Lab manual – ANALOG COMMUNICATION LAB (3049)

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Department of Electronics & Communication Engineering

GOVERNMENT POLYTECHNIC COLLEGE, PERUMBAVOOR

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General Remarks: (For office use only)							
Test 1:		Test 2:		Assign 1:		Assign 2	

Exp No. 1 Date:

VISION AND MISSION

Government Polytechnic College, Perumbavoor Vision and Mission
Vision Excel as a centre of skill education moulding professionals who sincerely strive for the betterment of society.
Mission • To impart state of the art knowledge and skill to the graduate and moulding them to be competent, committed and responsible for the well being of society. • To apply technology in the traditional skills, thereby enhancing the living standard of the community

Department of Electronics & Communication Engineering
Vision Excel as a centre of skill education in Electronics and Communication Engineering, moulding professionals who sincerely strive for the betterment of themselves and society.
Mission • To impart state of the art knowledge, skill and attitude to the students and contributing to their sustainable development. • To merge technologies in the field of Electronics and Communication Engineering with occupational skills, thereby improving quality of living.

Exp No. 2 Date:

PEO, PO and PSOs of the Program

Program Educational Outcome (PEOs)

PEO1: Secure successful careers in manufacturing, testing, maintenance, development and marketing in Electronics and Communication Engineering.

PEO2: Acquire knowledge and competency in the domain to develop innovative, cost effective and socially acceptable solutions to engineering problems in a multi disciplinary work environment.

PEO3: Develop strong fundamental knowledge that prepares them for professional careers/higher studies with attitude for lifelong learning.

PEO4: Instill the attitude to be sensitive to ethical, societal and environmental issues while pursuing their professional duties.

PEO5: Possess leadership qualities and be effective communicator to work efficiently with diverse teams, promote and practice appropriate ethical practices.

Program Outcomes (POs)

1. Ability to communicate effectively with customers and officials, both in writing and orally.

2. An ability to apply knowledge of Electronics, communication, computing, mathematical foundations and theory in the implementation and design of electronics based systems.

3. An ability to interpret data sheets and schematics.

4. An ability to understand and solve real time problems in electronics, electronics and communication domain.

5. An ability to develop real time applications based on communication programming skills.

6. Ability to configure, troubleshoot and maintain electronic, communication and digital circuits.

7. Ability to apply entrepreneurial skills in the awake of incubation centers.

8. Ability to use and design communication systems.

9. An ability to recognize the importance of professional development by pursuing undergraduate studies or face competitive examinations that offer challenging and rewarding career in Electronics & Communication.

10. Understanding professional ethical legal security and social issues and responsibilities further to function effectively in a multi disciplinary environment.

Program Specific Outcome (PSO):

PSO1: Specialization knowledge: Apply concepts and knowledge in the field of semiconductor devices, communication and networking technologies, embedded systems.

PSO2: Professional growth: Generate ideas from the knowledge of engineering specialization leading to professional growth.

PSO3: Entrepreneurship: Apply knowledge and understanding of engineering principles to initiate entrepreneurship ventures.

Exp No. 3 Date:

SAFETY PROCEDURES

Problem Statement:

The safety instructions are presented to the attention of the students as a mean of preventing accidents while performing experiments and activities in the communication lab of the department .The purpose is to draw attention to the risks involved in lab activities to prevent human suffering and damage to equipment.

Safety in the laboratory:

Working in the lab is not allowed without following electricity precautions displayed.

No individual work is allowed in the lab.

Laboratory in charge is responsible for the arrangements of your lab activities; Listen carefully to his/her instructions and follow them.

To do and not to do:

Inform the lab in charge about dangerous conditions and faults in the lab or nearby environment.

Do not do any action that may harm people or equipments in the lab.

Do not misuse any of the tools or instruments belong to the lab.

Strict discipline should be maintained in the laboratory.

Turn off cell phones before entering the lab.

At the end and beginning of laboratory, follow 5S procedures and leave the work table clean and tidy.

Electrical Safety:

Consult Electrical Engineering section available in the campus for electrical safety queries.

The lab equipment is powered from electrical sockets installed on the tables. Do not use equipment that is powered from a damaged socket.

Do not use equipment that is powered from flexible cable with damaged insulation or if it's plug is not assembled properly.

Do not repair or disassemble electrical equipment including replacement of fuses installed in the equipment.

Do not open the main fuse box, unless it is an emergency and you need to switch off main circuit breaker.

Emergency Switches:

The laboratory has circuit breakers, which is located in the main panel. Identify the place.
In an emergency condition, switch off circuit breakers immediately.

Result
Familiarization of safety precautions performed.

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 4 Date:

HANDLING ELECTROSTATIC DISCHARGE (ESD)

Problem Statement:

Familiarize ESD handling procedures in the laboratory

THEORY

In handling electronic devices, datasheets cautions about ESD (Electrostatic Discharge) precautions. These devices are prone to damage because of electrostatic charges made by human body. These charges may be up to 4000 volts and cause damage without being noticed. It is recommended to follow ESD precautions on handling of these devices.

Points for the elimination of ESD damage to electronic components

1. Make sure you have a reliable ground point available near the table.
2. Do not wear clothing which generates static electric charges every time you move.
3. Do not handle static generating objects while working on electronics.
4. Store all chips and other components in appropriate anti-static containers.
5. Keep all ESD sensitive components and spares in anti-static envelopes for storage.

6. Be sure to turn off the power and remove the power plug from all equipment before working repairing or assembling.

7. Do not plug in or remove equipments while the power is on.

Result

Familiarization of ESD protection procedures performed.

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 5

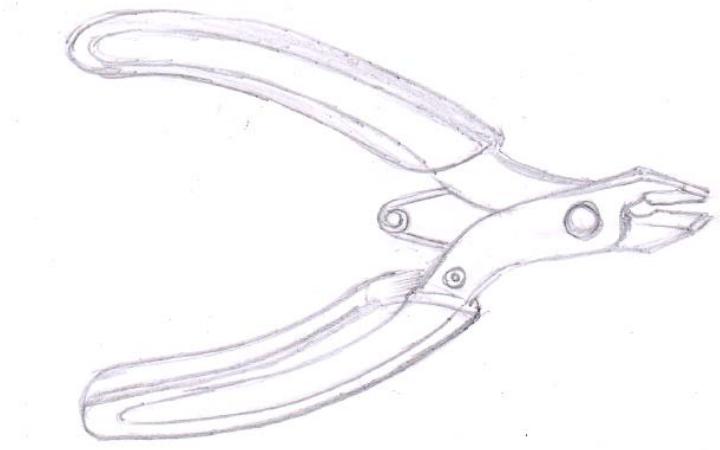
FAMILIARIZATION OF TOOLS AND PROCEDURES

Problem Statement:

To familiarize proper usage of tools used for handling componenets.

