Name of Student: ______________________________

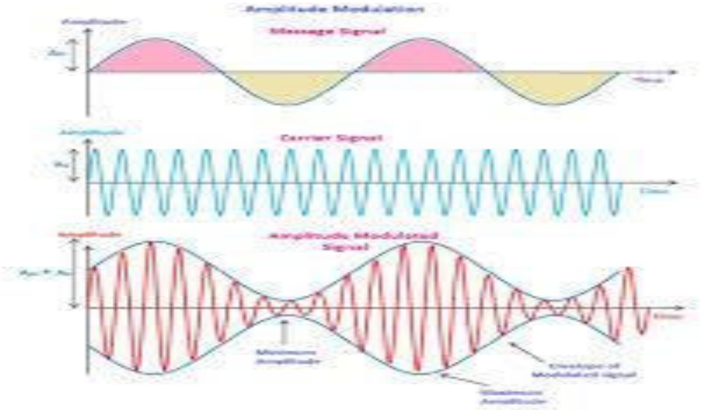
Enrollment No.: ______________________________

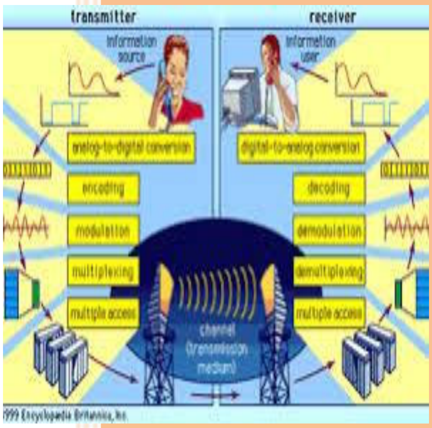
Class: ______________________________

Section: ______________________________

Session: ______________________________

Analog Communication [EC-403]
Lab Manual





Department of Electronics & Communication Engineering
LAKSHMI NARAIN COLLEGE OF TECHNOLOGY & SCIENCE BHOPAL
Kalchuri Nagar, Raisen Road Bhopal (MP) 462023

Vision and Mission of the Department

Vision

To be world-wide recognized for adopting and keeping innovation and entrepreneurship mindset as abreast of learning to produce professionals as valuable, ethical and moral resource for industry and society.

Mission

- **To establish an ecosystem where students could grow with innovative practices followed in communication engineering.**
- **Adopt the global approaches to transform the young aspirant into engineering professional catering the society with ethical and patriotic zeal.**
- **Facilitate and felicitate the learners to have close interactions with the industry experts and researchers for keeping them updated of the current and future needs of the society.**
- **To develop the mindset of learners for being innovative and entrepreneurial in becoming successful professional.**

Program Specific Outcomes (PSO's)

1. To analyze, design and develop solutions of real time problems and industry needs.
2. Ability of effectively communicating with the professionals and preparation of reports, documents and presentation while working in teams.
3. Knowledge and understanding of latest developments in the field of VLSI, Embedded system, Networking, Matlab and other major tools necessary for keeping pace with the industry.
4. Ability of solving complex engineering problems with ethical and law full approach to prevent the society and environment from adverse impacts.

Program Educational Objectives (PEO's)

1. The graduate will have the knowledge and skills of analog and digital communication in providing necessary solutions to the real world problems.
2. The graduate will be able to design, develop, analyze and implement the modern tools and systems involving principles of electronics and telecommunication engineering.
3. The graduate will be following the ethical practices of the core industry and supporting software industry in providing most acceptable solution to the society.
4. The graduate will have the innovative mindset of learning and implementing the latest technological advancements and research outcomes in the electronic hardware and software to keep pace with the rapid developments in socio economic world

INDEX

Name of Student:________________________Enrollment No.:_____________________

S. No.	Title of the Experiment	Date of Experiment	Date of Submission	Remark
1	To Study of Amplitude Modulation and Demodulation.			
2	To Study of DSBSC Modulation and Demodulation.			
3	To Study of SSBSC Modulation and Demodulation.			
4	To Study of Frequency Modulation and Demodulation.			
5	To Study of Pre Emphasis-De Emphasis Circuits.			
6	To Study of Frequency Division Multiplexing			
7	To design and obtain the characteristics of a mixer circuit			
9	To Study of Phase Locked Loop.			
10	To Study of AGC Characteristics.			

Code of Conducts for the Laboratory

- All bags must be left at the indicated place.
- The lab time table must be strictly followed.
- Be **PUNCTUAL** for your laboratory session.
- Works place must be kept clean and tidy at all time.
- Handle the experiment kit and interfacing kits with care.
- All students are liable for any damage to the accessories due to their own negligence.
- Students are strictly **PROHIBITED** from taking out any items from the laboratory.
- Students are **NOT** allowed to work alone in the laboratory without the Lab Supervisor.
- Report immediately to the Lab Supervisor if any malfunction of the accessories, is there.
- Before leaving the lab Place the stools properly.
- Please check the laboratory notice board regularly for updates.

Date of Experiment: _______________

EXPERIMENT NO: 1

Aim: 1.To generate amplitude modulated wave and determine the percentage modulation.

2. To demodulate the modulated wave using envelope detector.

Apparatus Required:

Name of the Component/Equipment	Specifications/Range	Quantity
Transistor(BC107)	f_T = 300 MHz P_d= 1W I_c(max)=100mA	1
Diode(0A79)	MaxCurrent35mA	1
Resistors	1KΩ,2KΩ,6.8KΩ,10KΩ	1 each
Capacitor	0.01µF	1
Inductor	130mH	1
CRO	20MHz	1
Function Generator	1MHz	2
Regulated Power Supply	0-30V,1A	1

Theory:

Amplitude Modulation is defined as a process in which the amplitude of the carrier wave c(t) is varied linearly with the instantaneous amplitude of the message signal m(t).The standard form of an amplitude modulated (AM)wave is defined by

$$s(t)=A_c[1+\mu\cos(2\pi f_m t)]\cos(2\pi f_c t)$$

Where μ is a modulation index of the modulator.

Thedemodulationcircuitisusedtorecoverthemessagesignalfromtheincoming AM Wave at the receiver. An envelope detector is a simple and yet highly effective device that is well suited for the demodulation of AM wave, for which the percentage modulation is less than 100%.Ideally, an envelope detector produces an output signal that follows the envelop of the input signal wave form exactly; hence, the name. Some version of this circuit is used in almost all commercial AM radio receivers.

The Modulation Index is defined as, $m = \frac{(E_{max} - E_{min})}{(E_{max} + E_{min})}$

Where E_{max} and E_{min} are the maximum and minimum amplitudes of the modulated wave.

Circuit Diagrams:

For modulation:

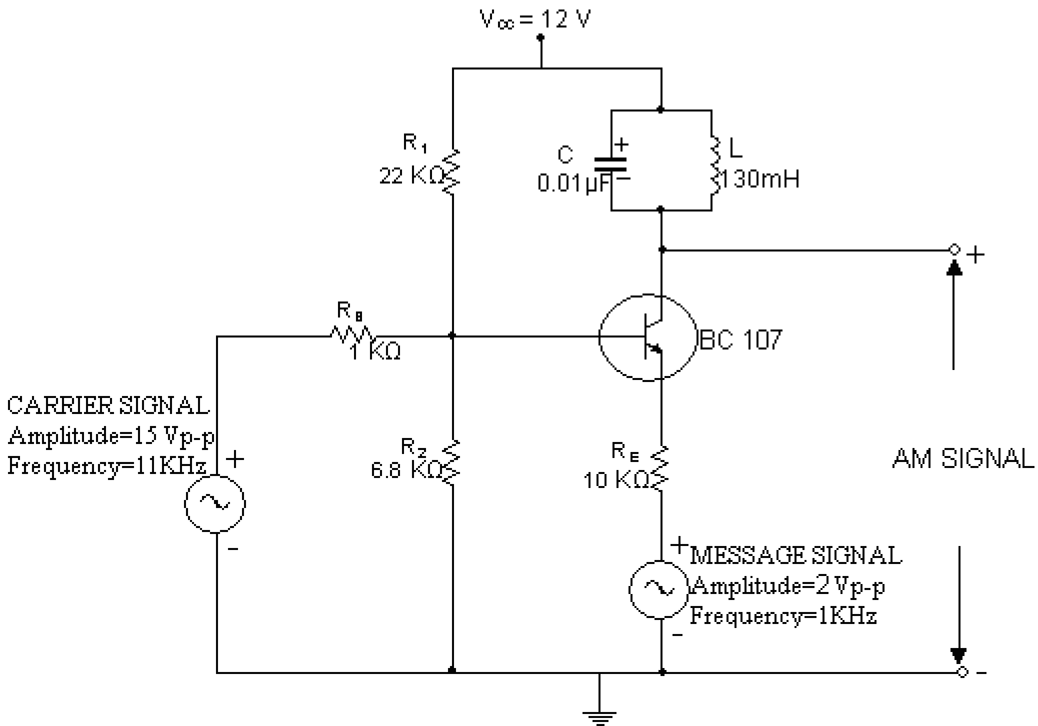


Fig.1.AM modulator

For demodulation:

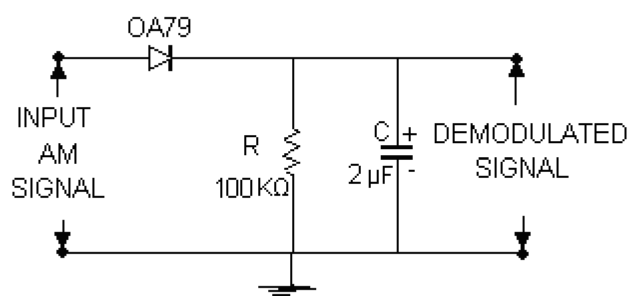


Fig.2.AMdemodulator

Procedure:

1. The circuits connected asperthecircuitdiagramshowninFig.1.
2. Switchon+12 volts V_{CC} supply.

3. Apply sinusoidal signal of 1KHz frequency and amplitude 2Vp-p as modulating signal, and carrier signal offrequency11KHzand amplitude15 Vp-p.
4. Now slowly increase the amplitude of the modulating signal upto7V and note down values of $E_{max}$and E_{min}.
5. Calculate modulation index using equation
6. Repeat step5 by varying frequency of the modulating signal.
7. Plot the graphs: Modulation index vs. Amplitude & Frequency.
8. Find the value of R from $F_m = \frac{1}{2RC}$ Taking C=0.01µF
9. Connect the circuit diagramasshowninFig.2.
10. Feed the AM wave to the demodulator circuit and observe the output.
11. Note down frequency and amplitude of the demodulated output waveform.
12. Draw the demodulated waveform. ,m=1

Observations

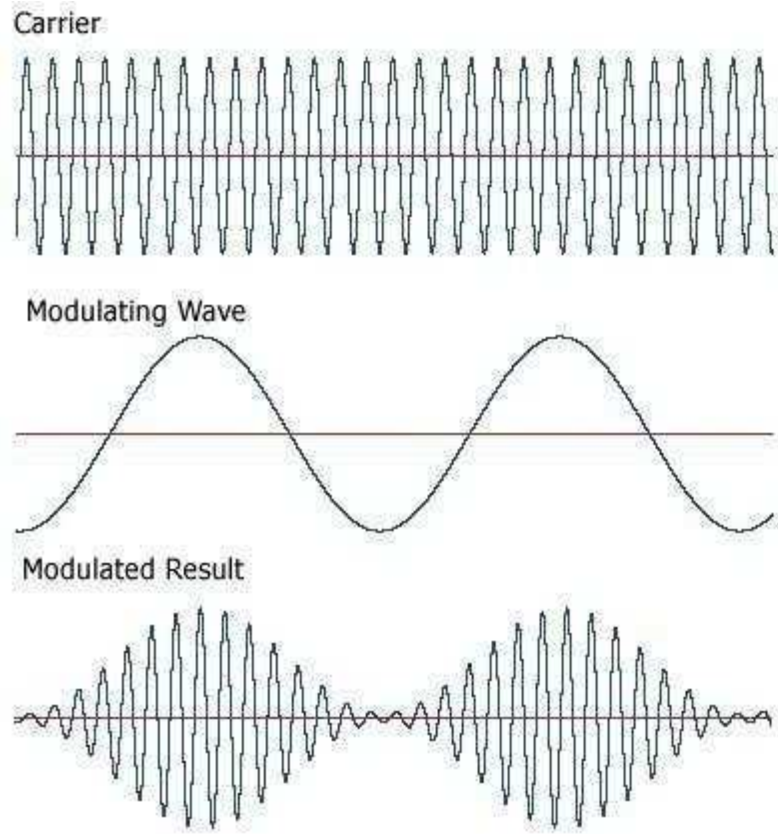
Table1: f_m=1 KHz, f_c=11 KHz, A_c=15Vp-p.

S.No.	V_m(Volts)	E_{max}(volts)	E_{min}(Volts)	m	%m(mx100)

Table2: A_m=4Vp-p f_c=11 KHz, A_c=15Vp-p.

S.No.	f_m(KHz)	E_{max}(volts)	E_{min}(Volts)	m	%m(mx100)

Waveforms and graphs:



Result: Study has been completed successfully

Precautions:

1. Check the connections before giving the power supply
2. Observations should be done carefully.

Signature of Faculty

Date of Experiment: _______________

EXPERIMENT NO: 2

Aim: To generate AM-Double Side Band Suppressed Carrier (DSB-SC)signal.

Apparatus Required:

Name of the Component/Equipment	Specifications/Range	Quantity
IC1496	Wide frequency response up to 100MHz Internalpowerdissipation–500mw(MAX)	1
Resistors	6.8KΩ 10KΩ,3.9KΩ 1KΩ,51KΩ	1 2 each 3 each
Capacitors	0.1µF	4
Variable Resistor (Linear Plot)	0-50KΩ	1
CRO	100MHz	1
Function Generator	1MHz	2
Regulated Power Supply	0-30 v,1A	1

Theory:

Balanced modulator is used for generating DSB-SC signal. A balanced modulator consists of two standard amplitude modulators arranged in a balanced configuration so as to suppress the carrier wave. The two modulators are identical except the reversal of sign of the modulating signal applied to them.

Circuit Diagram:

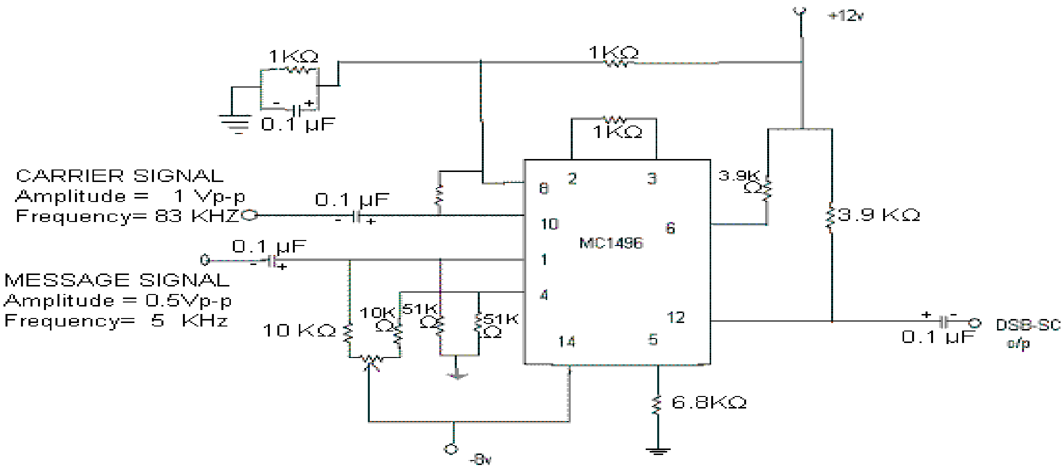
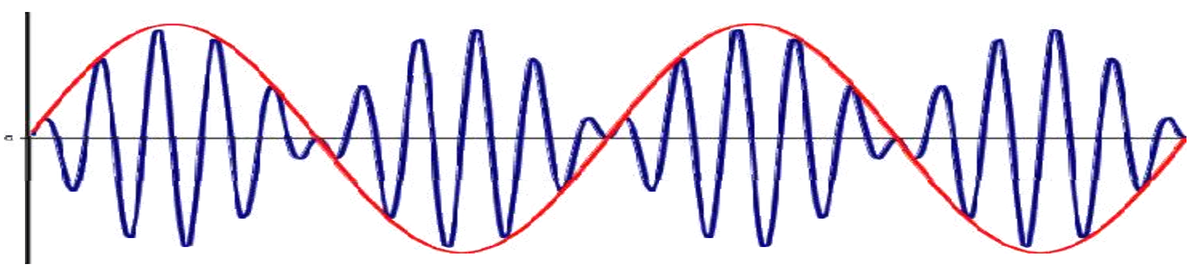


Fig.1.Balanced Modulator Circuit

Waveform:



Date of Experiment: _______________

EXPERIMENT NO: 3

Aim: To generate the SSB modulated wave.

Apparatus Required:

Name of the Component/Equipment	Specifications	Quantity
SSB system trainer board	---	1
CRO	30MHz	1

Theory:

An SSB signal is produced by passing the DSB signal through a highly selective band pass filter. This filter selects either the upper or the lower sideband. Hence transmission bandwidth can be cut by half if one side band is entirely suppressed. This leads to single side band modulation(SSB).In SSB modulation band width saving is accompanied by a considerable increase in equipment complexity.

Circuit Diagram:

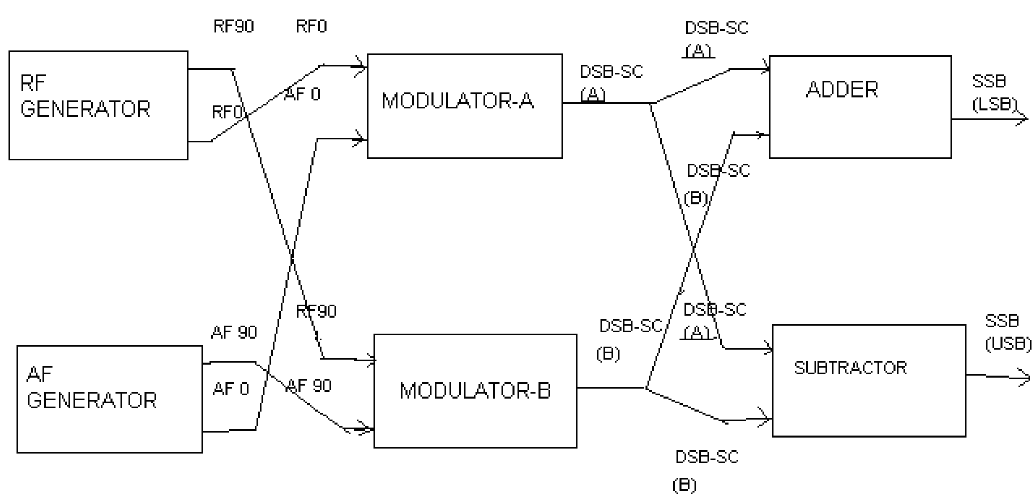


Fig.1Single Side Band system

Procedure:

1. Switch on the trainer and measure the output of the regulated power supply i.e., ±12V and-8V.
2. Observe the output of the RF generator using CRO. There are 2 outputs from the RF generator, one is direct output and another is 90^o out of phase with the direct output. The output frequency is 100 KHzandtheamplitudeis≥0.2V_{PP}.(Potentiometers are provided to vary the output amplitude).
3. Observe the output of the AF generator, using CRO. There are 2 outputs from the AF generator, one is direct output and another is 90^o out of phase with the direct output. A switch is provided to select the required frequency (2 KHz, 4KHz or 6 KHz). AGC potentiometer is provided to adjust the gain of the oscillator (or to set the output to good shape). The oscillator output has amplitude ≈ 10V_{PP}.This amplitude can be varied using the potentiometers provided.
4. Measure and record the RF signal frequency using frequency counter. (Or CRO).
5. Set the amplitudes of the RF signals to 0.1 V_{p-p} and connect direct signal to one balanced modulatorand90^o phase shift signal to another balance demodulator.
6. Select the required frequency (2 KHz, 4 KHz or 6 KHz) of the AF generator with the help of switch and adjust the AGC potentiometer until the output amplitude is ≈ 10 V_{PP} (when amplitude controls are in maximum condition).
7. Measure and record the AF signal frequency using frequency counter (or CRO).
8. SettheAFsignalamplitudesto8V_{p-p}usingamplitudecontrolsandconnecttothebalancedmodulators.
9. Observe the outputs of both the balanced modulators simultaneously using Dual trace oscilloscope and adjust the balance control until desired output waveforms (DSB-SC).
10. To get SSB lower side band signal, connect balanced modulator output (DSB_SC) signals to subtractor.
11. Measure and record the SSB signal frequency.
12. Calculate theoretical frequency of SSB (LSB) and compare it with the practical value.LSB frequency= RF frequency– AF frequency
13. To get SSB upper sideband signal, connect the output of the balanced modulator to the summer circuit.
14. Measure and record the SSB upper side band signal frequency.
15. Calculate the practical value of the SSB (USB) frequency and compare it with practical value.

    USB frequency= RF frequency+ AF frequency

Observations:

Signal	Amplitude(volts)	Frequency(KHz)
Message signal	2	1
Carrier signal	2	100
SSB(LSB)	0.5	98.54
SSB(USB)	0.42	101.4

Precautions:

1. Check the connections before giving the power supply
2. Observations should be done careful.

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment:_______________

EXPERIMENT NO: 4

Aim: 1. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal.

2. To demodulate a Frequency Modulated signal using FM detector.

Apparatus required:

Name of the Component/Equipment	Specifications/Range	Quantity
IC566	Operatingvoltage–Max-24Volts Operatingcurrent-Max.12.5mA	1
IC8038	Powerdissipation–750mW Supply voltage-±18V or 36Vtotal	1
IC565	Powerdissipation-1400mw Supply voltage-±12V	1
Resistors	15 K Ω,10K Ω,1.8K Ω, 39KΩ, 560 Ω	1,2,1 2,2
Capacitors	470pF,0.1µF 100pF,0.001µF	2,1 1,1each
CRO	100MHz	1
Function Generator	1MHz	2
Regulated Power Supply	0-30 v,1A	1

Theory: The process, in which the frequency of the carriers varied in accordance with the instantaneous amplitude of the modulating signal, is called "Frequency Modulation". The FM signal is expressed as

$$fm(t) = fc + k\,Am.\cos(2\pi fmt)$$

$$fm(t) = fc + k\,m(t)$$

Where, fm(t)=frequency-modulated wave.,fc→frequency of the carrier wave.m(t)→modulating signal.

