
2. The capacitor C_1 is kept constant and C_2 is up to some value.
3. The resistor R_2 is adjusted until sinusoidal waveform is observed on the CRO.
4. Then the time period and hence the frequency are calculated which is nearly equal to the theoretical frequency.

5. The theoretical and practical values of frequency are verified using the formula.

$f_o = 1 / 2\Pi \sqrt{LC_{eq}}$ where $C_{eq} = \frac{C_1C_2}{C_1+C_2}$

f_o practical = 1 /T (Hz) T = Time period.

6. The experiment is repeated for different values of C_2.

TABULARFORM :

S.NO.	INDUCTANCE (L)	CAPACITANCE			Theoretical $f_o=1/2\Pi \sqrt{LC_{eq}}$ (kHz)	T (Sec)	f=1/T (Hz)
		C_1	C_2	C_{eq}			
1.	2mH	330pf	330pf				
2.	2mH	330pf	470pf				
3.	2mH	330pf	570pf				

PRECAUTIONS : 1. Avoid loose and wrong connections.
2. The sinusoidal waveform obtained must be distortion.
3. Readings should be taken without parallax error.

RESULT

VIVA QUESTIONS:

1. What is an oscillator?
2. Mention the condition for oscillations in colpitts oscillator?
3. What type of feedback is used in oscillator?
4. What is the range of frequencies?
5. What are the characteristics of positive feedback?
6. What is the total phase shift in an oscillator.

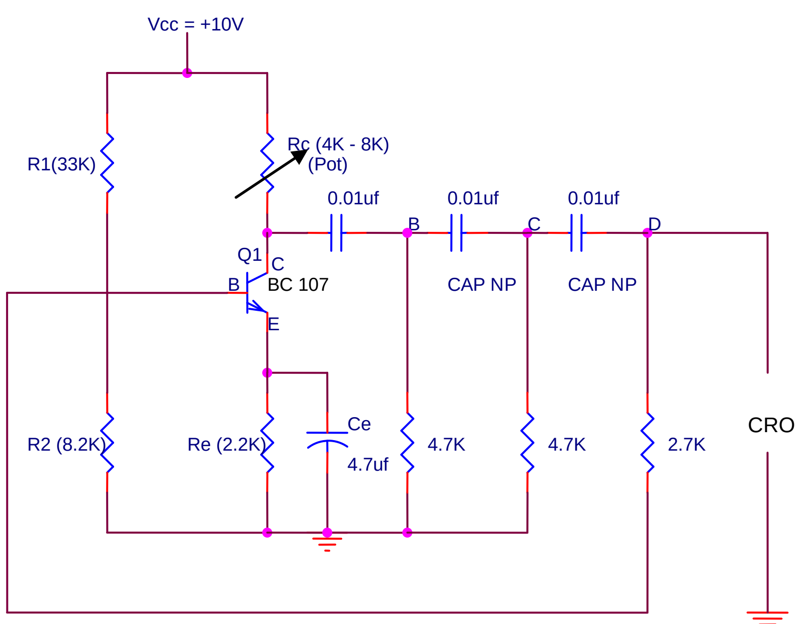
9. RC PHASE SHIFT OSCILLATOR

AIM: To find the frequency of oscillations of the RC phase Shift oscillator and to measure the phase shift of each Section of the RC network.

APPARATUS

1. Transistor BC 107,
2. Resistors – 4.7KΩ (2), 33KΩ (1),2.2KΩ (1), 8.2KΩ (1) and 2.7KΩ (1).
3. Capacitors – 0.01µf (3) & 47µf(1),
4. Potentiometer 10KΩ (1),
5. Regulated Power Supply,
6. CRO with probes,
7. Bread Board & wires.