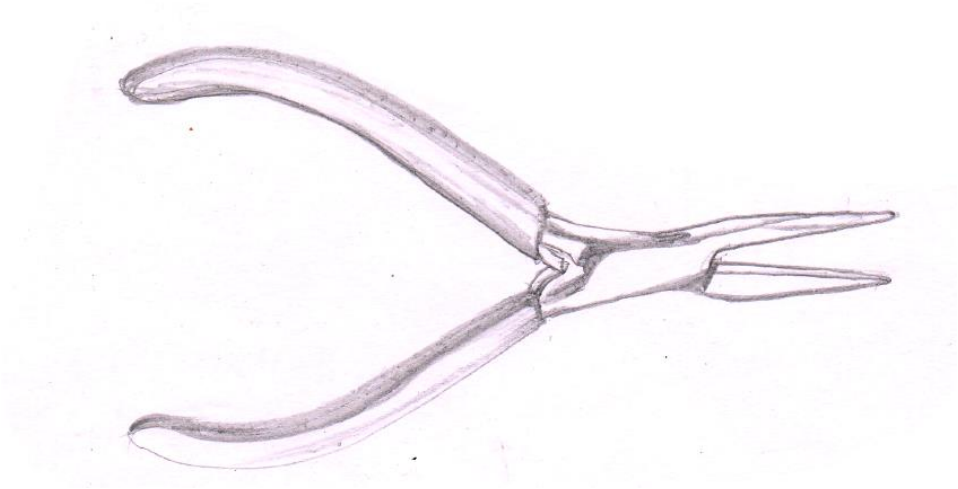
Nipper

These electronic nippers are for cutting wires and component leads. They have a cushioned handle which makes them much more comfortable to use.



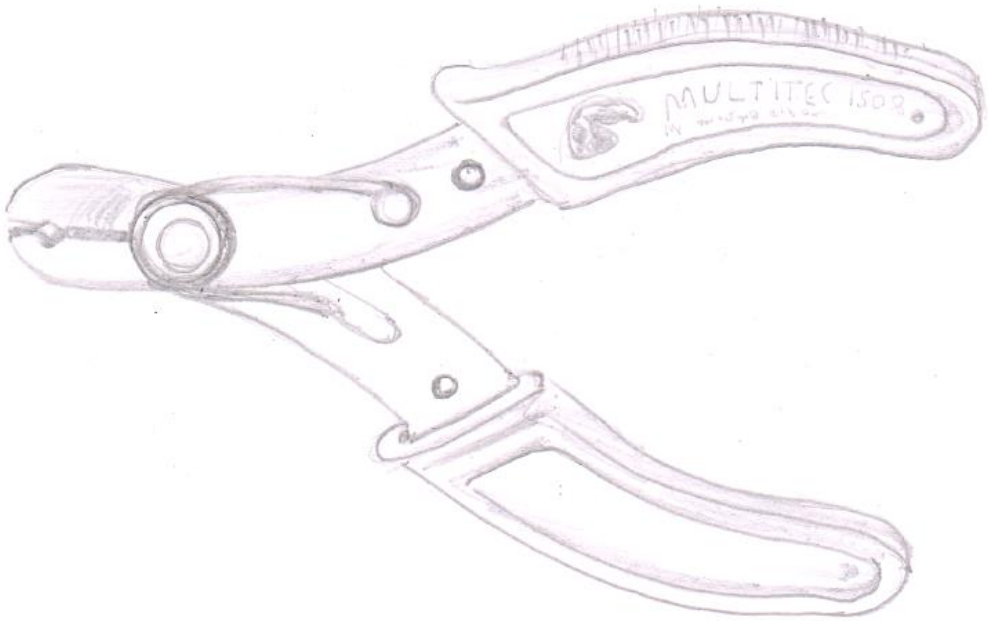
Long nose pliers

Needle-nose pliers are both cutting and holding pliers used to bend, re-position and snip wire. Because of their long shape they are useful for reaching into small areas where cables or other materials have become stuck or unreachable with fingers or other means.



Wire stripper

A wire stripper is a small, hand-held device used to strip the electrical insulation from electric wires.



Result

Study of handling components and their fixing performed.

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 6 Date:

ACTIVE LOWPASS FILTER

Problem Statement:

To study and setup active low pass filter, plot the response curve and find the cutoff frequency.

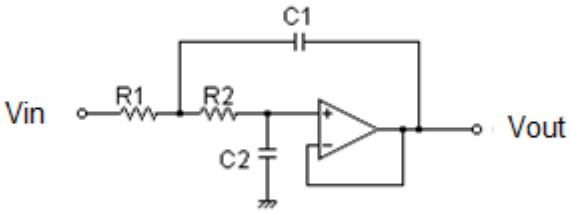
EQUIPMENTS/COMPONENTS

Name & Specification.	**Quantity**
CRO/DSO	1No.
Function generator	1No.
Dual Power supply +/- 15V	1No.
OP-AMP (741)	1 No
Capacitors-0.01µF, 0.0047µF	
Resistors- 30kΩ,18Kω	

THEORY

Filter is a circuit that can be designed to modify, reshape or reject all unwanted frequencies of an electrical signal and accept or pass only wanted signals. Passive Filters are made up of passive components such as resistors, capacitors and inductors and have no amplifying elements (transistors, op-amps, etc) so have no signal gain, therefore their output level is always less than the input. Filters are so named according to the frequency range of signals that they allow to pass through them, while blocking or attenuating the rest. The low pass filter only allows low frequency signals from 0Hz to its cut-off frequency, point to pass while blocking those any higher. Cut off frequency,

$fc = \frac{}{2\pi\sqrt{}}$



Low Pass Filter (Active)

$$fc = \frac{1}{2\pi\sqrt{R1C1R2C2}}$$

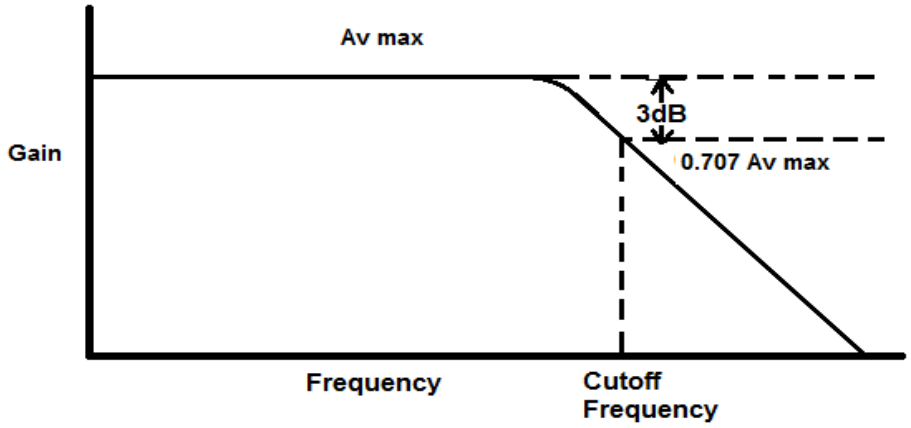
IC=741, R1= 30K, R2= 18K, C1=0.01 µF, C2=0.0047 µF

Observation

Vin = 1Vpp

Sl	Frequency(Hz)	Vout	Gain Av = Vout/Vin	Gain dB = 20 logAv

Graph (*for indication only. Use graph sheet for original plot)*



PROCEDURE

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Apply 1V pp/100Hz sine wave to the circuit.
- Observe the output waveform in the CRO, and measure amplitude.
- Vary the frequency of input signal up to 3kHzwith uniform increment of 100Hz and plot frequency response curve.
- Find the cutoff frequency point as 70.7% of maximum Av or -3dB point from the frequency response curve.

Result

Obtained cutoff frequency from the frequency response curve.

Designed value = Observed value =

Inference

Difference in designed and observed value is due to

_____

_____

_____

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 7 Date:

ACTIVE HIGH PASS FILTER

Problem Statement:

To study and setup active low pass filter, plot the response curve and find the cutoff frequency.

