CLASS:II BSc PHYSICS
COURSE NAME: PHYSICS OF DEVICES AND COMMUNICATION PRACTICAL
COURSE CODE: 18PHU312
BATCH-2018-2021

EXPERIMENTS

Experiment No:1

Date:

FIRST ORDER LOW PASS FILTER

AIM

To construct study the characteristics of active low pass filter using op-amp and draw the frequency response curve.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

A low-pass filter (LPF) is an active filter which passes low frequency signals and stops high frequency signal i.e., it transmit signals with a frequency lower than a certain cut off frequency and attenuates signals with frequencies higher than the cut off frequency.

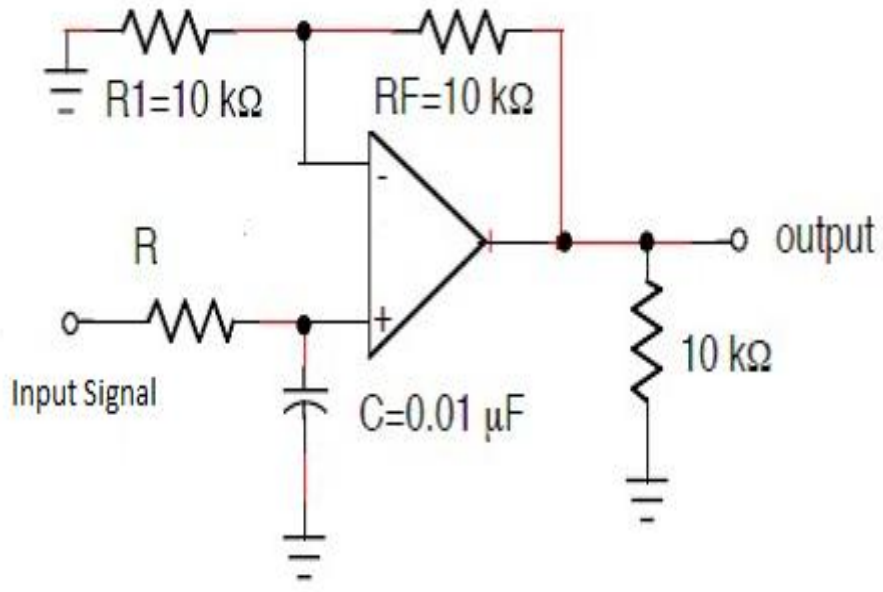
PROCEDURE

1. Connections are made as shown in the diagram
2. Set the input signal as 1V (peak to peak) from function generator and apply to the circuit.
3. Observe the output from the CRO.
4. Vary the input frequency from signal generator and measure the corresponding output voltage.
5. Draw the frequency response curve in semilog graph.

6. Find out the cut off frequency from the graph and compare it to the theoretical value

$f_H = 1/2\pi RC$

CIRCUIT DIAGRAM



TABULAR FORM

Input Voltage Vi =……. Volts

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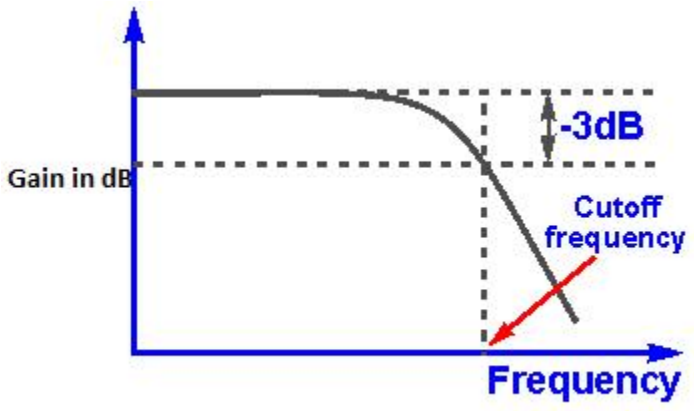
Sr.No	Frequency in Hz	Output Voltage Vo in Volts	Gain =Vo/Vi	Gain in dB = 20log Gain

MODEL GRAPH



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RESULT

Low pass filter using operational amplifier is constructed and calculated the cut off frequency.

Viva-Questions

1. What is filter?
2. What is low pass filter?
3. What is passive filter?
4. What is the role of Op-amp in filter circuits?
5. Explain the working principle of Low pass filter.

Experiment No:2

FIRST ORDER HIGH PASS FILTER

AIM

To construct study the characteristics of active high pass filter using op-amp and draw the frequency response curve.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

A high pass filter is an active filter which passes high frequency signal and stops low frequency signal i.e., it passes signals with a frequency higher than a certain cutoff frequency and attenuates signals with frequencies lower than the cutoff frequency.

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PROCEDURE

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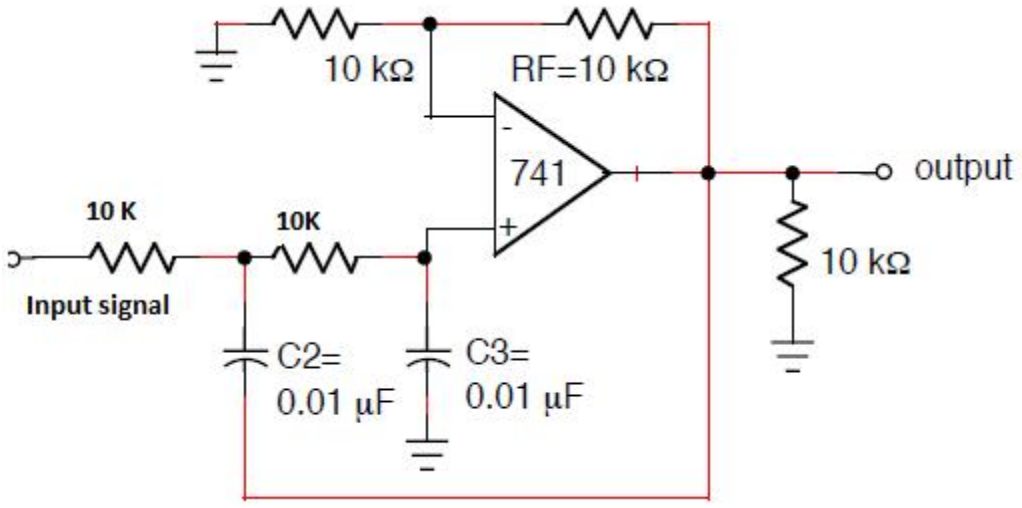
1. Connections are made as shown in the diagram
2. Set the input signal as 1V (peak to peak) from function generator and apply to the circuit.
3. Observe the output from the CRO.
4. Vary the input frequency from signal generator and measure the corresponding output voltage.
5. Draw the frequency response curve in semilog graph.
6. Find out the cut off frequency from the graph and compare it to the theoretical value