CIRCUIT DIAGRAM :



RC PHASE SHIFT OSCILLATOR

PROCEDURE :

1. Connections are made as per the circuit diagram.
2. Set the value of Rc (4KΩ – 8KΩ) by varying DRB and observe the output waveform at '0' on CRO which is sinusoidal.
3. Now, the CRO probe is changed to position 'B' such that the output Waveform at B is observed on CRO which is shifted by 60° w.r.t '0'.
4. The output waveform at 'C' is observed on CRO, which is shifted by 120° w.r.t '0'.
5. The output waveform at 'D' is observed on CRO, which is shifted by 180° w.r.t '0'.

6. Theoretically the frequency of oscillations is calculated by the formula,

$$\mathbf{f=1/2\pi RC\sqrt{6+4K}, \qquad K = R_C / R}$$

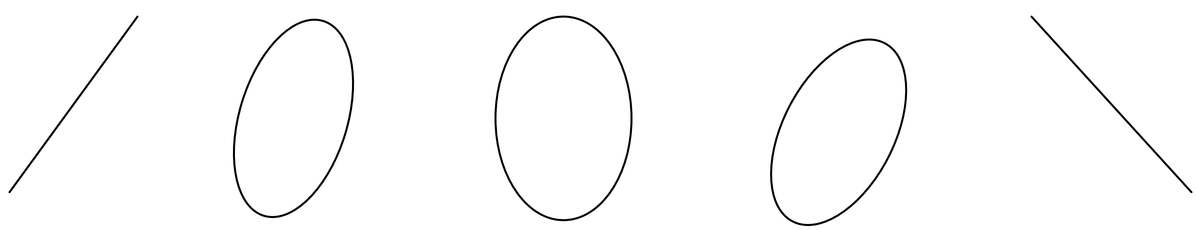
Practically the time period 'T' on CRO is noted and frequency **f = 1/T** is calculated.

7. The readings for different values of R_C at 4K,5K,6K,7K and 8K are noted And are tabulated as shown in the tabular form for different Lissajous pattern.
8. A graph is plotted for phase and amplitude locating the phase shift observed On CRO at different positions of (B,C,D).

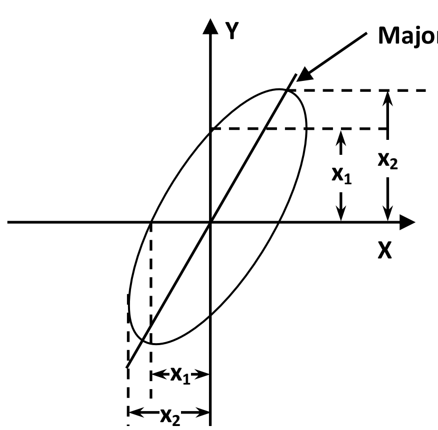
TABULAR FORM :

S.NO	R_C (KΩ)	Position w.r.t Collector	Lissajous Pattern	Y_1 (V)	Y_2 (V)	$\theta=Sin^{-1}$ (Y_1/Y_2)	T (Sec)	f_0 (Hz) Theoretical	f_0 (Hz) Practical
1	4.7KΩ	B C D							