Circuit Diagrams:

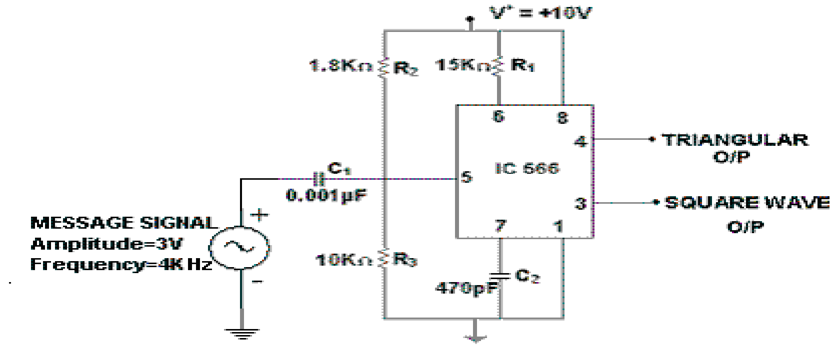


Fig.1.FM Modulator Using IC566

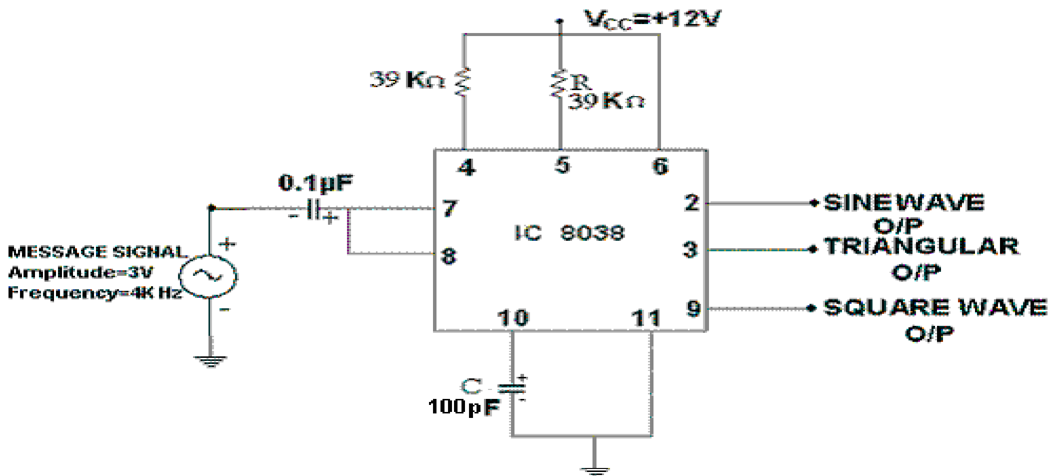


Fig.2.FM Modulator Circuit

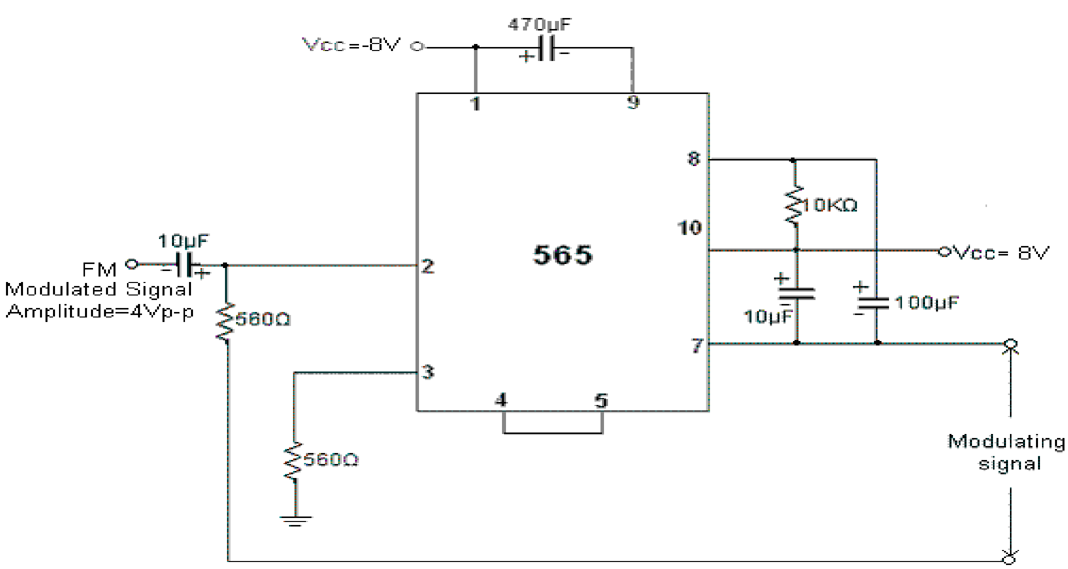


Fig.3.FM Demodulator Circuit

Procedure:

Modulation:

1. The circuitis connected as per the circuit diagramshowninFig.2(Fig.1forIC566)
2. Without giving modulating signal observe the carrier signal at pin no.2 (at pin no.3 for IC 566).Measure amplitude and frequency of the carrier signal. To obtain carrier signal of desired frequency, find value of R from f= 1/ (2ΠRC) taking C=100pF.
3. Apply the sinusoidal modulating signal of frequency 4 KHz and amplitude 3Vp-p at pin no.7. (pinno.5forIC566)

   Now slowly increase the amplitude of modulating signal and measure f_{min} and maximum frequency deviation Δf at each step. Evaluate the modulating index (m_f = β) using Δf / f_m where Δf = |f_c - f_{min}|.Calculate Band width. BW= 2 (β +1)f_m= 2(Δf+ f_m)

4. Repeat step 4 by varying frequency of the modulating signal.

Demodulation:

1. Connectionsaremadeaspercircuitdiagramshowninfig.3
2. Check the functioning of PLL (IC565)by giving square wave to input and observing the output.
3. Frequency of input signal is varied till input and output are locked.
4. Now modulated signal is fed as input and observe the demodulated signal (output) on CRO.
5. Draw the demodulated waveform.

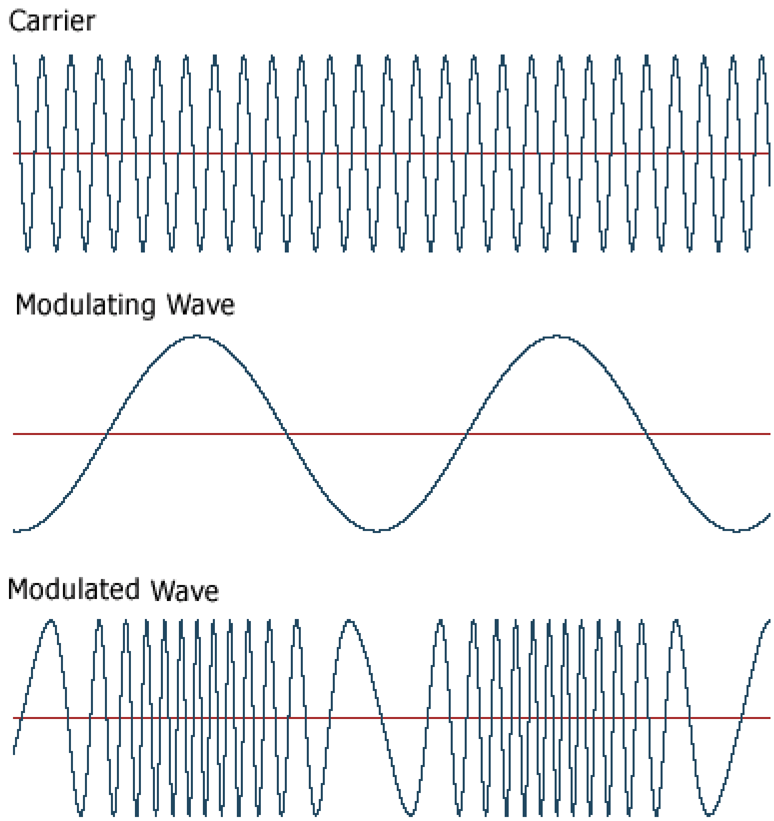
Table:1f_c =45KHz

S.No.	f_m(KHz)	T_{max}(μsec)	f_{min}(KHz)	Δf(KHz)	β	BW (KHz)

Table2: f_m= 4 KHz, f_c =45 KHz

S.No.	A_m(Volts)	$T_{(\mu sec)}$	f_{min}(KHz)	Δf(KHz)	β	BW(KHZ)

Waveforms:



Precautions:

1. Check the connections be for giving the power supply
2. Observations should be done carefully.

Result: Study has been completed successfully.