$f_H = 1/2\pi RC$

CIRCUIT DIAGRAM

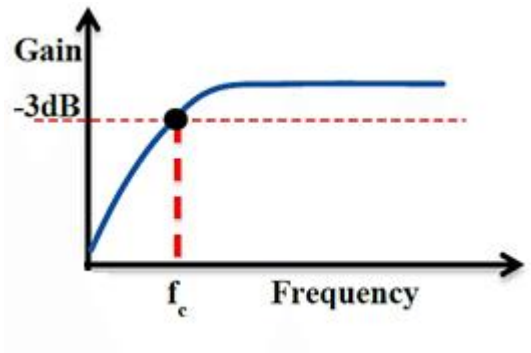


TABULAR FORM

Input Voltage Vi =……. Volts

Sr.No	Frequency in Hz	Output Voltage Vo in Volts	Gain =Vo/Vi	Gain in dB = 20log Gain

MODEL GRAPH



RESULT

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High pass filter using operational amplifier is constructed and calculated the cut off frequency.

Viva-Questions

1. What is active filter?

2. What is high pass filter?

3. What are the filter components used in high pass filter?

4. What is the role of Op-amp in filter circuits?

5. Explain the working principle of High pass filter.

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Experiment No:3

Date:

JUNCTION FIELD EFFECT TRANSISTOR

AIM:

To study the characteristics of junction field effect transistor and plot the characteristics curve.

APPARATUS:

JFET transistor (BMW10), Resistance, Regulated power supply, Voltmeters, Ammeters, Bread board and connecting wires.

THEORY

It is a voltage controlled semiconductor device. JFET is a unipolar device since the current is carried by only one type of carriers. It has a very high input electrical resistance. Field effect transistor or FET is a voltage controlled device because it consists of a section of silicon whose conductance is controlled by an electric field. The section of silicon through which the current flows is called the channel, and it consists of one type of silicon, either N-type or P-type. It has three terminals Source, Drain and gate. Circuit operation is controlled by gate voltage.

Parameters to be calculated:

rd = ΔVDS/ ΔID (VGS = constant)

Transconductance, gm = ΔID/Δ VGS (VDS = constant).

PROCEDURE

To find the input characteristics:

1. Connect the circuit as shown in the circuit diagram.
2. Keep the output voltage V_{DD} constant and by varying gate voltage note down the corresponding change in I_D and $V_{GS.}$
3. Repeat the above steps for different values of $V_{GG.}$
4. Plot the input characteristics.

To find the output characteristics:

1. Connect the circuit as shown in the circuit diagram.
2. Keep the input voltage V_{GG} constant and by varying V_{DD} note down the corresponding change in I_D and $V_{DS.}$
3. Repeat the above steps for different values of $V_{DD.}$
4. Plot the output characteristics.

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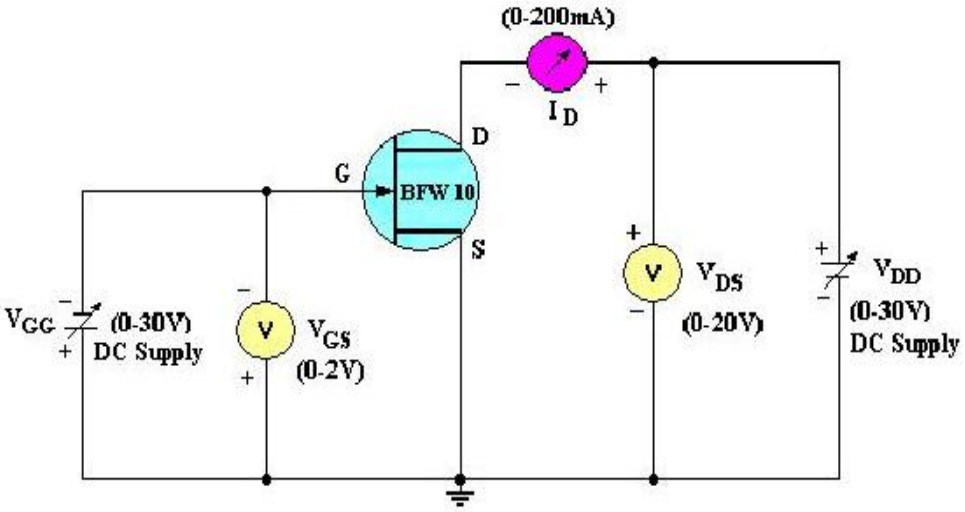
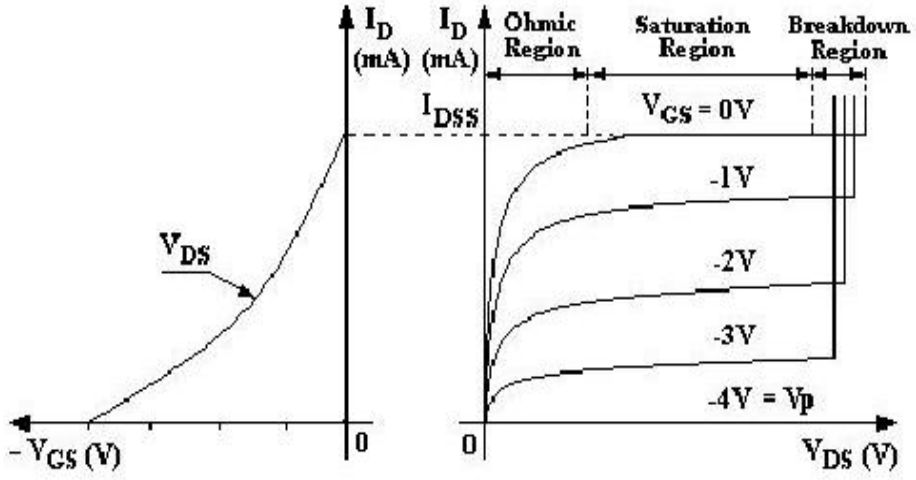
CIRCUIT DIAGRAM



MODEL GRAPH



TABULAR FORM:

DRAIN CHARACTERISTICS:

S.No	VDS (V)	VGS = 0 volts ID (mA)	VGS = -1V ID (mA)	VGS = -2V ID (mA)

TRANSFER CHARACTERISTICS:

S.No	VGS (V)	VDS = 1.0V ID (mA)	VDS = 3.0V ID (mA)	VDS = 5.0Ā ID (mA)

RESULT

The characteristics of transistor using were studied and plot the characteristics curve.