EQUIPMENTS/COMPONENTS

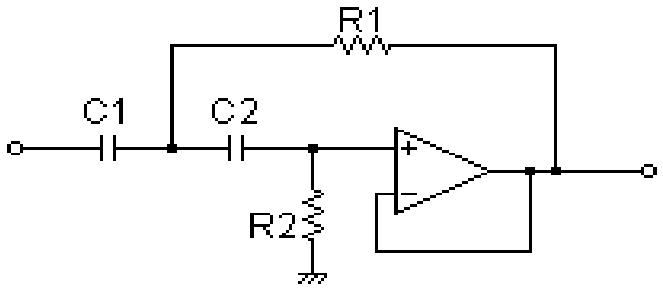
Name & Specification.	**Quantity**
CRO/DSO	1No.
Function generator	1No.
Dual Power supply +/- 15V	1No.
OP- AMP (741)	1 No
Capacitors-0.01Mf	2No
Resistors- 11KΩ,22KΩ	

THEORY

Filter is a circuit that can be designed to modify, reshape or reject all unwanted frequencies of an electrical signal and accept or pass only wanted signals. Passive Filters are made up of passive components such as resistors, capacitors and inductors and have no amplifying elements (transistors, op-amps, etc) so have no signal gain, therefore their output level is always less than the input. Filters are so named according to the frequency range of signals that they allow to pass through them, while blocking or attenuating the rest The high pass filter only allows high frequency signals from its cut-off frequency,fc and block lower frequencies. Cut off frequency,

$$fc = \frac{1}{2\pi\sqrt{R1C1R2C2}}$$

High Pass Filter (Active)



Vin Vout

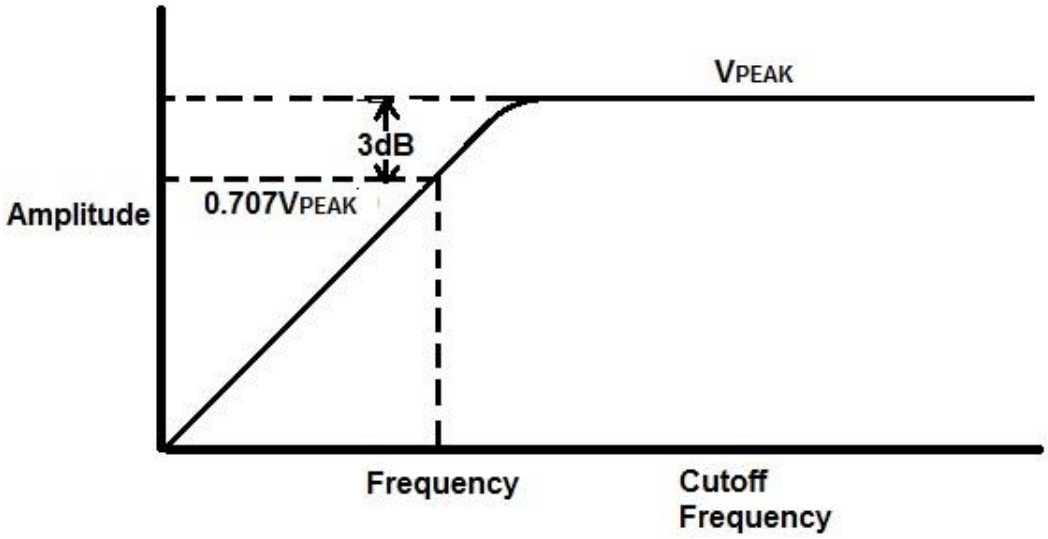
IC=741, R1 = 11kΩ, R2 = 22kΩ, C1 = 0.01uF, C2 = 0.01uF

Observation

Vin = 1Vpp

Sl	Frequency(Hz)	Vout	Gain Av = Vout/Vin	Gain dB = 20 logAv

Graph (*for indication only. Use graph sheet for original plot)*



PROCEDURE

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Apply 1V pp/100Hz sine wave to the circuit.
- Observe the output waveform in the CRO, and measure amplitude.
- Vary the frequency of input signal up to 10kHzwith uniform increment of 200Hz and plot frequency response curve.
- Find the cutoff frequency point as 70.7% of maximum Av or -3dB point from the frequency response curve.

Result

Obtained cutoff frequency from the frequency response curve.

Designed value = Observed value =

Inference

Difference in designed and observed value is due to

_____

_____

_____

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 8 Date:

ACTIVE BAND PASS FILTER

Problem Statement:

To study and setup active band pass filter, plot the response curve and find the cutoff frequencies, bandwidth.

EQUIPMENTS/COMPONENTS

Name & Specification.	**Quantity**
CRO/DSO	1No.
Function generator	1No.
Dual Power supply +/- 15V	1No.
OP-AMP (741)	1 No
Capacitors-0.01µF, 0.0047µF	
Resistors- 5.6KΩ,	
4.7KΩ	2 No

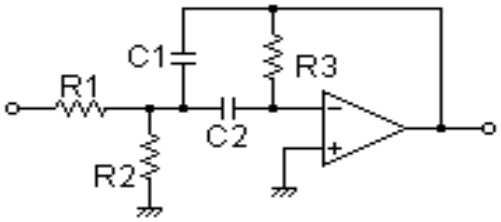
THEORY

Filter is a circuit that can be designed to modify, reshape or reject all unwanted frequencies of an electrical signal and accept or pass only wanted signals. Passive Filters are made up of passive components such as resistors, capacitors and inductors and have no amplifying elements (transistors, op-amps, etc) so have no signal gain, therefore their output level is always less than the input. Filters are so named according to the frequency range of signals that they allow to pass through them, while blocking or attenuating the rest. The band pass filter allows signals falling within a certain frequency band while blocking both the lower and higher frequencies on either side of this frequency band .

$$fc = \frac{1}{2\pi\sqrt{R1C1R2C2}}$$

BW = f_2 ... f_1

Band Pass Filter (Active)



Vin Vout

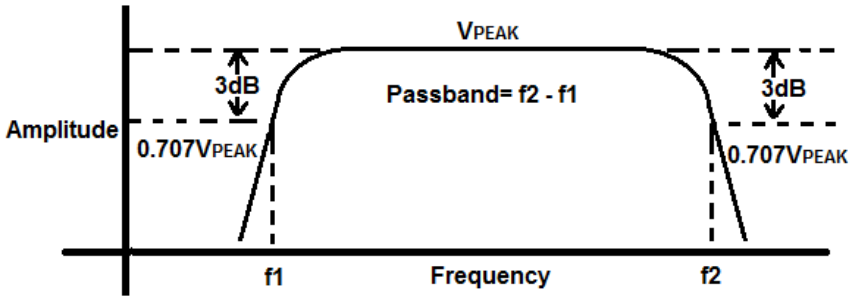
IC= 741, R1 = 4.7kΩ, R2 = 4.7kΩ, R3 = 5.6kΩ, C1 = 0.0047uF, C2 = 0.01uF

Observation

Vin = 1Vpp

Sl	Frequency(Hz)	Vout	Gain Av = Vout/Vin	Gain dB = 20 logAv

Graph (*for indication only. Use graph sheet for original plot)*



PROCEDURE

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Apply 1V pp/100Hz sine wave to the circuit.
- Observe the output waveform in the CRO, and measure amplitude.
- Vary the frequency of input signal up to 5kHzwith uniform increment of 200Hz and plot frequency response curve.
- Find the cutoff frequencies point as 70.7% of maximum Av or -3dB points from the frequency response curve.

Result

Obtained cutoff frequency from the frequency response curve.

