ANALOG COMMUNICATIONS LAB()

LABORATORY MANUAL

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SREE CHAITANYA COLLEGE OF ENGINEERING
(Approved by AICTE-New Delhi, Affiliated to JNTU-Hyderabad)
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List of Experiments

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2	DSB-SC Modulator & Detector
3	SSB-Sc Modulator & Detector (Phase Shift Method)
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5	spectrum analyzer and analysis of am and fm signals
6	Pre-emphasis & de-emphasis.
7	Time Division Multiplexing & De multiplexing
8	Frequency Division Multiplexing & De multiplexing
9	Verification of Sampling Theorem
10	Pulse Amplitude Modulation & Demodulation
11	Pulse Width Modulation & Demodulation
12	Pulse Position Modulation & Demodulation
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14	AGC Characteristics.
15	PLL as FM Demodulator

EXPERIMENT NO-2

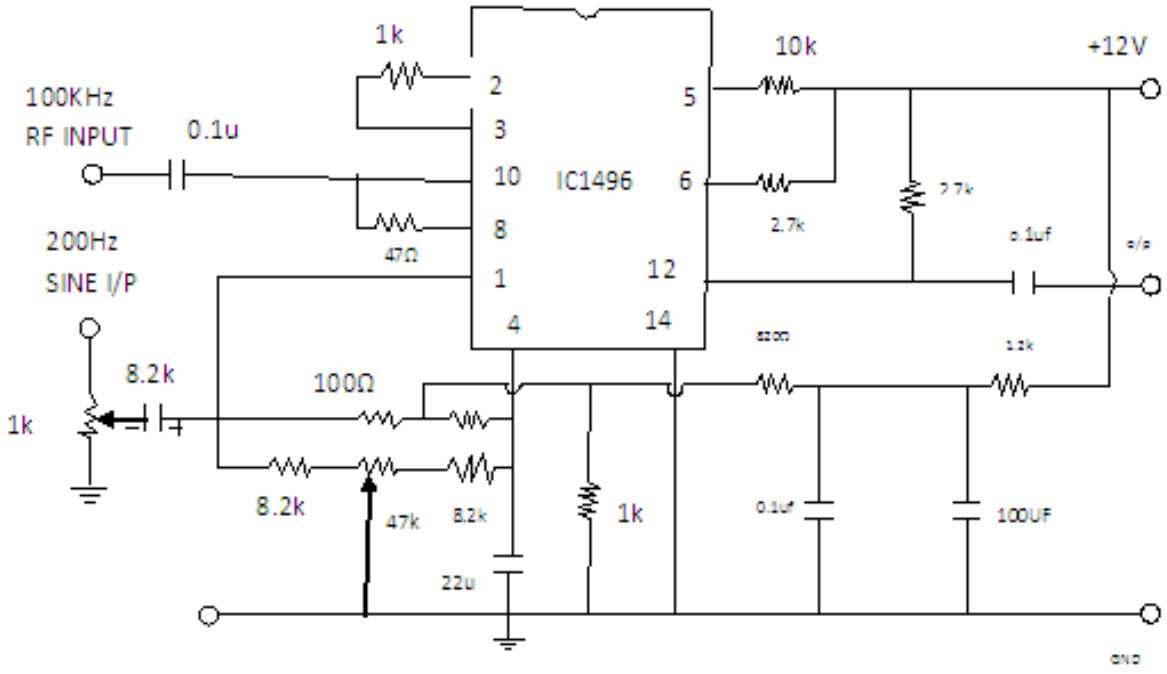
DSB-SC MODULATOR & DETECTOR

AIM: To study the Modulation and demodulation process involved in DSB-SC (double sideband suppressed carrier) wave using an IC based balanced modulator.

APPARATUS:

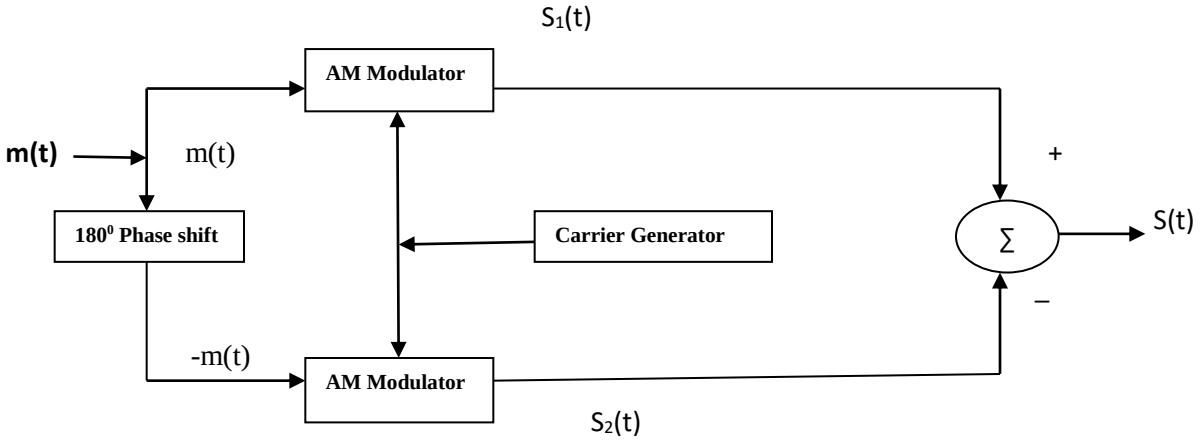
S No	Equipment Name	Specifications	Quantity
1	Balanced Modulator Trainer Kit		1
2	Function Generator	10Hz to 1MHz	1
3	CRO	25MHz	1
4	Connecting Patch Cords & wires		As Required
5	Connecting Probes		2

CIRCUIT DIAGRAM:

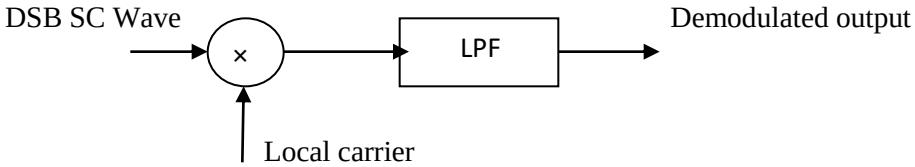


BLOCK DIAGRAM:

Modulation:



Demodulation:



THEORY:

Balanced modulator circuit is used to generate only the two side bands DSB-SC. The balanced modulation system is a system is a system of adding message to carrier wave frequency there by only the side bands are produced. It consists of two AM modulators arranged in a balanced configuration. The AM modulator is assumed to be identical. The carrier input to the two modulators is same.

If we eliminate or suppress the carrier then the system becomes suppressed carrier DSB-SC. In this we need reinsert the carrier is complicated and costly. Hence the suppressed carrier DSB system may be used in point to point communication system.

Message signal: $m(t) = Am \cos\omega_m t$

Where ω_m is message frequency

Am is message Amplitude value

Carrier voltage: $C(t) = Ac \cos\omega_c t$

The DSB-SC Modulation is

S (t)= $Ac.K_{a.}Am*\cos\omega_m t*\cos\omega_c t$.

PROCEDURE:-

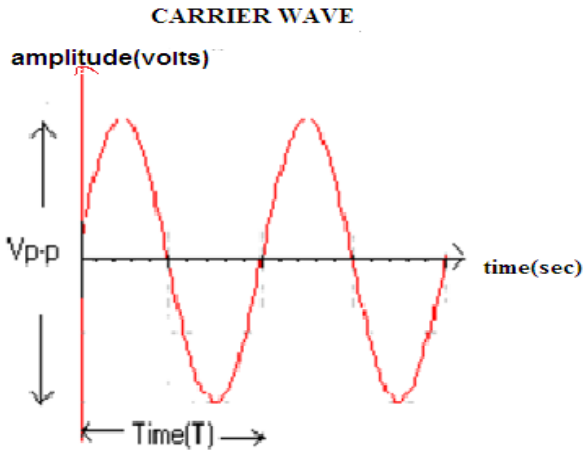
Modulation:

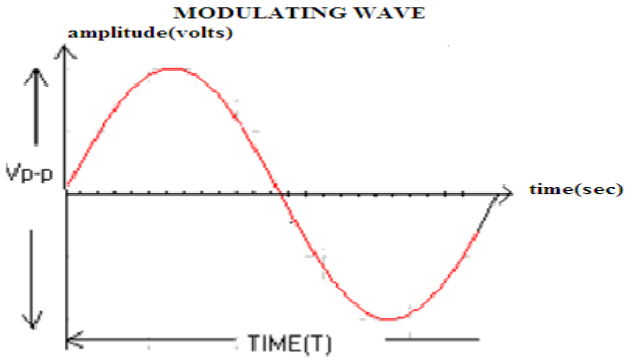
1. Connect the sine wave (message signal) of frequency in between 3KHz to 5KHz and a 90KHz to 100KHz carrier signals of peak amplitude 1 to 2V as inputs to the balanced modulator.
2. Observe the DSB SC Wave using CRO
3. Plot the Graphs