Viva-questions

1. Define transconductance.
2. What is called JFET?
3. What are the difference between JFET and BJT?
4. Why JFET is known as voltage controlled device?
5. What is saturation region and break down region?

Experiment No:4

Date:

FIRST ORDER BAND PASS FILTER

AIM

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To construct study the characteristics of active band pass filter using op-amp and draw the frequency response curve.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

Band pass filter is a combination of high pass and low pass filter. Cascading of LPF and HPF produces low Q factor with wide band pass. It is a frequency selective circuit. It passes range of frequencies is set between two cut-off frequency points labeled as "lower frequency" (f_L) and the "higher frequency" (f_H) while attenuating any signals outside of these two points.

PROCEDURE

1. Connections are made as shown in the diagram
2. Set the input signal as 1V (peak to peak) from function generator and apply to the circuit.
3. Observe the output from the CRO.
4. Vary the input frequency from signal generator and measure the corresponding output voltage.
5. Draw the frequency response curve in semilog graph.
6. Find out the cut off frequency from the graph and compare it to the theoretical value

$$f_H = 1/2\pi RC$$

CIRCUIT DIAGRAM

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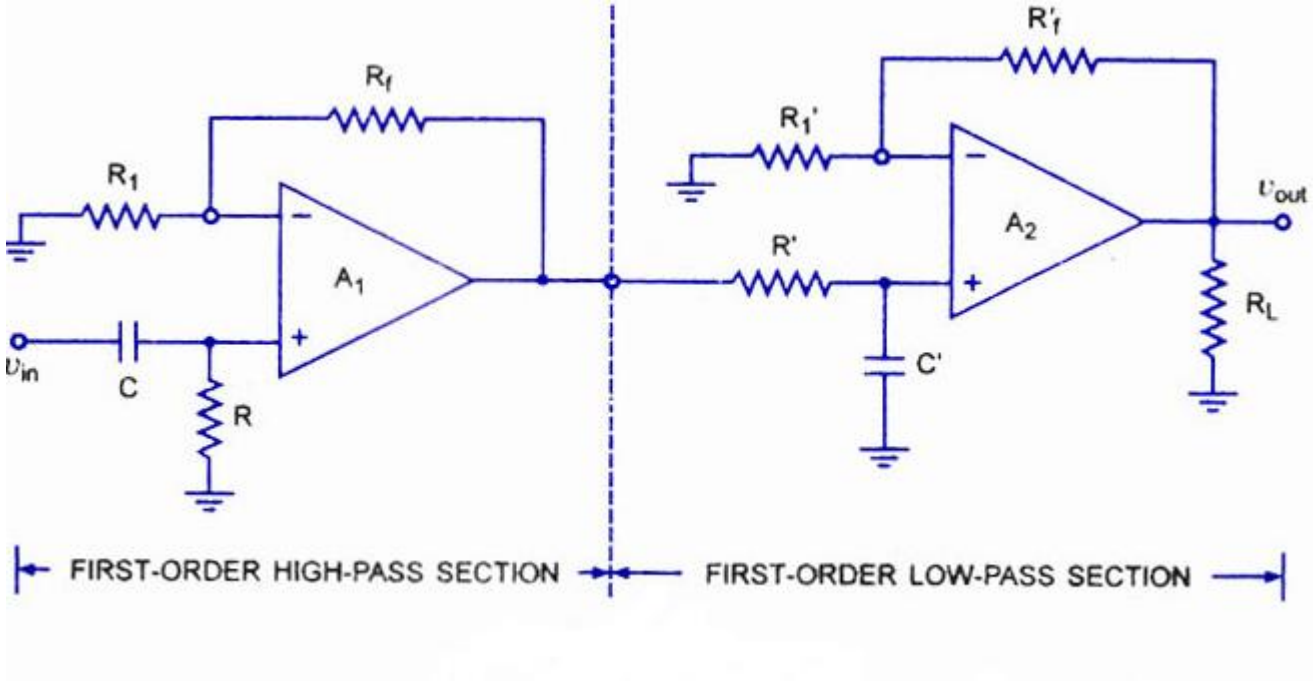


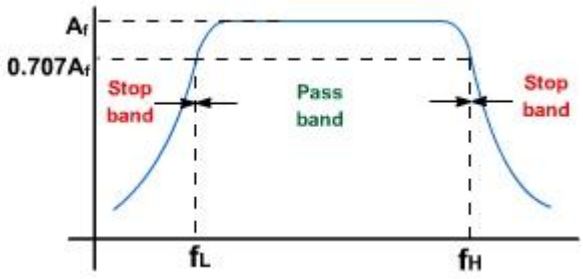
R1=R2=R'1=R2'=Rf=Rf'=10 KΩ, C=C'=.01μF

TABULAR FORM

Input Voltage Vi =……. Volts

Sr.No	Frequency in Hz	Output Voltage Vo in Volts	Gain =Vo/Vi	Gain in dB = 20log Gain

MODEL GRAPH



RESULT

Band pass filter using operational amplifier is constructed and calculated the cut off frequency.

Viva-Questions

1. What is the difference between passive and active filter?

2. What is band pass filter?

3. What is narrow band pass filter?

4. What is pass band and stop band

5. Explain the working principle of band pass filter.

Experiment No:5

Date:

NARROW BAND REJECT FILTER

AIM

To construct and to study the characteristics of active narrow reject filter using op-amp and draw the frequency response curve.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

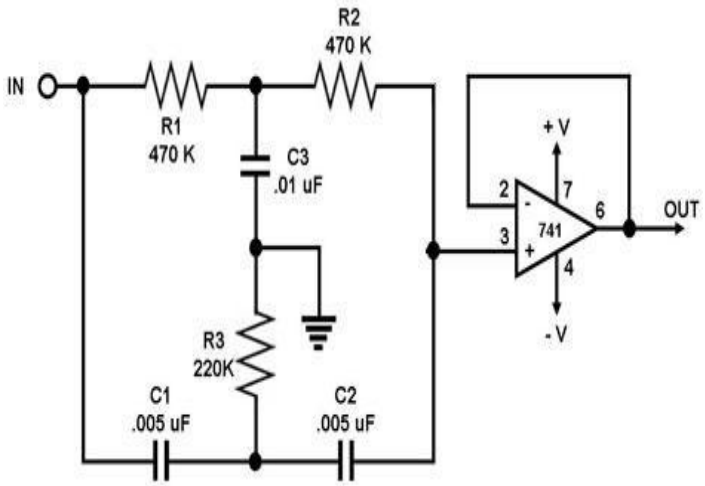
Narrow band reject filter is a combination of low pass and high pass filter. It is a frequency selective circuit. It is called as Notch filter, it rejects a narrow band of frequency. That is it rejects a particular frequency having a notch where the signals are rejected.