Signature of Faculty

Date of Experiment: _______________

EXPERIMENT NO: 5

Aim:

I) To observe the effects of pre-emphasis on given input signal.

II) To observe the effects of De-emphasis on given input signal.

Apparatus Required:

Name of the Component/Equipment	Specifications/Range	Quantity
Transistor(BC107)	f_T = 300 MHz P_d= 1W I_c(max)=100mA	1
Resistors	10KΩ,7.5KΩ,6.8KΩ	1 each
Capacitors	10 nF 0.1μF	1 2
CRO	20MHZ	1
Function Generator	1MHZ	1
Regulated Power Supply	0-30V,1A	1

Theory:

The noise has an effect on the higher modulating frequencies than on the lower ones. Thus, if the higher frequencies were artificially boosted at the transmitter and correspondingly cut at the receiver, an improvement in noise immunity could be expected, thereby increasing the SNR ratio. This boosting of the higher modulating frequencies at the transmitter is known as pre-emphasis and the compensation at the receiver is called de-emphasis.

Circuit Diagrams:

For Pre-emphasis:

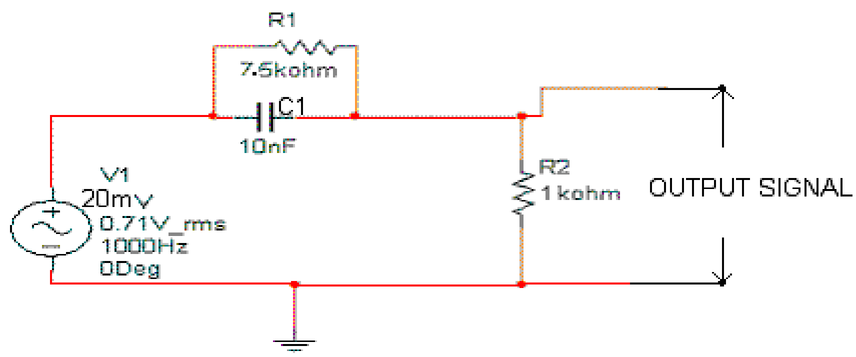


Fig.1.Pre-emphasiscircuit

For De-emphasis:

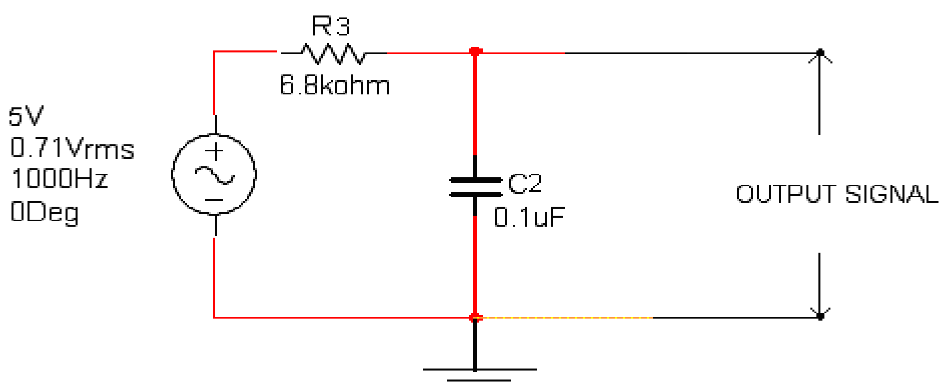


Fig.2.De-emphasiscircuit

Procedure:

1. Connect the circuit as per circuit diagram as shown inFig.1.
2. Apply the sinusoidal signal of amplitude 20mV as input signal to pre emphasis circuit.
3. Then by increasing the input signal frequency from 500Hz to 20 KHz, observe the output voltage(v_o) and calculate gain($20\log(v_o/v_i)$).
4. Plot the graph between gain Vs frequency.
5. Repeat above steps2 to4 for de-emphasis circuit (showninFig.2).by applying the sinusoidal signal of5Vasinput signal.

Sample readings:

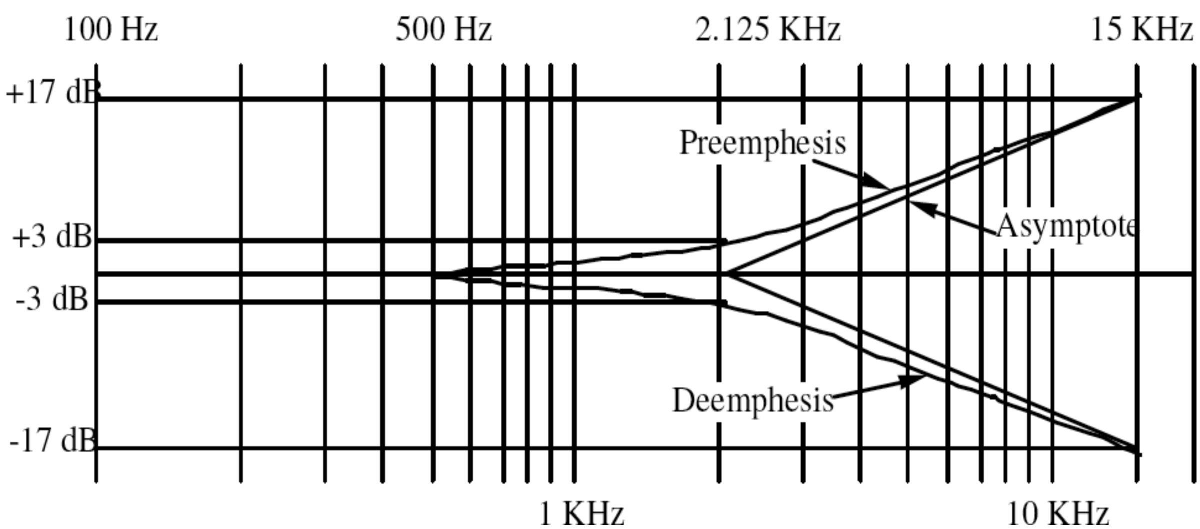
Table1:Pre-emphasis V_i=20mV

Frequency(KHz)	Vo(mV)	Gainin dB(20logV_o/V_i)

Table2:De-emphasis V_i=5v

Frequency(KHz)	Vo(Volts)	Gainin dB(20logV_o/V_i)

Graphs:



Precautions:

1. Check the connections before giving the power supply
2. Observation should be done carefully

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment:_______________

EXPERIMENT NO: 6

Aim: To construct the frequency division multiplexing and de multiplexing circuit and to verify its operation.

Apparatus required:

Name of the apparatus	Specifications/Range	Quantity
Resistors	3.9kΩ,3kΩ,10kΩ,680kΩ	Each one
Capacitors	0.01µF,60µF	2,1
Function Generator	1MHz	1
RPS	0-30v,1A	1
CRO	0-30MHz	1
IC555	Operatingtem:SE555 -55ºCto 125ºCNE555 0º to 70ºC Supply voltage:+5V to+18V Timing :µ SectoHours Sink current :200mA Temperature stability :50 PPM /º change in temp or 0-005%/ºC.	1
CRO Probes	----	1

Theory:

When several communications channels are between the two same point's significant economics may berealizedbysendingallthemessagesononetransmissionfacilityaprocesscalledmultiplexing.Applications of multiplexing range from the vital, if prosaic, telephone networks to the glamour of FM stereo and space probe telemetry system. There are two basic multiplexing techniques.