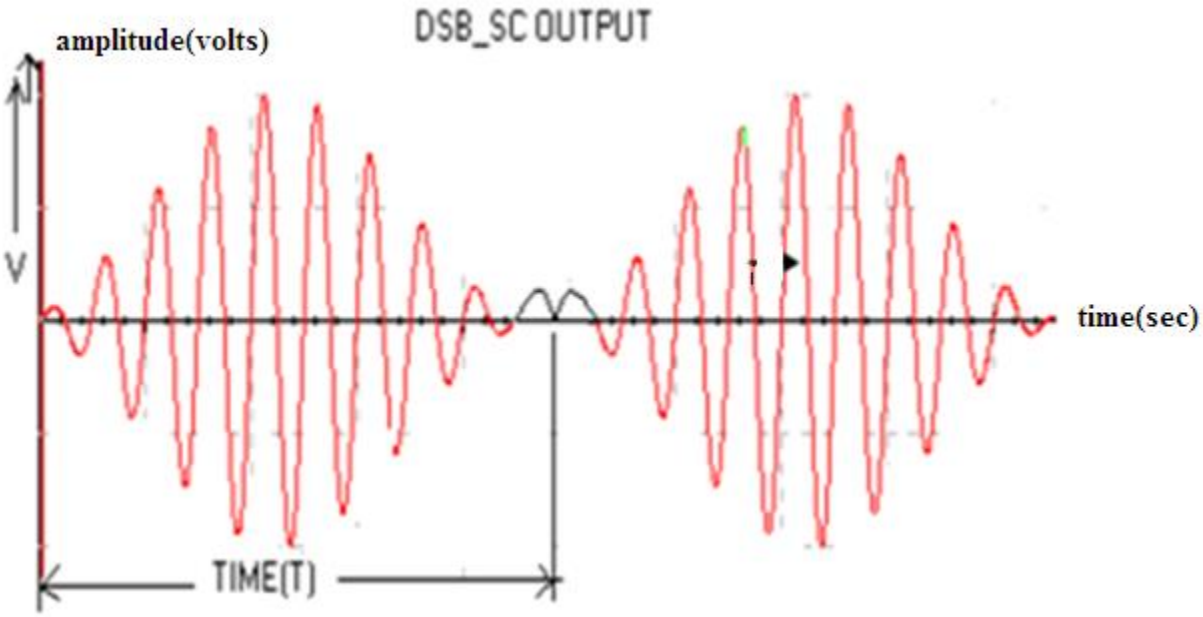
Demodulation:

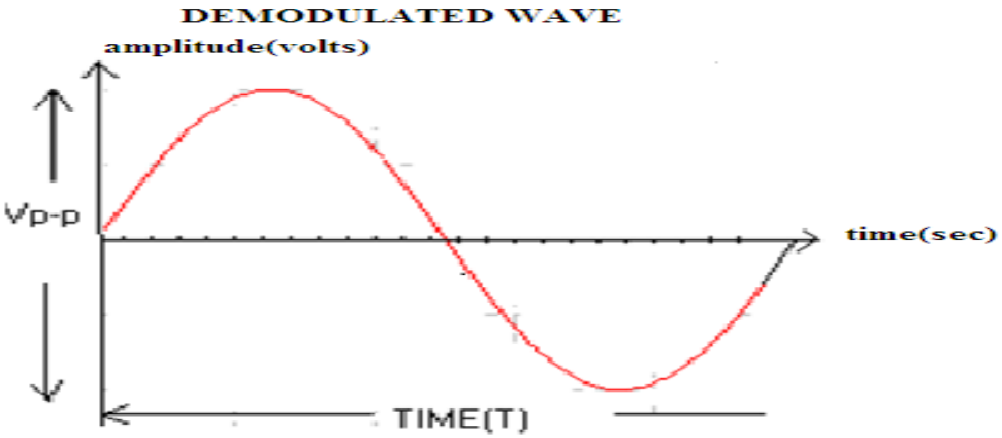
4. Balanced modulator output is connected as one of the input of the Demodulator
5. Coherent carrier signal is connected as another input of the demodulator
6. Observe the Demodulator output and plot the graphs

EXPECTED WAVEFORMS:-




MODULATING WAVE
amplitude(volts)
Vp-p
time(sec)
TIME(T)


DSB_SC OUTPUT
amplitude(volts)
V
time(sec)
TIME(T)


DEMODULATED WAVE
amplitude(volts)
Vp-p
time(sec)
TIME(T)

RESULT:

Using balanced modulator, the DSB-SC signal has been generated

QUESTIONS

1. What are the two ways of generating DSB_SC?
2. What are the applications of balanced modulator?
3. What are the advantages of suppressing the carrier?
4. What are the advantages of balanced modulator?
5. What are the advantages of Ring modulator?