PROCEDURE

1. Connections are made as shown in the diagram
2. Set the input signal as 1V (peak to peak) from function generator and apply to the circuit.
3. Observe the output from the CRO.
4. Vary the input frequency from signal generator and measure the corresponding output voltage.
5. Draw the frequency response curve in semilog graph.
6. Find out the cut off frequency from the graph and compare it to the theoretical value

$$f_H = 1/2\pi RC$$

CIRCUIT DIAGRAM

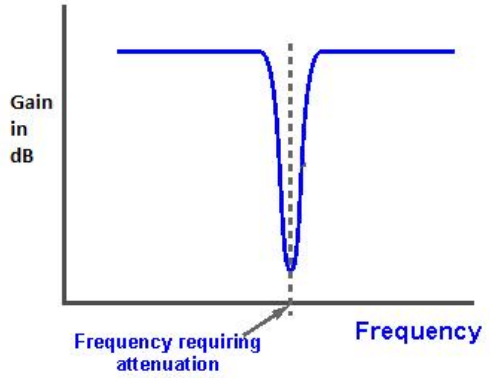


TABULAR FORM

Input Voltage Vi =……. Volts

Sr.No	Frequency in Hz	Output Voltage Vo in Volts	Gain =Vo/Vi	Gain in dB = 20log Gain

MODEL GRAPH



RESULT

Narrow band reject filter using operational amplifier is constructed and calculated the cut off frequency.

Viva-Questions

1. What is wide band reject filter?

2. What is notch filter?

3. Draw the frequency response curve of notch filter.

4. What are the applications of notch filter?

5. Explain the working principle of notch filter

Experiment No:6

Date:

ASTABLE MULTIVIBRATOR

AIM

To study the operation of IC555 Timer as monostable multivibrator.

APPARATUS

IC 555, Resistors, Capacitors, Power supply, CRO, Bread board and connecting wires.

THEORY

An Astable Multivibrator is a free running oscillator circuit that continuously produces rectangular wave without the help of external triggering. It has no stable state.

T charges= 0.69 (RA+RB) C

T discharge= 0.69 RBC

The total time period is T= T charges+ T discharge

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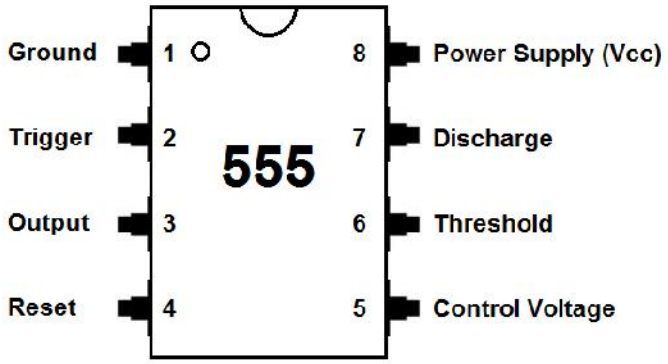
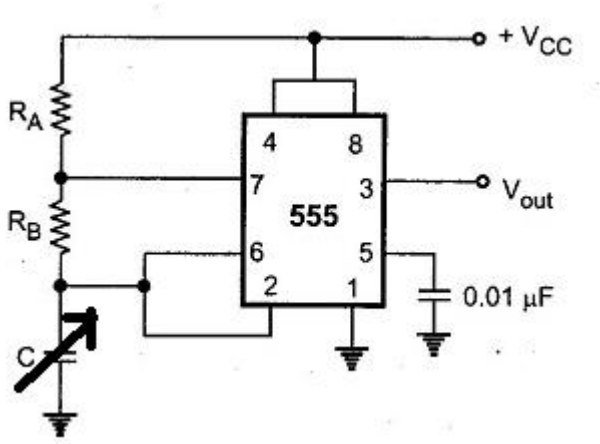
PIN DIAGRAM



PROCEDURE

1. Make the connections as shown in the figure.
2. Switch on the power supply and observe the output wave form from CRO
3. Change the value of capacitor using a variable capacitance box and measure the time period of the signal and calculate the frequency.

CIRCUIT DIAGRAM

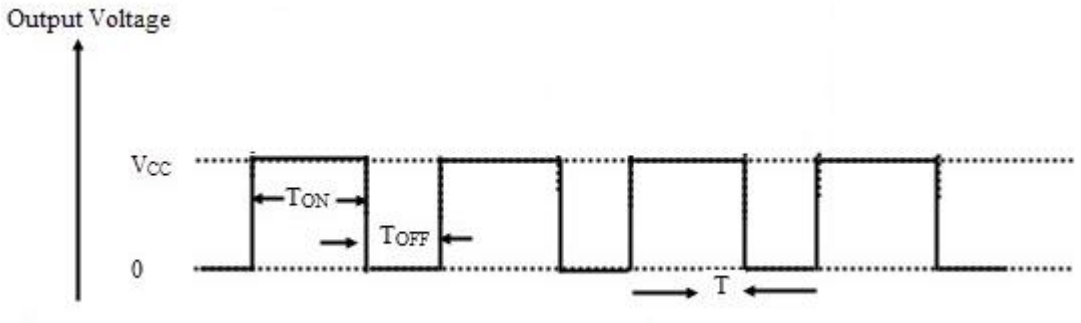


RA=10KΩ, RB=100KΩ, C1=0.01μf

TABULAR FORMS

Sr.No	Value of the capacitor	Time per division	Length of the wave	Time period (T mS)	Practical Frequency F=1/T in Hz	Theoretical Frequency

MODEL GRAPH



RESULT

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Performance of astable multivibrator using 555 timer is studied.