Designed value f1 = f2 = Observed value f1 = f2 =

Band Width =

Inference

Difference in designed and observed value is due to

_____

_____

_____

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 9 Date:

AUDIO POWER AMPLFIER

Problem statement:
To set up study about Audio power amplifier.

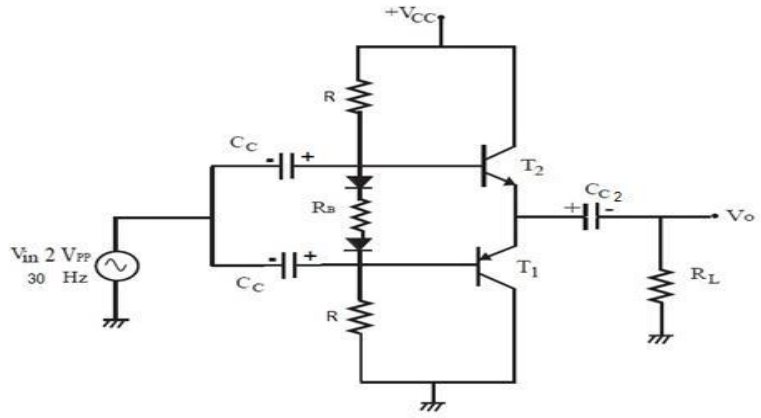
Equipments/Components:

Name & Specification.	Quantity
CRO/DSO	1No.
Function generator 20MHz	1No.
Regulated DC Power supply 0-9V	1No.
Transistors (SL100,SK100)	1 Each
Diode 1N 4001	2 Nos
Capacitors220 µF	3 Nos
Resistors 1KΩ	4 Nos

THEORY:

An Audio power amplifier is an amplifier that amplifies low power audio signals (frequencies between 20-20000 Hz) to a level suitable for driving loudspeakers. It is the final electronic stage in a typical audio playback chain. The term power amplifier is a relative term with respect to the amount of power delivered to the load and provided by the power supply circuit. Power amplifier circuits (output stages) are classified as A, B, AB and C for analogue designs and class D and E for switching designs based on the proportion of each input cycle (conduction angle), during which an amplifying device passes current.

Class A 100% of the input signal is used (conduction angle θ = 360°). The active element remains conducting all of the time. **Class B** 50% of the input signal is used (θ = 180°); the active element carries current half of each cycle, and is turned off for the other half. **Class AB** Class AB is intermediate between class A and B, the two active elements conduct more than half of the time **Class C** Less than 50% of the input signal is used (conduction angle θ < 180°). **Class D** amplifier uses some form of pulse-width modulation to control the output devices.



R=1KΩ, R_B=1KΩ, R_L=1KΩ, C_{C1}=220µF, C_{C2} =100µF, D_1&D_2=1N4001, T_1 =SK100, T_2= SL100 & Vcc =10V

PROCEDURE

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the circuit as per the diagram.
- Check DC level conditions.
- Apply 2Vpp/30Hz sine wave and observe output waveform **/** response of loud speaker.
- Draw the input and output waveform.

Result

Obtained the output waveform.

Input value = Output value =

Inference

Difference in amplitudes due to _____

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 10 Date:

AM GENERATOR USING TRANSISTOR

Problem statement:
To set up AM generator using transistor.

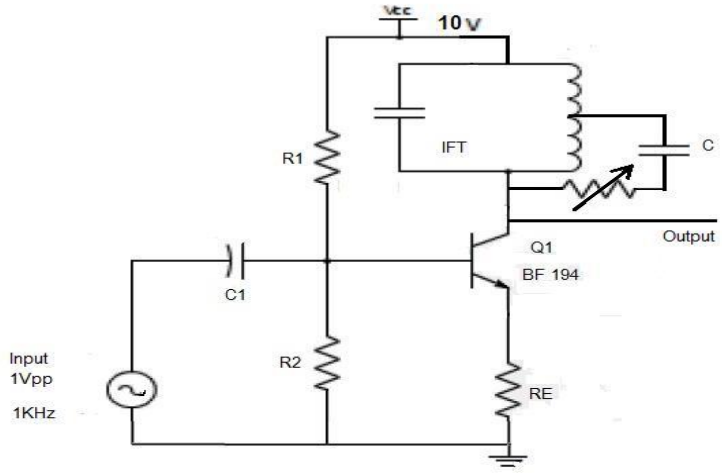
EQUIPMENTS/COMPONENTS

Name & Specification.	**Quantity**
CRO/DSO	1No.
Function generator 20MHz	1No.
Regulated DC Power supply 0-12V	1No.
Transistors (BF194)	1 No.
Diode 1N 4001	2 Nos
Capacitors0.1µF,330pf	1 each
Resistors 82 k,18k,1k,	1 each
POT 47K	1 No.
IFT	1 No.

THEORY:

Amplitude Modulation is defined as a process in which the amplitude of the carrier wave c(t) varied linearly with the instantaneous amplitude of the message signal m(t). Modulation is the process by which some characteristics of a carrier signal is varied in accordance with a modulating signal. The base band signal is referred to as the modulating signal and the output of the modulation process is called as the modulation signal. Amplitude modulation is defined as the process in which is the amplitude of the carrier wave is varied in accordance with the instantaneous amplitude of base band signal. In Amplitude Modulation the amplitude of the carrier wave c(t) is varied linearly with the instantaneous amplitude of the message signal m(t).The standard form the amplitude modulated wave is defined as

Circuit diagram



R_1=82K, R_2=18K, R_e=1K, Pot=47K, C_1=0.1µF, C=330pf

OBSERVATION

Sl.No	Am(volts)	V_{max}	V_{min}	m	%m

GRAPH

PROCEDURE:

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes
- Set up the circuit after verifying the condition of components
- Feed AF modulating signal (say, fm = 1kHz and Em = 5mV) using a function generator.
- Adjust amplitude and frequencies of the AF and carrier signals and observe amplitude modulated waveform on the CRO.
- Adjust IFT and note down Emax and Emin of the AM signal and calculate modulation index according to the formula,

$$m = \frac{E_{max} - E_{min}}{E_{max} + E_{min}}$$

Here *Emax* is the maximum of the positive envelope of the carrier and *Emin* is minimum of the positive envelope of the carrier.

- Plot the waveforms on a graph sheet.

Result

Obtained modulation index **m**1 = **m**2 = **m**3 =

Inference

Difference in designed and observed values of **m**

_____

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 11 Date:

FM MODULATOR USING IC565

Problem Statement:

To set up and study FM modulator using IC 565.

EQUIPMENTS/COMPONENTS

Name & Specification.	**Quantity**
CRO/DSO	1 No
Function Generator	2 Nos
Regulated DC Power supply 0-12v	1No
IC 565	1No
Capacitors 0.1µF, 0.001µF, 0.01µF	1 Each
Resistors 10K, 6.8K, 47K	1 Each

THEORY

In FM, frequency of the carrier is varied in accordance with the instantaneous amplitude of the modulating signal. FM is being used very popularly in Television and Radio transmission systems.

FM can be generated using direct method or indirect method.In direct method, the tank circuit parameters are varied by the modulating voltage. The reactance modulator and varactor modulators are the examples of this method. In the indirect method, frequency of the oscillation is not directly varied. When a PLL is used for FM generation its VCO alone is used. The AF input to pn no. 7 varies the frequency of VCO.