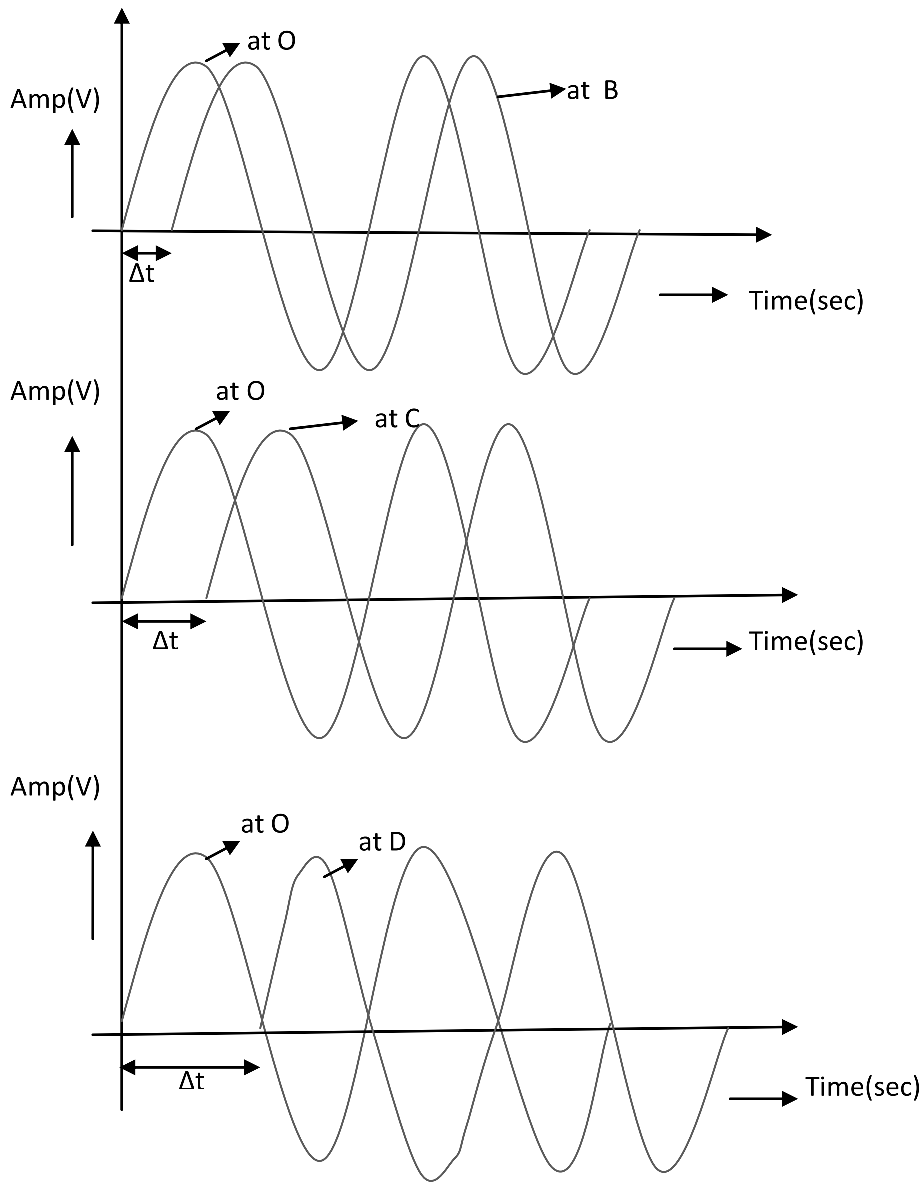
LISSAZEOUS PATTERN:



$\Phi = 0^0$ $\qquad 0 < \Phi < 90^0$ $\qquad \Phi = 90^0$ $\qquad 90^0 < \Phi < 180^0$ $\qquad \Phi = 180^0$



MODEL GRAPH: OUTPUT WAVEFORMS



PRECAUTIONS: 1. The readings are to be noted down without parallax error.

2. Wrong connections should be avoided.

RESULT:

VIVA QUESTIONS:

1. What is an oscillator?
2. Mention the condition for oscillations in RC phase shift oscillator?
3. What type of feedback is used in oscillator?
4. What is the range of frequencies? What is the phase shift produced by transistor.
5. What are the characteristics of positive feedback?