Viva-Questions

1. Define multivibrator
2. What is astable multivibrator?
3. Explain the working principle of astable multivibrator.
4. Explain the origin of name IC555.
5. Explain the working principle of IC 555

Experiment No:7

Date:

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MONOSTABLE MULTIVIBRATOR

AIM

To study the operation of IC555 Timer Mono stable multivibrator.

APPARATUS

IC 555, Resistors, Capacitors, Power supply, CRO, Bread board and connecting wires.

THEORY

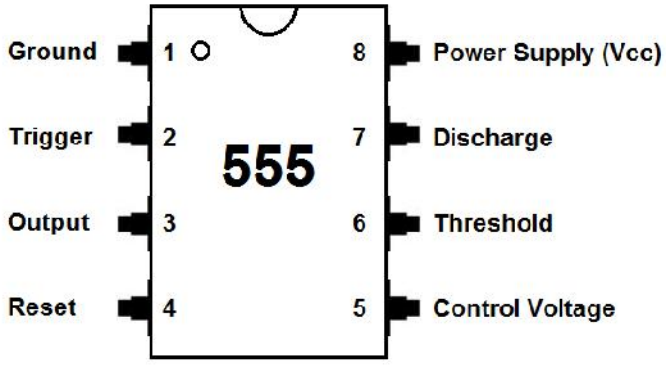
Monostable multi vibrator is an oscillator circuit that continuously produces rectangular wave .It has one stable state.

Tcharges= 0.69 (RA+RB) C

Tdischarge= 0.69 RBC

The total time period is T= Tcharges+ Tdischarge

PIN DIAGRAM

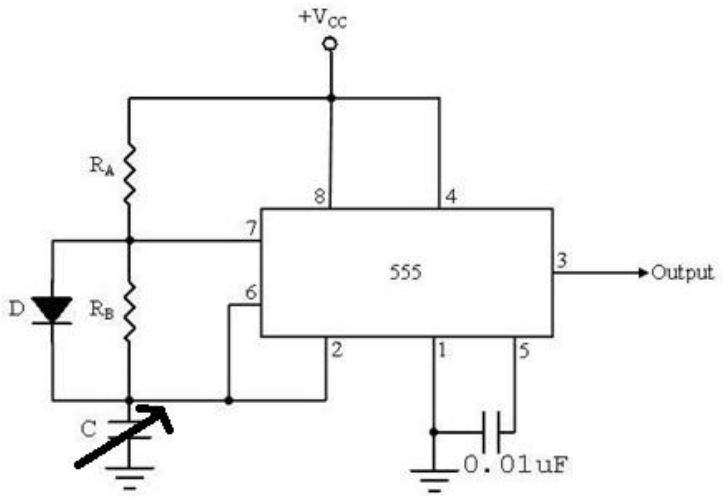


PROCEDURE

1. Make the connections as shown in the figure.
2. Switch on the power supply and observe the output wave form from CRO

3. Change the value of capacitor using a variable capacitance box and measure the time period of the signal and calculate the frequency.

CIRCUIT DIAGRAM

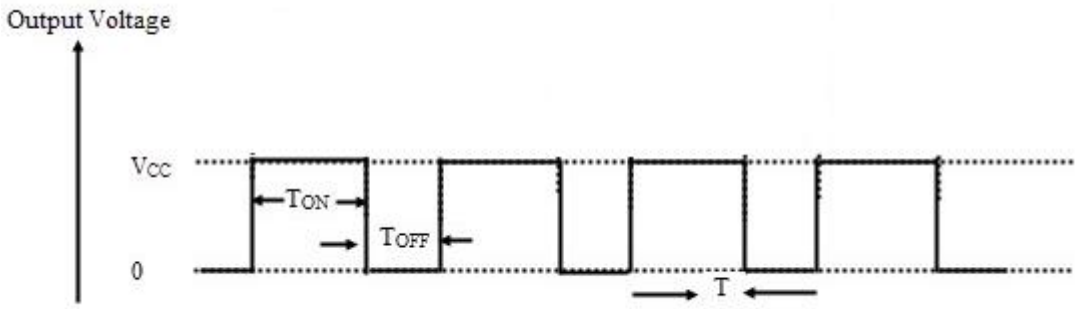


RA=10KΩ, RB=10KΩ

TABULAR FORMS

Sr.No	Value of the capacitor	Time per division	Length of the wave	Time period (T mS)	Practical Frequency F=1/T in Hz	Theoretical Frequency

MODEL GRAPH



RESULT

Studied the performance of IC555 as monostable multivibrator.

Viva –Questions

1. What is monostable multivibrator?

2. What are the applications of monostable multivibrator?

3. What is the role of diode in monostable multivibrator circuit?

4. Explain the pin diagram of I555.

5. Explain the origin of name 555.

Experiment No:8

Date:

RC COUPLED AMPLIFIER

AIM

To construct RC coupled amplifier and to plot the frequency response curve and find out the bandwidth**.**

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APPARATUS

NPN transistor, Resistance, Regulated power supply, function generator, CRO, Bread board and connecting wires.

THEORY

RC coupled amplifier is a multi stage amplifier. It has two stages. The capacitor C is used as a coupling element between the first and second stage. When a.c. signal is applied to the base of the first transistor, it is amplified and developed across the out of the 1st stage. This amplified voltage is applied to the base of next stage through the coupling capacitor Cc where it is further amplified and reappears across the output of the second stage. Thus the successive stages amplify the signal and the overall gain is raised to the desired level. Much higher gains can be obtained by connecting a number of amplifier stages in succession (one after the other). Resistance-capacitance (RC) coupling is most widely used to connect the output of first stage to the input (base) of the second stage and so on. It is the most popular type of coupling because it is cheap and provides a constant amplification over a wide range of frequencies.