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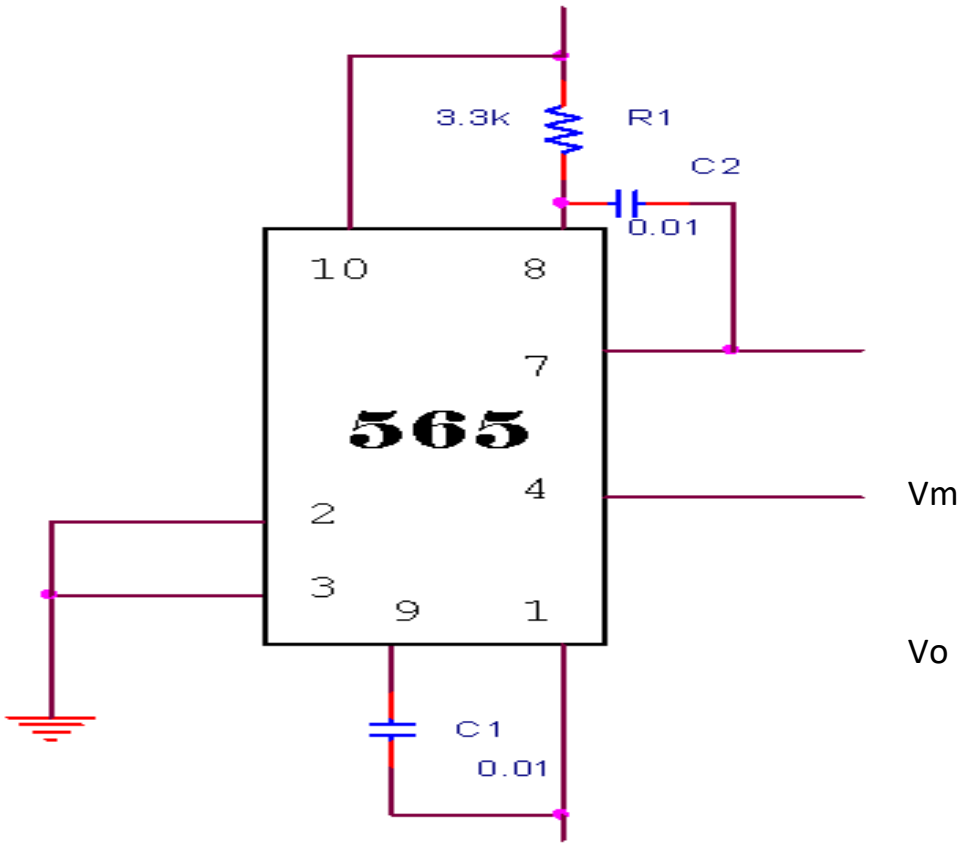
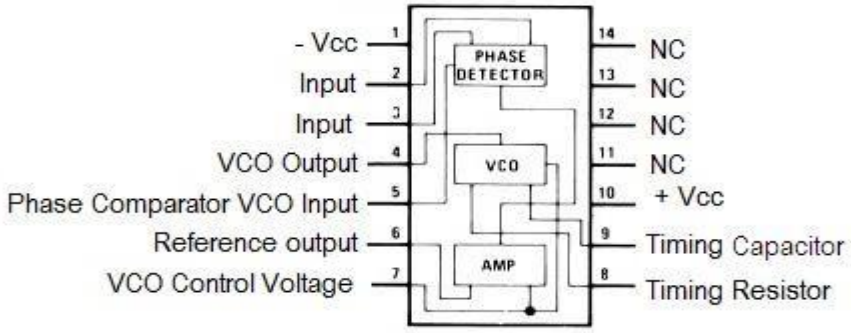
Circuit diagram +9v



Internal Diagram of IC565



Procedure

1. Follow precautions for personal and equipment safety.
2. Check all the components, equipments and signal probes.
3. Set up the connections as per the circuit diagram.
4. Without giving modulating signal observe the carrier signal at pin no.3.
5. Measure amplitude and frequency of the carrier signal.
6. Apply the sinusoidal modulating signal of frequency 150Hz and amplitude 100mV at pin no.5.
7. Observe output waveform.

Result

Obtained output waveform of FM.

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 12 Date:

FM DEMODULATOR USING IC565

Problem Statement:

To set up and study FM demodulator using IC 565.

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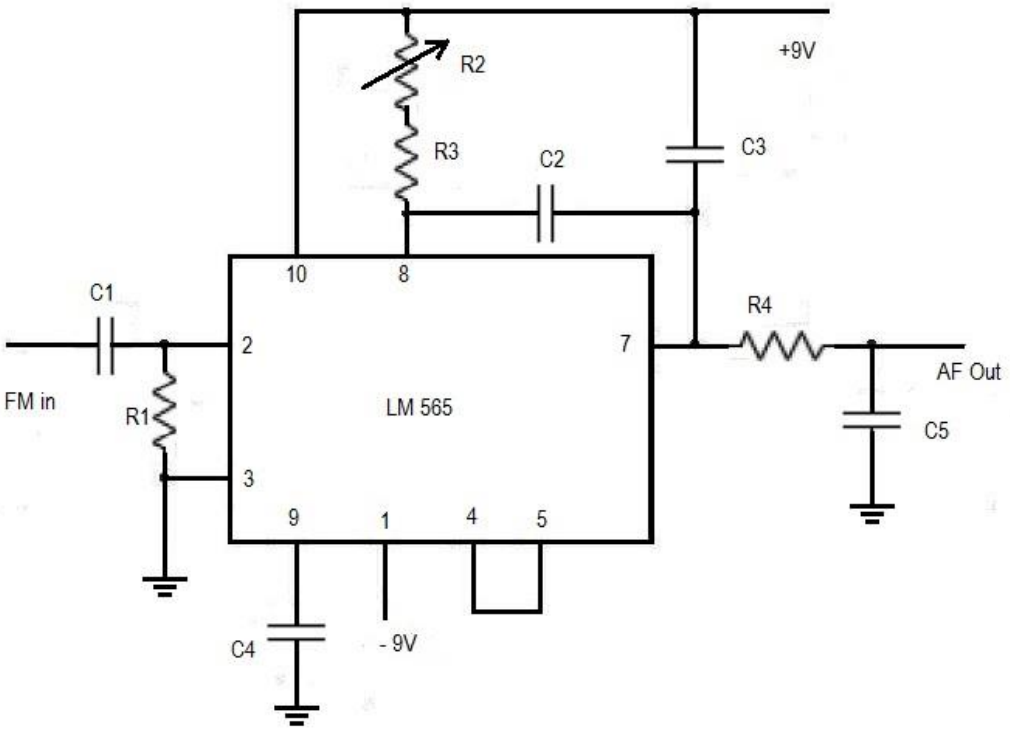
EQUIPMENTS/COMPONENTS

Name & Specification	**Quantity**
CRO/ DSO	1 No
FM Generator	1 No
Regulated DC Power supply	1 No
IC 565 PLL	1 No
Capacitors 0.1µF, 0.001µF	3,2 No's
Resistors 620Ω, 10Kpot, 4.7K, 1K	1 each

THEORY

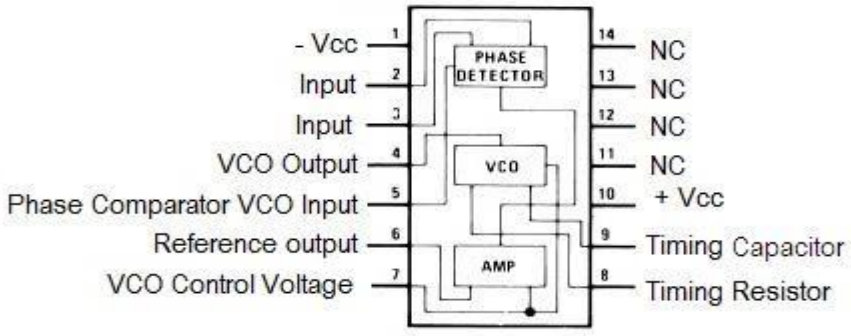
The LM565 and LM565C are general purpose phase locked loops containing a stable, highly linear voltage controlled oscillator for low distortion FM demodulation, and a double balanced phase detector with good carrier suppression. The VCO frequency is set with an external resistor and capacitor, and a tuning range of 10:1 can be obtained with the same capacitor. The characteristics of the closed loop system - bandwidth, response speed, capture and pull in range - may be adjusted over a wide range with an external resistor and capacitor. The loop may be broken between the VCO and the phase detector for insertion of a digital frequency divider to obtain frequency multiplication.