EXPERIMENT.NO-3

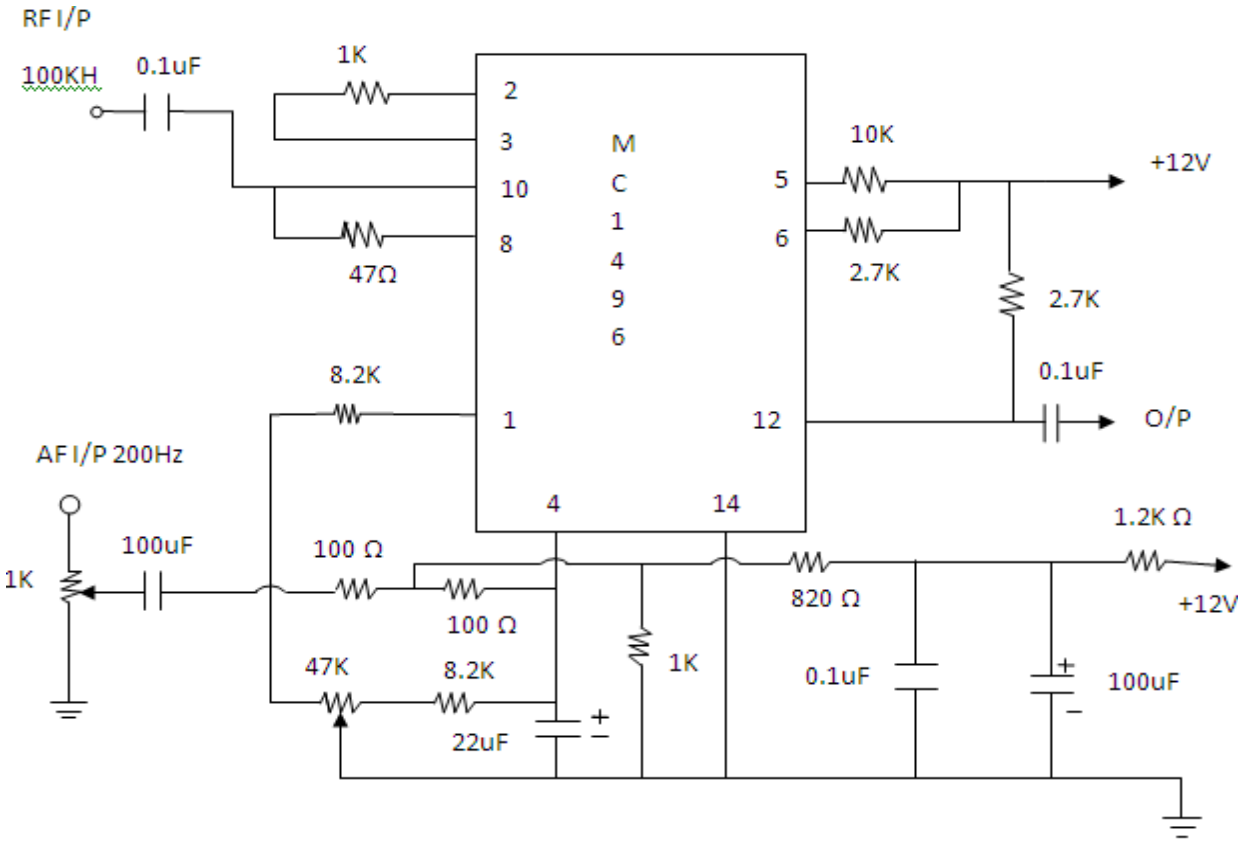
SSB-SC MODULATOR & DETECTOR

AIM:- To study the modulation and demodulation process involving SSB-SC scheme of communication.