PROCEDURE

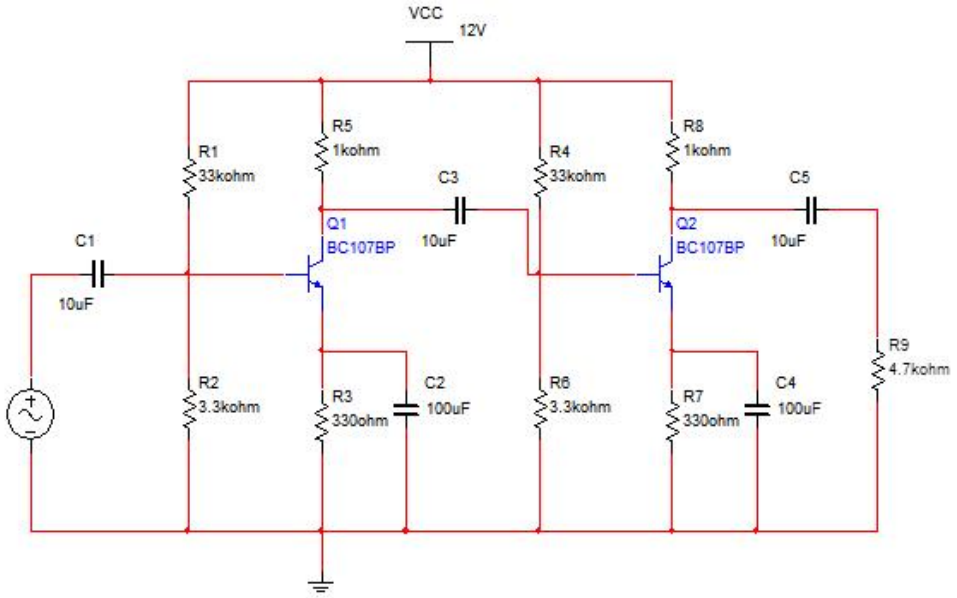
1. Connect the circuit as shown in the Diagram.
2. Set input voltage (1 V) from the Signal Generator
3. Observe the output wave form from CRO
4. Vary the frequency from Signal Generator in appropriate steps and note down the corresponding O/P Voltage Vo.

4. Calculate the Voltage Gain Av = Vo/Vi and note down in the tabular form.

5. Plot the frequency response curve on a Semi-log Graph sheet

6 Find out the Bandwidth B.W = f2 – f1.

CIRCUIT DIAGRAM

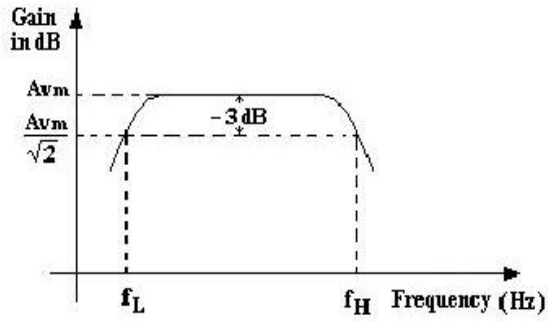


TABULAR FORMS:

Input Voltage= …….. V

S.No	Frequency (Hz)	O/P Voltage, Vo (V)	Voltage Gain Av =Vo/Vi	Av in dB = 20 log (Av)

MODEL GRAPH



Viva -Questions

1. What is multistage amplifier?

2. What is cascade amplifier?

3. Explain the working principle of RC coupled amplifier.

4. What are the different elements used to couple different stages of amplifier?

5. What are the advantages and application of multistage amplifier?

Experiment No:9

Date:

WAVE FORM GENERATOR USING OP-AMP

AIM

Construct a wave form generator circuit using operational amplifier and verify the output.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors Constant Dual power supply, multimeter, CRO, Bread board and connecting wires.

THEORY

Wave form generator is a kind of oscillator used to generate different wave forms. Op-amp uses astable mode of operation to produce wave forms. The frequency of oscillation is determined by charging and discharging of capacitor through the resistor R. The square wave output is given as input to the integrator circuit it will be converted to ramps or triangular by charge and discharges of the capacitor. That is this wave form generator is a combination of astable multivibrator and integrator.

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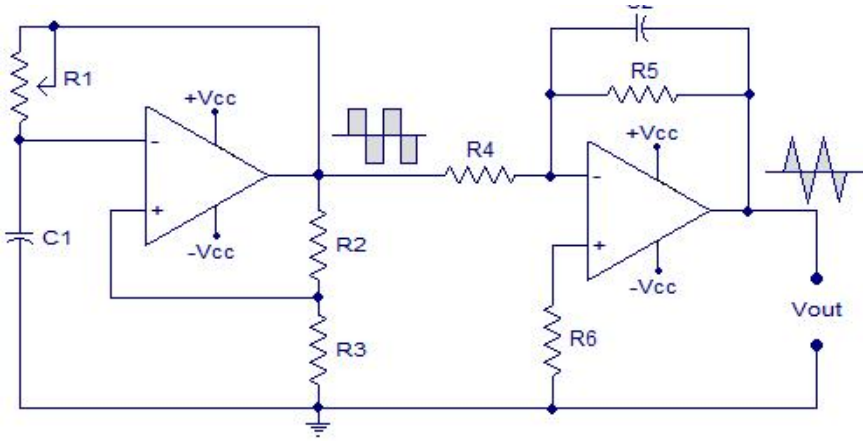
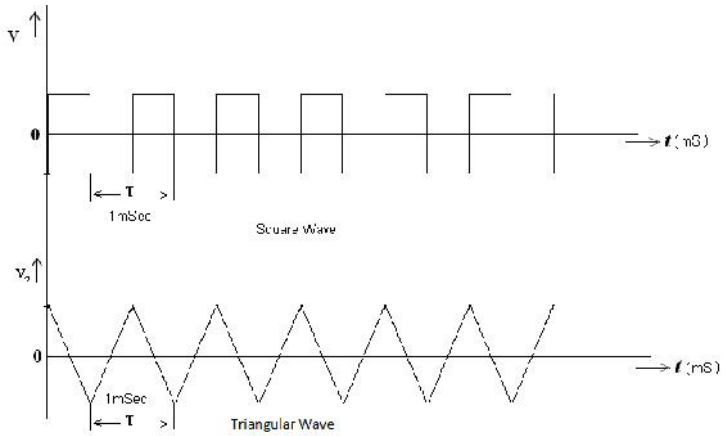
PROCEDURE

1. Connections are made as shown in the diagram
2. Connect the circuit diagram to CRO using probes to see output wave form
3. By varying the pot, observe the output wave form from both the op-amp output terminals
4. Sketch the output wave form.

CIRCUIT DIAGRAM



MODEL GRAPH



RESULT

Wave form generator is constructed and verified the output.

Viva –Questions

1. Explain the working principle of wave form generator.
2. What is the working principle of astable multivibrator?
3. Explain the role of integrator circuit in wave form generator.
4. Explain the role of astable multivibrator circuit in wave form generator.
5. What are the applications of wave form generator?