Circuit Diagram



C_1=0.1µF, R_1=620Ω, R_2=10K, R_3=4.7K, C_2=.001µF, R_4=1K, C_3=.1µF C_4=0.001µF

Internal Diagram of IC565



Procedure

1. Follow precautions for personal and equipment safety.
2. Check all the components, equipments and signal probes.
3. Set up the connections as per the circuit diagram.
4. Set up the circuit after verifying the condition of components.
5. Feed FM signal using an FM generator.
6. Adjust amplitude of the FM signal and observe modulating signal on the CRO.

Result

Obtained out put waveform of FM.

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 14 Date:

IF TUNED AMPLIFIER

Problem Statement:

To set up and study IF tuned amplifier.

EQUIPMENTS/COMPONENTS

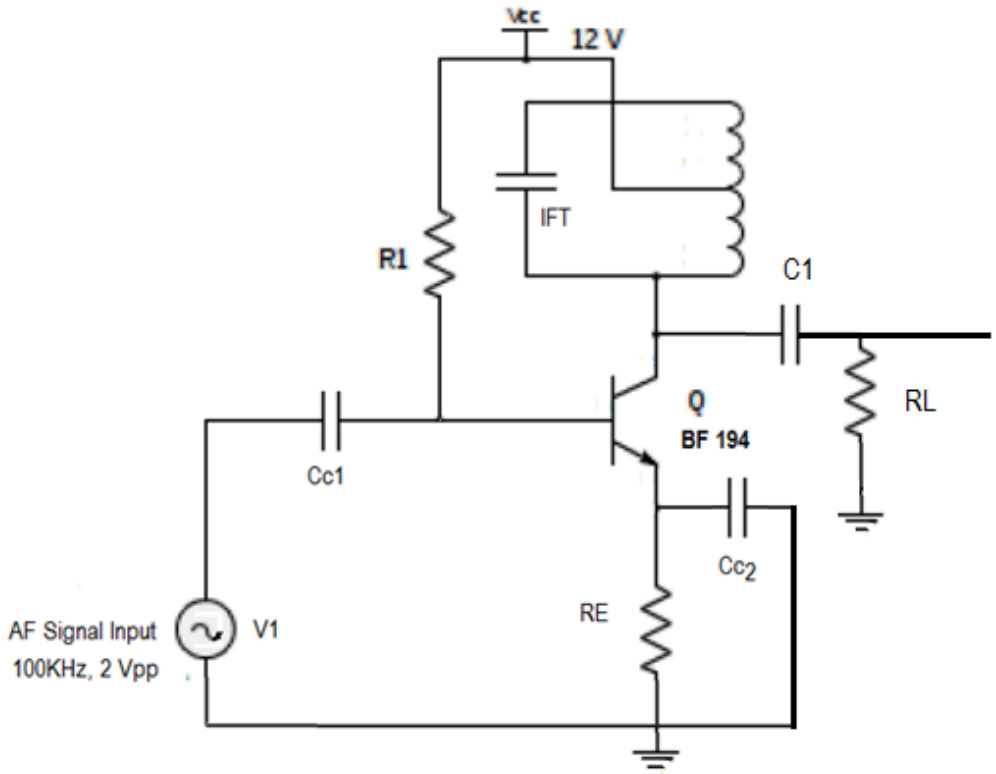
Name & Specification	**Quantity**
CRO/ DSO	1 No
Function Generator	1 No
Regulated DC Power supply	1 No
Transistor BF194	1 No
IFT	1 No
Capacitors 0.1µF, 0.1µF	1 Each
Resistors 680K, 1.2K, 10µF,1K	1 Each

THEORY

Intermediate frequency amplifiers are tuned voltage amplifiers used to amplify a particular frequency. Its primary function is to amplify only the tuned frequency with maximum gain and reject all other frequencies above and below this frequency. These types of amplifiers are widely used in intermediate frequency amplifiers in AM super heterodyne receivers, where intermediate frequency is usually 455 kHz. In tuned voltage amplifier the collector resistance is replaced by a tuned load upon which the gain is dependent. For a parallel resonating circuit consisting of a capacitor, C and an inductor, L the impedance Zo is maximum at resonant frequency, $fo = 1/2\pi \sqrt{LC}$. So an amplifier with tuned load will have maximum gain at resonant frequency fo.

In practical tuned amplifier circuits, an intermediate frequency transformer (IFT) is used as tuned load. IFT is tuned to standard 455 kHz audio frequency. The quality factor of the circuit is given by Q = fo/Bandwidth.

Circuit diagram



R1=680K, R_E=1.2K, C_{C1}=0.1µF, C_{C2}= 0.1µF, C1=10µF, RL= 1K

Observation:

Sl.No	Frequency(KHz)	Vout(V)	Gain=(Vout/Vin)	Gain in dB=20logA

GRAPH

Procedure

- Follow precautions for personal and equipment safety.
- Set up the connections as per the circuit diagram.
- Feed the sine wave of 1Vpp/350kHz the circuit and observe the output.
- Vary the input frequency up to 550 kHz with uniform increment of 25 kHz.
- Find the Gain and draw the graph. Mark 3dB points on the graph (f1,f2). Calculate the bandwidth BW=f1-f2 and Q factor, Q=f0/BW (f_0 =resonant frequency, BW=bandwidth

Result

Obtained output waveform of IF.

IF Tuned frequency = Q =

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 13 Date:

MIXER STAGE USING DISCRETE COMPONENTS

Problem Statement:

To set up and study mixer stage using discrete components.