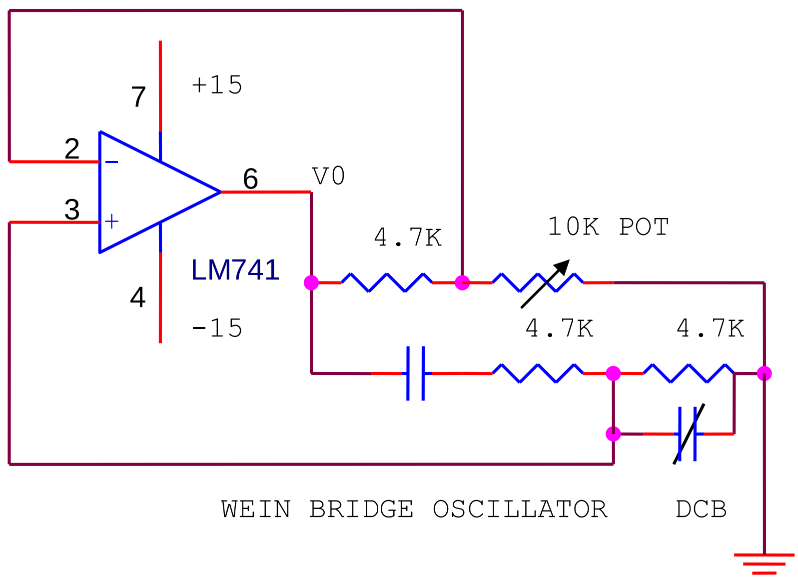
10. WEIN BRIDGE OSCILLATOR

AIM : To obtain the frequency of oscillations of a Wein Bridge oscillator.

APPARATUS :

1. 741 OP – Amp,
2. Resistors – 4.7K (2) & 10K (1),
3. Potentiometer 10K (1),
4. Decade Capacitances Boxes (2),
5. Bread Board and connecting wires,
6. CRO with probes,
7. TRPS

CIRCUIT DIAGRAM :



PROCEDURE :

1. Connections are made as per the circuit diagram.
2. The two capacitances are varied by using variable capacitance box.
3. The output wave is observed on the CRO.
4. The time period of the wave for each value of capacitor is noted.
5. The frequency of the wave is calculated from the time period using the formula **f = 1/T**
6. Theoretical frequency is calculated by using the Formula $f = 1/2\Pi\sqrt{R_1R_2C_1C_2}$
7. Compare the practical and theoretical values.

TABULAR FORM :

$R_1 = R_2$ (KΩ)	C		Theoretical $f = 1/2\Pi\sqrt{R_1R_2C_1C_2}$	Time Period T (Sec)	Practical f = 1/T (Hz)
	C_1	C_2			
4.7K	0.1µF	0.1µF			
4.7K	0.01µF	0.01 µF			
4.7K	0.01 µF	0.1 µF			

PRECAUTIONS
1. Avoid loose and wrong connections.
2. Connections should be made properly and theOutput should be a proper sine wave, such that the Time Period and amplitude may be obtained accurately.

RESULT:

VIVA QUESTIONS:

1. What is an oscillator?
2. Mention the condition for oscillations in wein bridge oscillator?
3. What type of feedback is used in oscillator?
4. What is the range of frequencies?
5. What are the characteristics of positive feedback?

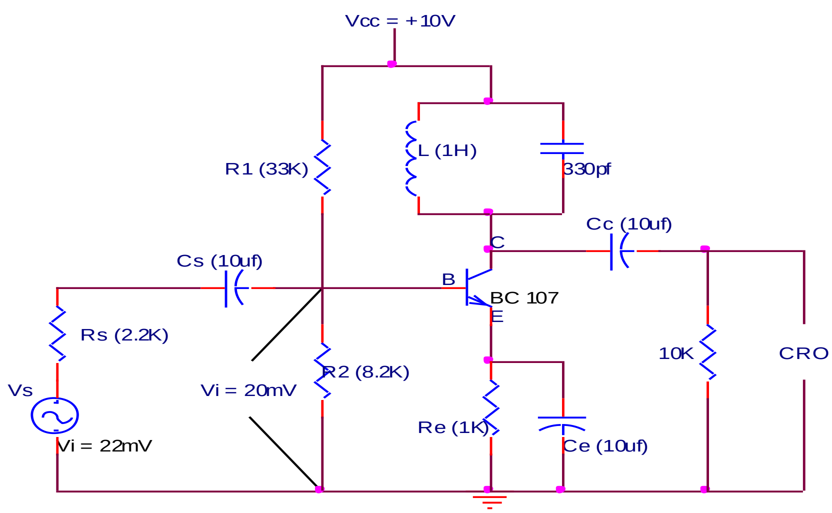
11. TUNED VOLTAGE AMPLIFIER

AIM: To obtain the frequency response and bandwidth of a Tuned voltage amplifier.