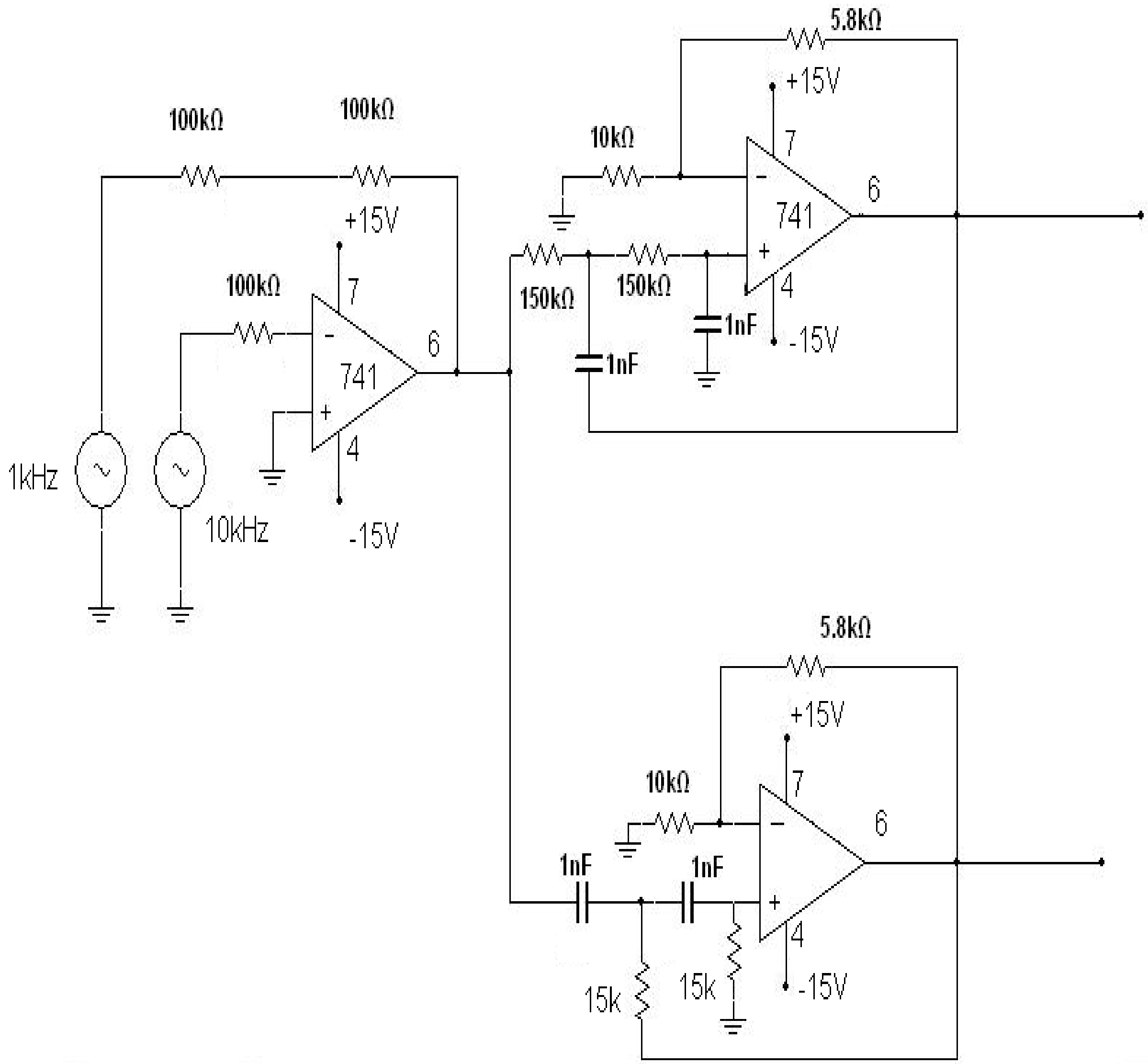
1. Frequency Division Multiplexing (FDM)

2. Time Division Multiplexing (TDM

The principle of the frequency division multiplexing is that several input messages individually modulate the subcarriers fc1, fc2, etc.after passing through LPFs to limit the message bandwidth. We show the subcarrier modulation as SSB, and it often is; but any of the CW modulation techniques could be employed or a mixture ofthem.Themodulatedsignalsarethensummonedtoproducethebasebandsignal with the spectrumXb9f), the designation “baseband” is used here to indicate that the final carrier modulation has not yet taken place.

The major practical problem of FDM is cross talks, the unwanted coupling of one message into another. Intelligible cross talk arises primarily because of non-linearity in the system, which cause 1message signal to appear as modulation on subcarrier. Consequently, standard practice calls for negative feedback to minimize amplifier nonlinearity in FDM systems.

Circuit diagram:



Procedure:

1. Connections are given as per the circuit diagram.

2. The FSK signals are obtained with two different frequency pair with two different FSK generators.

3. The 2signals are fed to op-amp which performs sadder operation.

4. The filter is designed in such away that low frequency signal is passed through the HPF.

5. Fixed signal is obtained will be equal to the one signal obtained from FSK modulator.

Tabular column:

SIGNALS	Amplitude(V)	Time(ms)
Input 1		
Input 2		
Modulated input		
Demodulated output 1		
Demodulated output 2		

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment:_______________

EXPERIMENT NO: 7

Aim: To design and obtain the characteristics of a mixer circuit.

Apparatus Required:

Name of the Component/Equipment	Specifications/Range	Quantity
Transistors(BC107)	f_T = 300 MHz P_d= 1W I_c(max)=100mA	1
Resistors	1KΩ, 6.8KΩ, 10KΩ	1 each
Capacitor	0.01µF	1
Inductor	1mH	1
CRO	20MHZ	1
Function Generator	1MHz	1
Regulated Power Supply	0-30v,1A	1

Theory:

The mixer is an online device having two sets of input terminals and one set of output terminals. Mixer will have several frequencies present in its output, including the difference between the two input frequencies and other harmonic components.

Circuit Diagram:

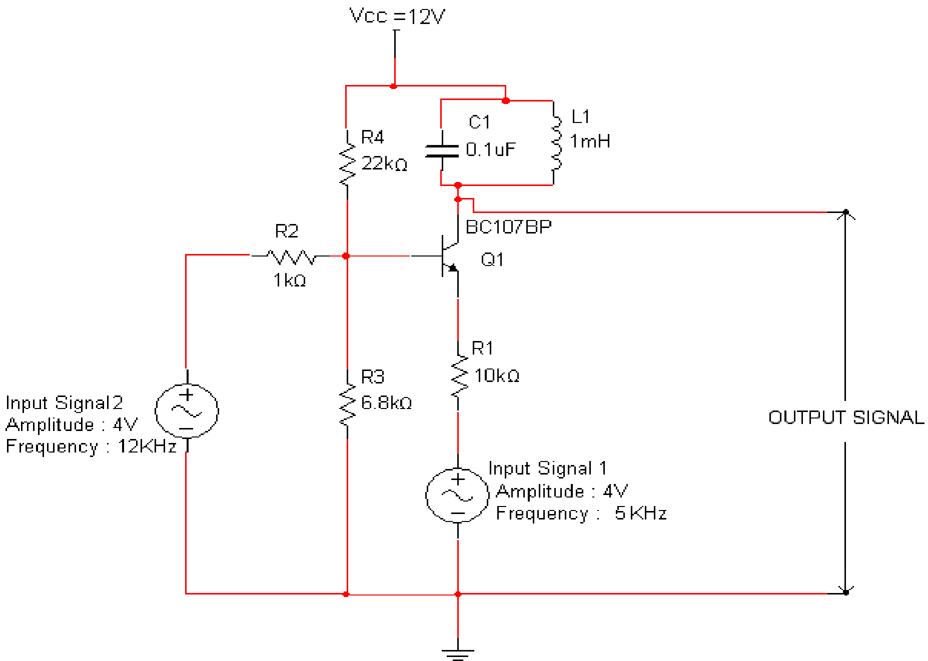


FIG.1.MixerCircuit

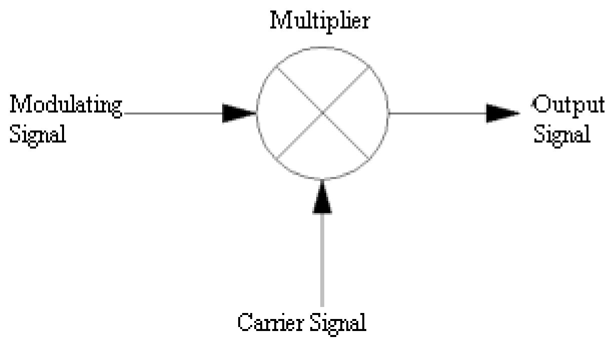
Procedure:

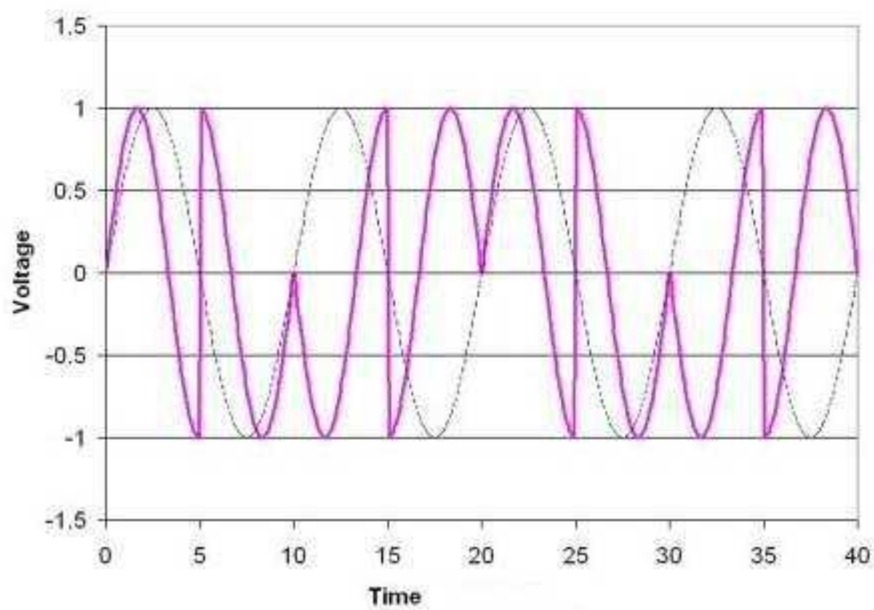
1. Connect the circuit as per the circuit diagram as shown in Fig.1. Assume C=0.1µFand calculate value of L_1 Using $f = \frac{1}{2\pi\sqrt{L_1 C_1}}$ Where f=7 KHz
2. Apply the input signals at the appropriate terminals in the circuit.
3. Note down the frequency of the output signal, which is same as difference frequency of given signals.

Sample readings:

Signal	Amplitude(Volts)	Frequency(KHz)
Input signal1	4	5
Input signal 2	4	12
Output signal	9	7

Waveforms:





Precautions:

1. Check the connections before giving the supply

2. Observations should be done carefully

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment: _______________

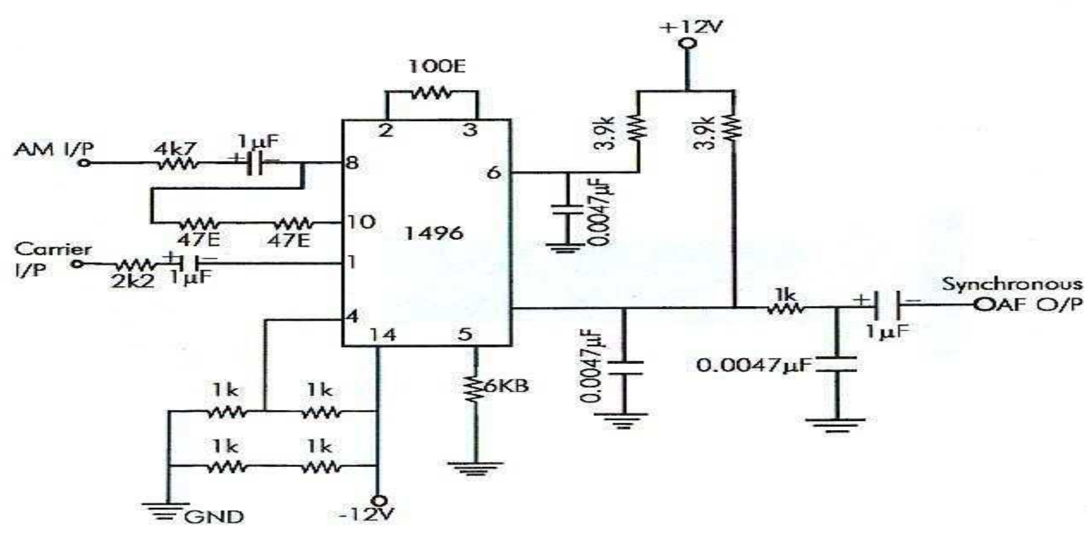
EXPERIMENT NO: 8

Aim: To study about detection of AM demodulator (or) Synchronous Demodulator.

Theory:

The phase and frequency of the locally generated carrier in synchronous detector is extremely critical .Precision phase and frequency control of the local carrier needs an expensive and a complicated circuitry at the receiver. Pilot carrier is one synchronization technique. A small amount of carrier signal known as pilot carrier is transmitted along with the modulated signal from the transmitter. This small amount of carrier signal is known as pilot carrier. This pilot carrier, separated at the receiver by an appropriate filter, is amplified, and is used to phase lock the locally generated carrier at the receiver. The phase locking provides synchronization. This system, where a weak carrier is transmitted along with AM –SC signal, is also referred to as partially suppressed carrier system, as the carrier is not totally suppressed. The process in which a large carrier is transmitted along with AM-SC signal is called amplitude modulation. The large carrier simplifies the reception system. The AM-SC with partially suppressed carrier is equivalent to an over modulated AM signal. The base band signal m(t) can be uniquely recovered from a DSB-SC wave S(t) by first multiplying s(t) with a locally generated sinusoidal wave and the low-pass filtering the product, as in fig. below.

Circuit Diagrams:



Procedure:

1. Observe the carrier signal at the terminal provided on the. Set it to100kHz.(For Synchronous ckt)

2. Connect 200 Hz AF signal externally from the signal generator to the AF input Terminal provided on the kit. Adjust the amplitude pot of signal generator such that you should observe on AM wave form at the AM output terminal.

3. Connect the carrier output to the carrier input of Synchronous circuit.

4. Connect the AM output to the AM input of the Synchronous circuit.

5. Observe the Synchronous Detector AF output on the Oscilloscope.

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment: _______________

EXPERIMENT NO: 9

Aim: To study phase lock loop and its capture range, lock range and free running VCO.

Theory:

PLL has emerged as one of the fundamental building block in electronic technology. It is used for the frequency multiplication, FM stereo detector, FM demodulator, frequency shift keying decoders, local oscillator in TV and FM tuner. It consists of a phase detector, a LPF and a voltage controlled oscillator (VCO) connected together in the form of a feedback system. The VCO is a sinusoidal generator whose frequency is determined by a voltage applied to it from an external source. In effect, any frequency modulator may serve as a VCO.

The phase detector or comparator compares the input frequency, f_{in} , with feedback frequency , f out , (output frequency). The output of the phase detector is proportional to the phase difference between f in, and fout . The output voltage of the phase detector is a DC voltage and therefore m is often refers to as error voltage. The output of the phase detector is then applied to the LPF, which removes the high frequency noise and produces a DC lend. The DC level, in term is the input to the VCO.