EQUIPMENTS/COMPONENTS

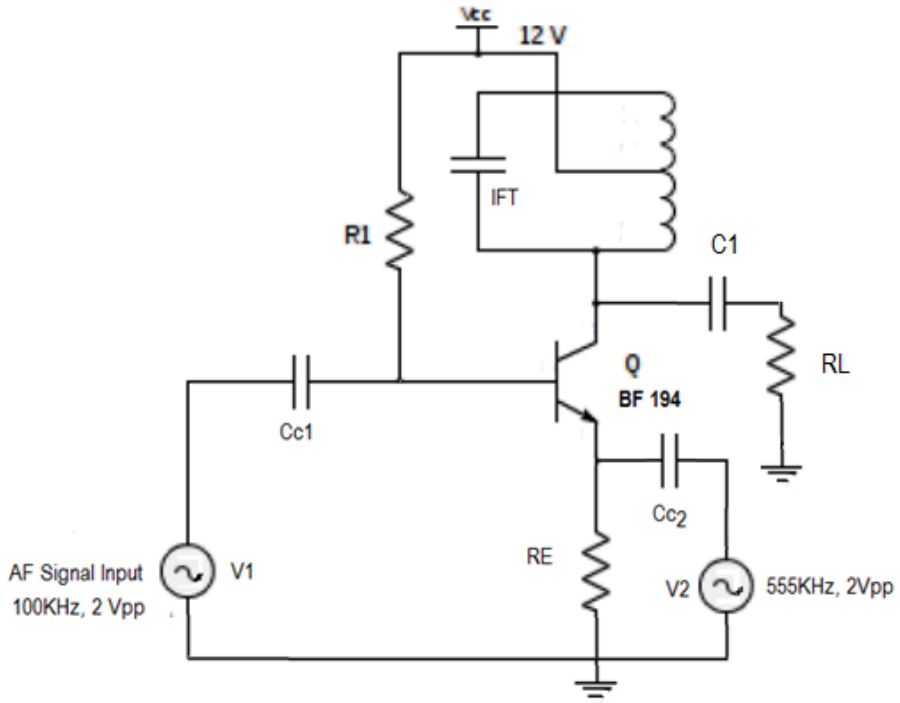
Name & Specification	Quantity
CRO/ DSO	1 No
Function Generator	1 No
Regulated DC Power supply	1 No
Transistor BF194	1 No
IFT	1 No
Capacitors 0.1µF, 10µF	2, 1 No
Resistors 680K, 1.2K, 1K	1Each

THEORY

A mixer or frequency mixer is a nonlinear electrical circuit that creates new frequencies from two signals applied to it. In its most common application, two signals at frequencies f_1 and f_2 are applied to a mixer, and it produces new signals at the sum $f_1 + f_2$ and difference $f_1 - f_2$ of the original frequencies. Other frequency components (like $f_1 \pm 2f$) may also be produced in a practical frequency mixer. The most important application of mixers is in superhetrodyne receivers where the very high carrier frequency is down converted to an intermediate frequency. This is done by mixing the carrier frequency with a locally generated oscillator frequency to get an output frequency which is the difference between local oscillator frequency and incoming signal frequency, ie the intermediate frequency. In widely used AM receivers the local oscillator frequency is so chosen with respect to carrier frequency such that their difference is a constant intermediate frequency of 455 kHz.

$f_{IF} = f_{oscillator} - f_{carrier}$ = 455 kHz. The mixer output which contains all image frequencies of $f_1 \pm nf_2$ is filtered to obtain the required difference frequency f1 − f2.

Circuit diagram:



$R1=680K$, $R_E=1.2K$, $C_{C1}=0.1\mu F$, $C_{C2}=0.1\mu F$, $C1=10\mu F$, $RL=1K$

Observation:

Sl.No	Frequency(KHz)	Vout(V)		Gain in dB=20logAv Gain=(Vout/Vin)

Procedure

- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Set up the circuit after verifying the condition of components.
- Apply sine wave 2Vpp/100kHz and 2Vpp/555 kHz using a function generator. (555 kHz-100 kHz = 455 kHz).
- Verify the waveform on the CRO.

Result

Obtained the out put waveform of mixer**.**

F =

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

GRAPH

Exp No. 15 Date:

PULSE AMPLITUDE MODULATOR AND DEMODULATOR

Problem Statement:

To set up and study pulse amplitude modulator and demodulator

EQUIPMENTS/COMPONENTS

Name & Specification	**Quantity**
CRO/ DSO	1 No
Function Generator	2 No
FET BFW10	1 No
Resistor 56Ω	1 No

THEORY

Pulse modulation is used to transmit analogue information. In this system continuous wave forms are sampled at regular intervals. Information regarding the signal is transmitted only at the sampling times together with synchronising signals. At the receiving end, the original waveforms may be reconstituted from the information regarding the samples. The pulse amplitude modulation is the simplest form of the pulse modulation. PAM is a pulse modulation system is which the signal is sampled at regular intervals, and each sample is made proportional to the amplitude of the signal at the instant of sampling. The pulses are then sent by either wire or cables are used to modulated carrier.

The two types of PAM are i) Double polarity PAM, and ii) the single polarity PAM, in which a fixed dc level is added to the signal to ensure that the pulses are always positive. Instantaneous PAM sampling occurs if the pulses used in the modulator are infinitely short. Natural PAM sampling occurs when finite-width pulses are used in the modulator, but the tops of the pulses are forced to follow the modulating waveform. Flat-topped sampling is a system quite often used because of the ease of generating the modulated wave. PAM signals are very rarely used for transmission because they easily distorted during transmission by noise, crosstalk, other forms of distortion. They are used frequently as an intermediate

step in other pulse modulating methods, especially where time-division multiplexing is used.

Procedure

- Follow precautions for personal and equipment safety.
- Check all the components, equipment's and signal probes.
- Set up the connections as per the circuit diagram.
- Set the modulating frequency to 5V/ 100Hz and sampling frequency to 15V/1kHz
- Observe the output on CRO. i.e. PAM wave.
- Measure the levels of the output waveform
- Feed the modulated wave to the low pass filter.
- The output observed on CRO will be the demodulated wave.
- Note down the amplitude and time period of the demodulated wave.
- Plot the wave forms on graph.

Result

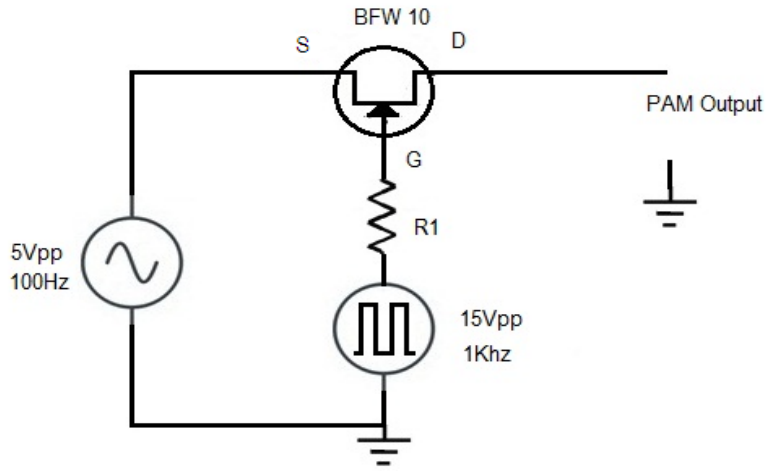
Obtained the out put waveform of PAM.

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

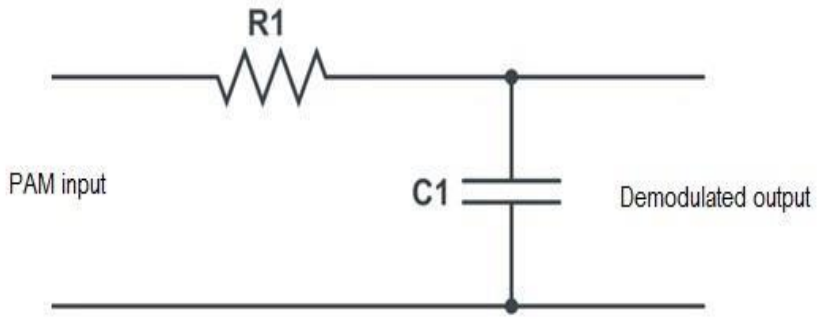
Circuit diagram

Modulator



R1=56Ω

Demodulator



R_1=1K, C_1=1µF

GRAPH

Exp No. 16 Date:

PULSE WIDTH MODULATOR USING IC555

Problem Statement:

To set up and study pulse width modulator using IC 555.