Experiment No:10

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Date:

INSTRUMENTATION AMPLIFIER

AIM

Construct and verify linear operational amplifier such as an instrumentation amplifier.

APPARATUS

Op-amp(IC 741), Resistors, Capacitors Constant Dual power supply, multimeter, Signal Generators, CRO, Bread board and connecting wires.

THEORY

Instrumentation amplifier is a kind of differential amplifier with additional input buffer stages. The addition of input buffer stages makes it easy to match (impedance matching) the amplifier with the preceding stage. Instrumentation amplifiers are commonly used in industrial test and measurement application. The instrumentation amplifier also has some useful features like low offset voltage, high CMRR (Common mode rejection ratio), high input resistance, high gain etc.

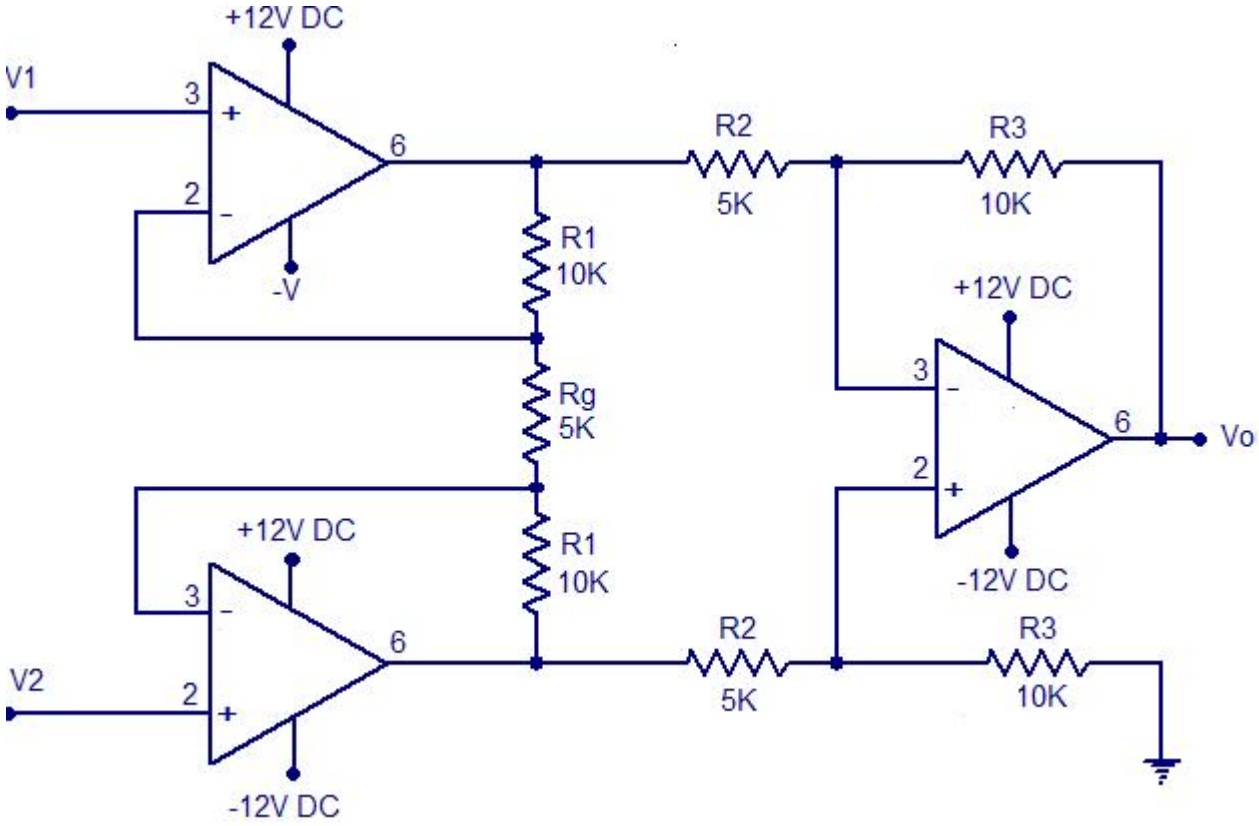
$$\text{Gain (Av)} = V_o / (V_2 - V_1) = (1 + (2R_1/R_g)) \times (R_3/R_2)$$

PROCEDURE

1. Connect the circuit as shown in the diagram
2. Apply the supply voltages of +15V to pin 7 and -15V to pin 4 of IC 741 respectively. Connect the ground to the ground point.

3. Apply DC voltage from regulated power supply to inputs V_1 and V_2.
4. Note down the Vo using Voltmeter.
5. Compare theoretical and practical gain.
6.

CIRCUIT DIAGRAM



TABULAR FORM

Input Voltage V1 in volts	**Input Voltage V1 in volts**	**Output Voltage V0 in volts**	**Gain=Vo/(V2-V1)**	**Gain =(1+2 R1/Rg)x(R3/R2)**

RESULT

Instrumentation amplifier circuit is constructed using operational amplifier and compared practical and theoretical gain

Viva-Questions

1. Explain the working principle of instrumentation amplifier.
2. Write the gain expression for instrumentation amplifier.
3. What are the applications of instrumentation amplifier?
4. What are the features of instrumentation amplifier?
5. What is buffer?

Experiment No:11

Date:

RC PHASE SHIFT OSCILLATOR

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AIM

To design and construct RC phase shift using operational amplifier and compare the experimental and theoretical frequencies**.**

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

RC phase shift oscillator is a sinusoidal oscillator used to produce the sinusoidal wave oscillations. The important component of RC phase shift oscillator is an inverting operational amplifier with positive feedback using a regenerative feedback RC filter network, hence the name RC phase shift oscillator. Here inverting amplifier gives 180^0 phase shift and RC net work gives another 180^0 phase shift, so that we will get perfect sine wave oscillations.

PROCEDURE

1. Make the connections as shown in the figure.
2. Switch on the power supply and observe the output wave form from CRO
3. Measure the time period of the signal and calculate the frequency.