APPARATUS :

1. TRPS,
2. BC 107 transistor,
3. Resistors- 2.2K(1), 33K(1), 8.2K(1), 1K(1) and 10K(1).
4. Capacitors 330pf(1)& 10µf (3),
5. Inductor 1H,
6. Signal Generator,
7. CRO with probes,
8. Bread Board with connecting wires.

CIRCUIT DIAGRAM:



TUNED VOLTAGE AMPLIFIER

PROCEDURE:

1. The circuit is connected as shown in the figure.
2. A 10V DC supply is given to the circuit for biasing.
3. An input signal of say 22mV is given from the output of the signal generator.
4. The output voltage V_o is noted for different values of the frequencies.
5. In each case the gain is calculated using the formula

$$A_V = 20 \log_{10} V_o/V_i \text{ (dB)}.$$

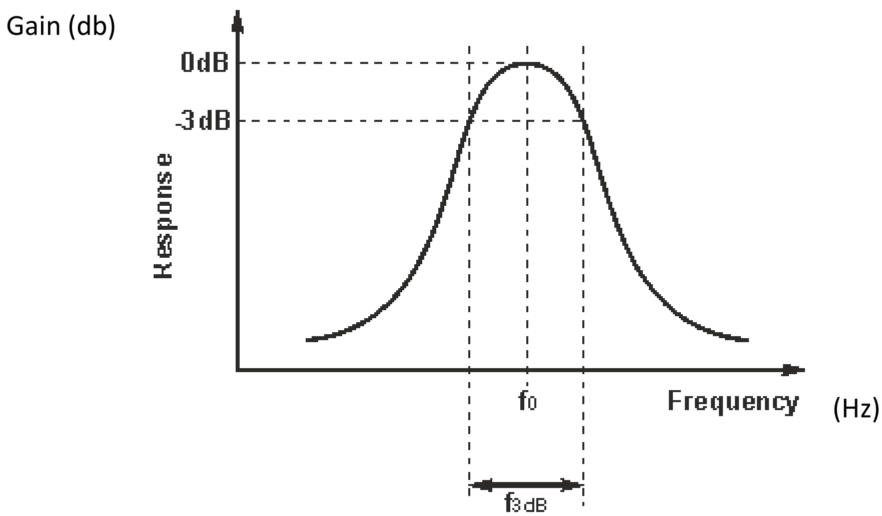
6. It is observed that at certain frequency the obtained value is maximum. The frequency is known as the resonant frequency at which $X_L = X_C$ and it is approximately

$$f_r \text{ (theoretical)} = 1 / 2\Pi\sqrt{LC}$$

TABULAR FORM **:** **I/P Voltage, V_i = 20mV**

Frequency (Hz)	**O/P Voltage, V_o (V)**	**Gain $A_V = 20 \log_{10} V_o/V_i$ (dB)**
100Hz TO 1MHz		

MODEL GRAPH :



PRECAUTIONS:

1. Avoid loose and wrong connections.
2. The amplitude of the input voltage must be maintained constant throughout the experiment.
3 Waveforms must be obtained without any distortion.

RESULT :

VIVA QUESTIONS:

1. What is tuned voltage amplifier?
2. What is selectivity?
3. What is bandwidth and the relation between bandwidth and selectivity.
4. What is frequency response?
5. Explain the operation of above circuit?
6. Why gain is expressed in dB?