EQUIPMENTS/COMPONENTS

Name & Specification	**Quantity**
CRO/ DSO	1 No
Function Generator	2 No's
Regulated DC Power supply	1 No
IC 555	1 No
Diode IN4007	1 No
Capacitors 0.001µF, 10µF, 0.1µF	1 Each
Resistors 1.2K, 10K, 4.7K	1 Each

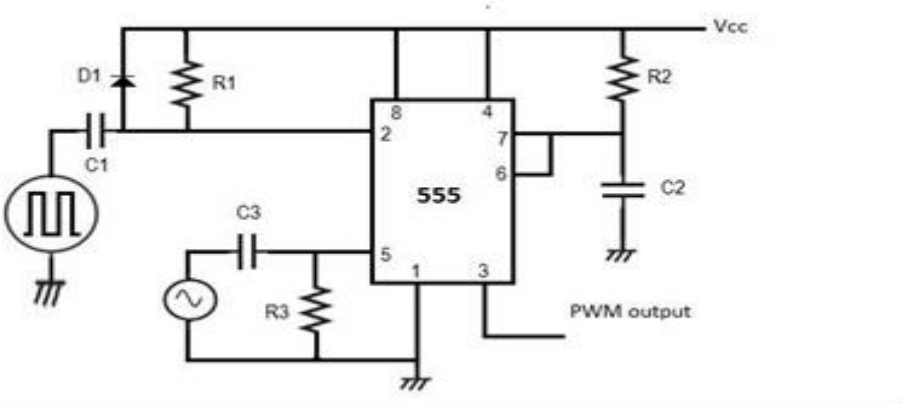
THEORY

Pulse Time Modulation is also known as Pulse Width Modulation or Pulse Length Modulation. In PWM, the samples of the message signal are used to vary the duration of the individual pulses. Width may be varied by varying the time of occurrence of leading edge, the trailing edge or both edges of the pulse in accordance with modulating wave. It is also called Pulse Duration Modulation.

Procedure

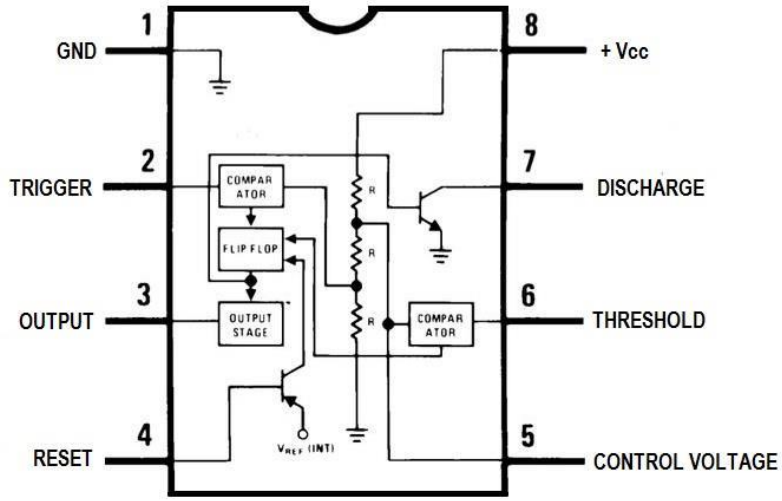
- Follow precautions for personal and equipment safety.
- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Apply a trigger signal (Pulse wave) of 5Vpp/ 2 kHz.
- Observe the sample signal at the pin3.
- Apply the ac signal at the pin 5 and vary the amplitude.
- Note that the control voltage is varied output pulse width is also varied.
- Observe the pulse width increases during positive slope condition and decreases under negative slope condition. Pulse width will be maximum at the positive peak and minimum at the negative peak of sinusoidal waveform. Record the observations.

Circuit diagram



R_1=1.2K, R_2=4.7K, R_3=10K, C_1= 0.001µF, C_2=0.1µF, C_3=10µF

Internal Diagram of IC555



GRAPH

Result

Obtained the out put waveform of PWM.

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 17 Date:

PULSE POSITION MODULATOR USIG IC555

Problem Statement

To set up and study pulse position modulator using 555.

EQUIPMENTS/COMPONENTS

Name & Specification	**Quantity**
CRO/ DSO	1 No
Function Generator	1 No
Regulated DC Power supply	1 No
IC 555	2 No
Diode IN 4001	1 No
Capacitors 0.001µF, 0.01µF, 10µF, 0.01µF	1 Each
Resistors 1.2K, 4.7K, 10K	2,2,1 No

THEORY

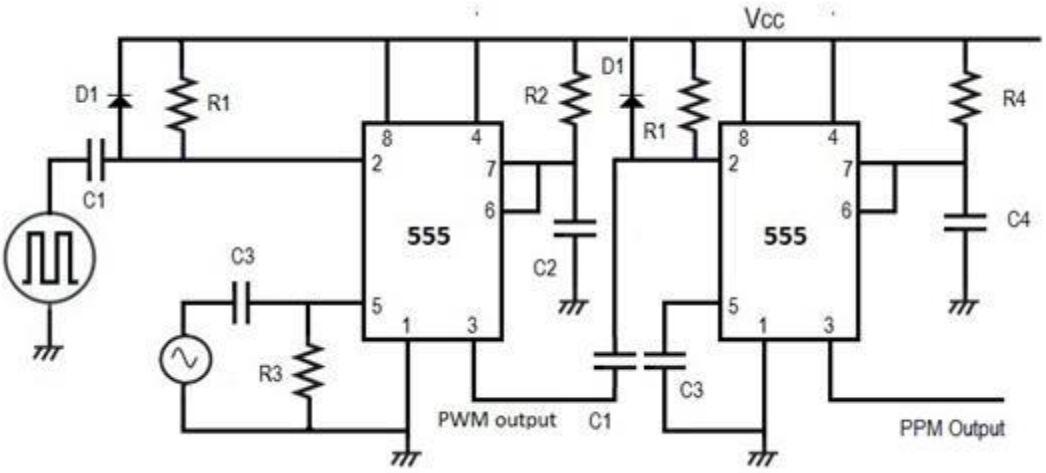
In Pulse Position Modulation, both the pulse amplitude and pulse duration are held constant but the position of the pulse is varied in proportional to the sampled values of the message signal. Pulse time modulation is a class of signalling techniques that encodes the sample values of an analogue signal on to the time axis of a digital signal and it is analogous to angle modulation techniques. The two main types of PTM are PWM and PPM. In PPM the analogue sample value determines the position of a narrow pulse relative to the clocking time. In PPM rise time of pulse decides the channel bandwidth. It has low noise interference.

Procedure

- Follow precautions for personal and equipment safety.

- Check all the components, equipments and signal probes.
- Set up the connections as per the circuit diagram.
- Observe the sample output at pin 3 and observe the position of the pulses on CRO and adjust the amplitude by slightly increasing the power supply. Also observe the frequency of pulse output.
- Apply the modulating signal, sinusoidal signal of 2Vpp to the control pin 5.
- Now by varying the amplitude of the modulating signal, note down the position of the pulses. Observe the output on CRO and plot the waveform.

Circuit diagram



C1=0.001µF, R1=1.2K, R2=4.7K, R3=10K, R4=4.7K C2=0.1µF, C3=0.001µF, C4=0.01µF

GRAPH

Result

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Obtained the out put waveform of PPM.

Inference

For Office use only	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

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