DESIGN

$f_0 = 1/2\pi RC\sqrt{6}$, $Rf \geq 29R$, $R1 \geq 10\ R$

Choose C = .1μF

f0 = 500 Hz

fo=**1/2πR 0.1**μ $\sqrt{6}$

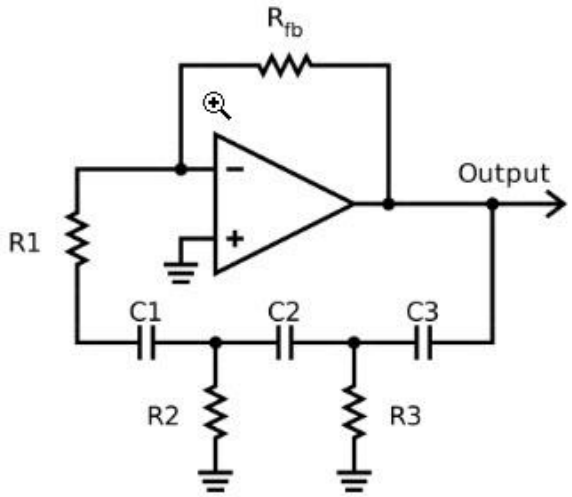
R = 1.3 KΩ, Therefore R=1.5 K Ω

R1 = 10R = 15K Ω

Rf = 29R1=29x15K=435 K Ω (use 1M Ω pot)

R=R1=R2=R3

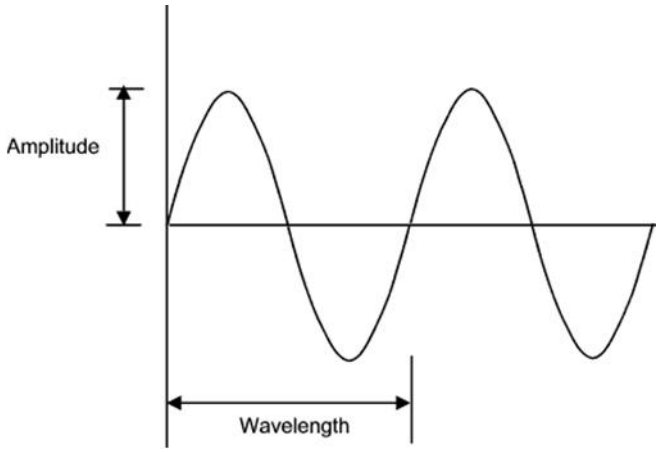
CIRCUIT THEORY



TABULAR FORMS

Sr.No	Time per division	Length of the wave	Time period (T mS)	Practical Frequency F=1/T in Hz	Theoretical Frequency

MODEL GRAPH



RESULT

Frequency of the Rc phase shift Oscillator = ……. Hz

Viva-Questions

1. What is an oscillator?
2. Define frequency.
3. Define amplitude.

4. What is the role of op-amp in Rc phase shift oscillator circuit?

5. Explain the working principle of RC phase shift oscillator.

Experiment No:12

Date:

WEIN BRIDGE OSCILLATOR

AIM

Design and construct Wein Bridge oscillator using operational amplifier and compare the experimental and theoretical frequencies**.**

APPARATUS

Op-amp(IC 741), Resistors, Capacitors, Constant Dual power supply, Signal Generators, CRO, Bread board and connecting wires.

THEORY

Wein Bridge oscillator is a sinusoidal oscillator used to produce the sinusoidal wave oscillations. .The important component of Wein bridge oscillator is an operational amplifier with positive feedback .It can generate a wide range of frequencies. Op amp is in non-inverting mode of operation so that it will not give any phase shift.

PROCEDURE

1. Make the connections as shown in the figure.
2. Switch on the power supply and observe the output wave form from CRO
3. Measure the time period of the signal and calculate the frequency.

DESIGN

$f_o = 1/2\pi RC$, $A_v = 1+R_f/R_1=3$

ie. $R_f/R_1=2$, Therefore $R_f=2R_1$

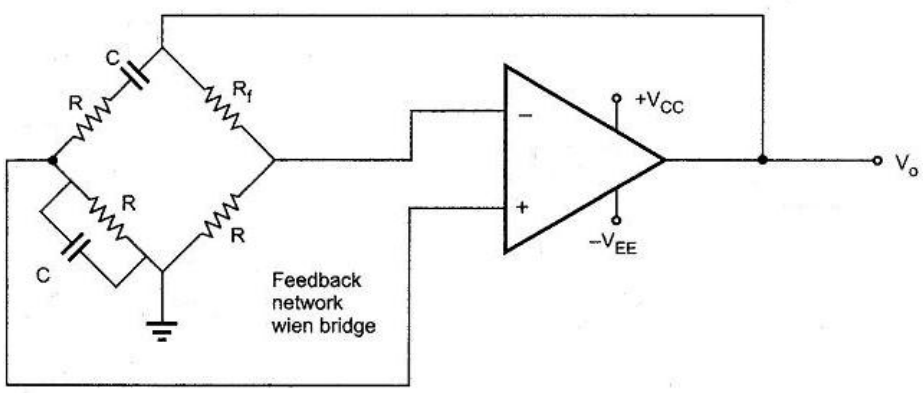
Let $C=0.047\ \mu F$ and $f_o =1KHz$

$R=1/2\pi f_0C =3.2\ K\Omega$

Let $R_1=10K$, $R_F=2R_1=20K\Omega$ (use 20 K pot)

CIRCUIT DIAGRAM

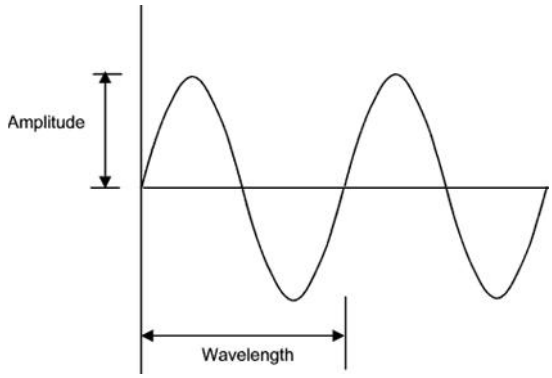
CLASS:II BSc PHYSICS
COURSE NAME: PHYSICS OF DEVICES AND COMMUNICATION PRACTICAL
COURSE CODE: 18PHU312
BATCH-2018-2021



TABULAR FORMS

Sr.No	Time per division	Length of the wave	Time period (T mS)	Practical Frequency F=1/T in Hz	Theoretical Frequency
1.					

MODEL GRAPH



RESULT

Frequency of the Wein Bridge Oscillator = ……. Hz

Viva-Questions

1. What is positive feedback?

2. Define frequency.

3. What is the role of op-amp in Wein Bridge oscillator circuit?

4. Explain the working principle of Wein Bridge**.**

5. Explain the working principle of Wein Bridge oscillator.