The output frequency of the VCO is directly proportional to the input DC level. The VCO frequency is compared with the input frequencies and adjusted until it is equal to the input frequency. In short, PLL keeps its output frequency constant at the input frequency.

Thus, the PLL goes through 3states.

1. Free running state.

2. Capture range/ mode

3. Phase lock state.

Before input is applied, the PLL is in the free running state. Once the input frequency is applied, the VCO frequency starts to change and the PLL is said to be the capture range/mode. The VCO frequency continues to change (output frequency) until it equals the input frequency and the PLL is the ninth phase locked state. When phase is locked, the loop tracks any change in the input frequency through its repetitive action.

Lock Range or Tracking Range:

It is the range of frequencies in the vicinity of f O over which the VCO, once locked to the input signal,will remain locked.

Capture Range :(fC): Is the range of frequencies in the vicinity of over which the loop will acquire lock with an input signal initially starting out of lock.

Circuit Diagrams:

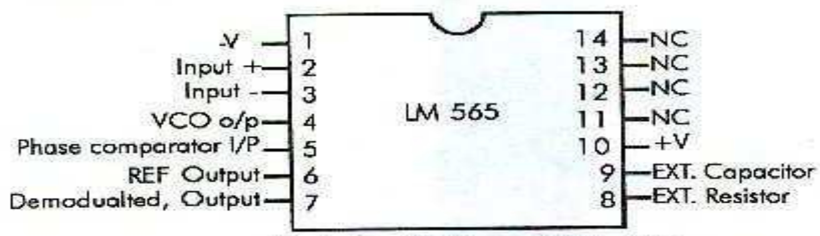
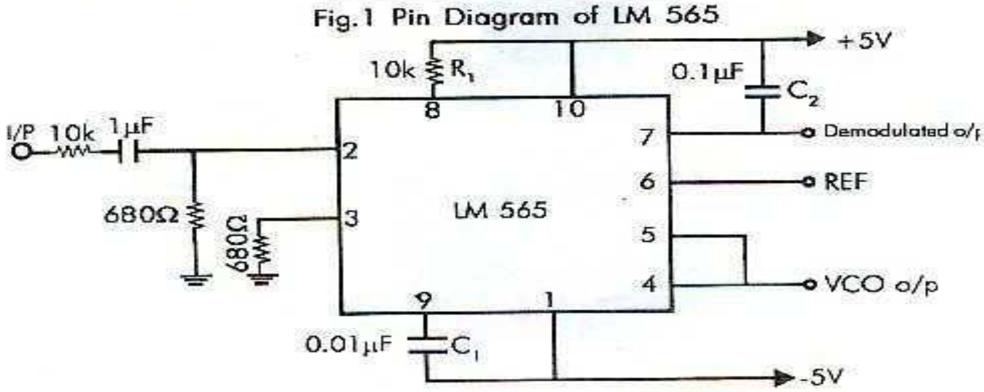


Fig.1 Pin Diagram of LM 565



Procedure:

1. Connect +5 V to pin10ofLM565.
2. Connect -5V to pin1.
3. Connect 10k resistor from pin 8 to+5V
4. Connect 0.01µf capacitor from pin 9to–5V
5. Short pin 4topin5.
6. Without giving input measure (fO) free running frequency.
7. Connect pin2 to oscillator or function generator through a1µf capacitor, adjust the amplitude around 2Vpp.
8. Connect 0.1µf capacitor between pin7and+5V(C2)
9. Connect output to the second channel is of CRO.
10. Connect output to the second channel of the CRO.
11. By varying the frequency in different steps observe that of one frequency the waveform will be phase locked.
12. Change RC components to shift VCO center frequency and see how lock range of the input varies.

Result: Study has been completed successfully

Signature of Faculty

Date of Experiment: _______________

EXPERIMENT NO: 10

Aim: To study the AGC Characteristics.

Apparatus Required:

(i) AGC Characteristics circuit kit consists of wired circuitry:

1. RF Generator
2. AF Generator
3. Regulated power supply
4. AM Modulator
5. Demodulator (simple diode detector)
6. AGC circuit

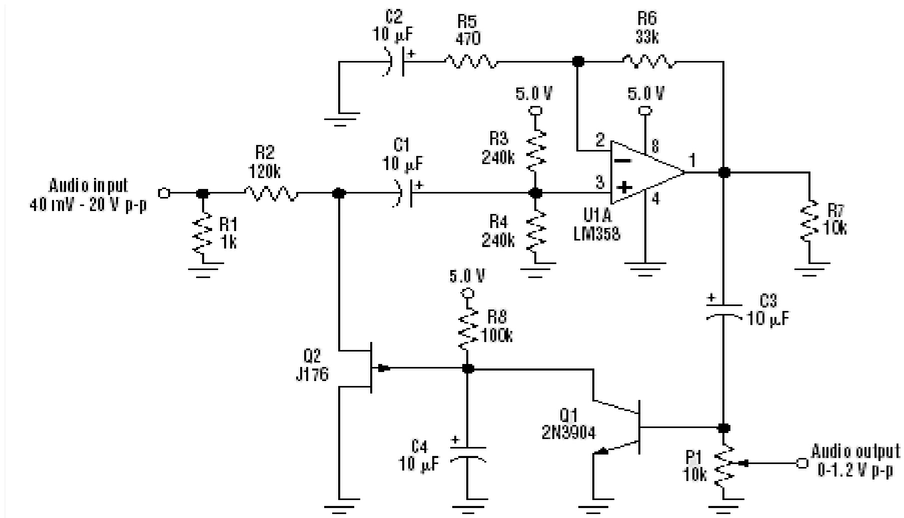
(ii) Dual trace C.R.O

(iii) Connecting wires

Theory:

A Simple AGC is a system by means of which the overall gain of a radio receiver is varied automatically with the changing strength of the received signal, to keep the output substantially constant. The devices used in those stages are ones whose transconductance and hence gain depends on the applied bias voltage or current. It may be noted that, for correct AGC operation, this relationship between applied bias and transconductance need not to be strictly linear, as long as transconductance drops significantly with increased bias. All modern receivers are furnished with AGC, which enables tuning to stations of varying signal strengths without appreciable change in the size of the output signal thus AGC "irons out" input signal amplitude variations, and the gain control does not have to be re adjusted every time the receiver is tuned from one station to another, except when the change in signal strength is enormous.

Circuit Diagrams:



Procedure:

1. As the circuits already wired you just have to trace the circuit according to the circuit diagram given above.
2. Connect the trainer to the main sand switch on the power supply.
3. Measures the output voltage so the regulated powers supply circuit i.e.+12vand-12v,+6@150mA.
4. Observe outputs of RF and AF signal generator using CRO, note that RF voltage is approximately 50m Vpp of 455 KHz frequency and AF voltage is 5Vpp of1KHz frequency.
5. Now vary the amplitude of AF signal and observe the AM wave at output, note the percentage of modulation for different values of AF signal.

%Modulation=(Emax -Emin)/(Emax+Emin)×100

6. Now adjust the modulation index to30%by varying the amplitudes of RF&AF signal simultaneously.
7. Connect AM output to the input of AGC and also to the CRO channel -1
8. Connect AGC link to the feedback network throughOA79 diode.
9. Now connect CRO channel-2 at output. The detected audio signal of1 KHz will be observed.
10. Calculate the voltage gain by measuring the amplitude of output signal(Vo) waveform, using Formula A= *Vo/Vi*
11. Now vary input level of 455 KHz IF signal and observe detected 1 KHz audio signal with and Without AGC link. The output will be distorted when AGC link removed i.e. there is no AGC action.
12. This explains AGC effect in Radio circuit.

Result: Study has been completed successfully

Signature of Faculty