APPARATUS:-

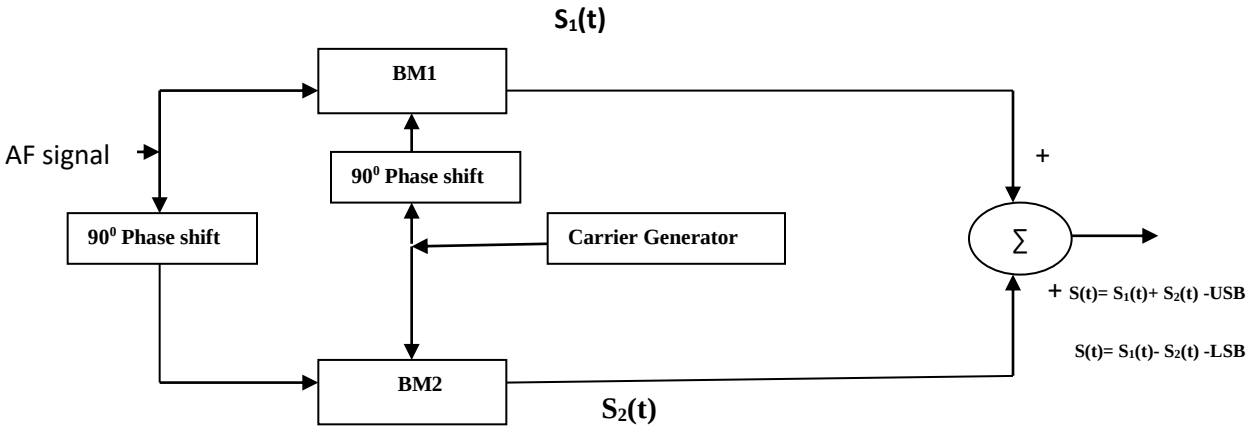
S No	Equipment Name	Specifications	Quantity
1	SSB System trainer kit		1
2	Function Generator	10Hz to 1MHz	1
3	CRO	25MHz	1
4	Connecting Patch Cords&wires		As Required
5	Connecting Probes		2

CIRCUIT DIAGRAM:

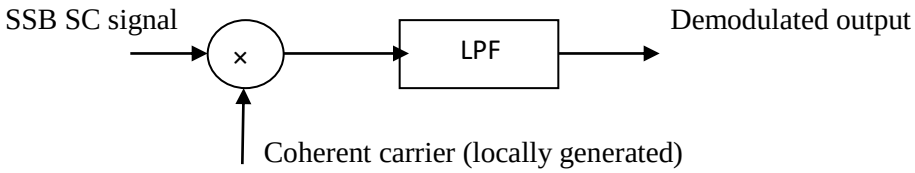


BLOCK DIAGRAM:

MODULATOR:



DEMODULATOR:



THEORY:

AM and DSBSC modulation are wasteful of band width because they both require a transmission bandwidth which is equal to twice the message bandwidth In SSB only one side band and the carrier is used. The other side band is suppressed at the transmitter, but no information is lost. Thus the communication channel needs to provide the same band width, when only one side band is transmitted. So the modulation system is referred to as SSB system.

The base band signal may not be recovered from a SSB signal by the Use of a diode modulator. The base band signal can be recovered if the spectral component of the output i.e either the LSB or USB is multiplied by the carrier signal.

Consider the modulating signal and carrier signal is

$m(t) = Am \cos\omega_m t$

$c(t) = Ac \cos\omega_c t$

SSB-SC is : $S(t) = m(t).c(t)$

The above signal when passed through a filter, only one of the above components is obtained which lays the SSB signal.

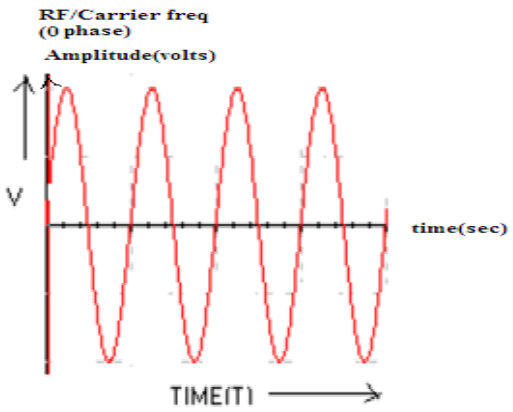
PROCEDURE:

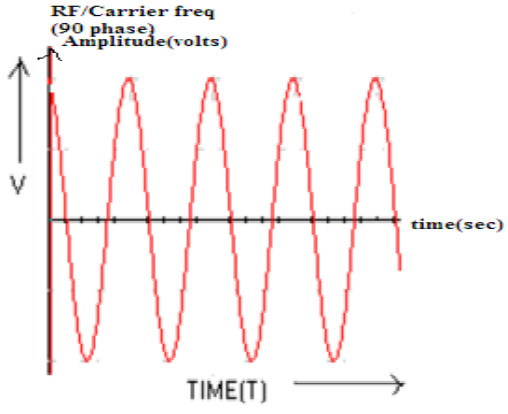
1. Select a carrier signal (RF signal) of frequency f=100KHz and amplitude=1V.
2. Select a message signal (AF signal) of frequency f=1KHz and amplitude=1.5V.
3. Connect the AF signal input and the RF input (90^0shift) to the BM1 and AF input (90^0shift) and RF input to the BM2.
4. Connect SSB-SC input signal to the SSB demodulator and tally the demodulated signal with the input AF signal (frequency).

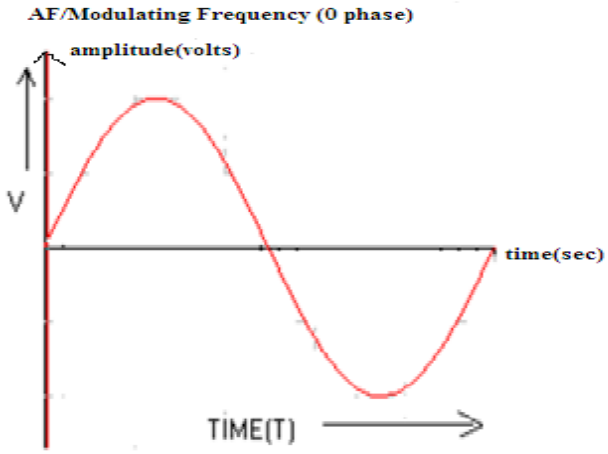
OBSERVATIONS:

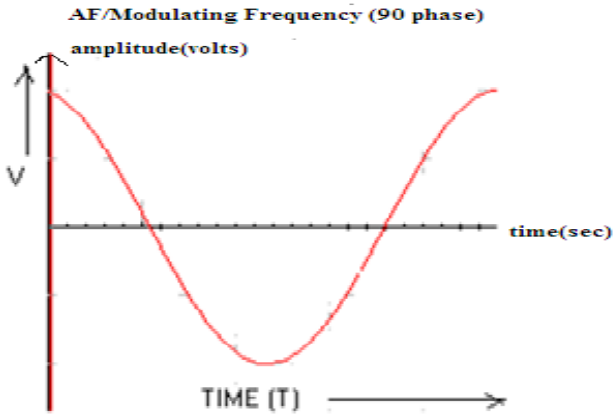
AF Signal frequency	RF Signal frequency	SSB-SC (LSB) frequency	SSB-SC (USB) frequency	Demodulation Frequency

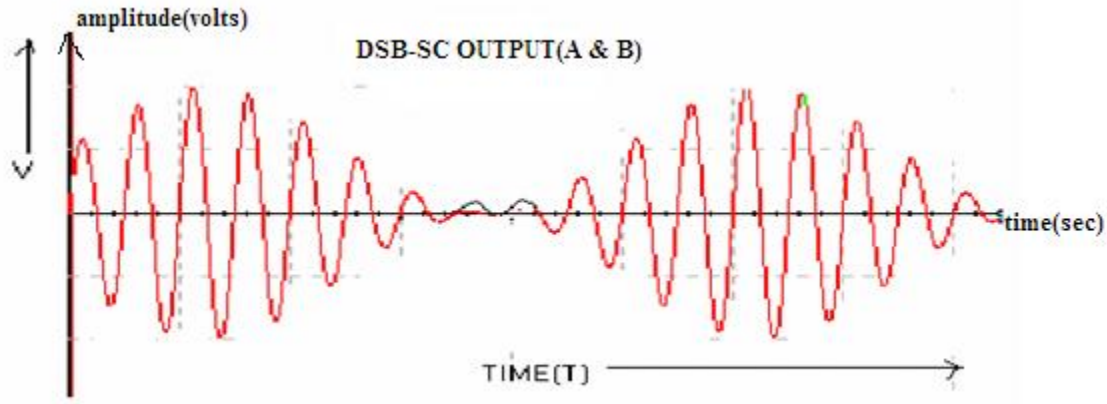
EXPECTED WAVE FORMS: -

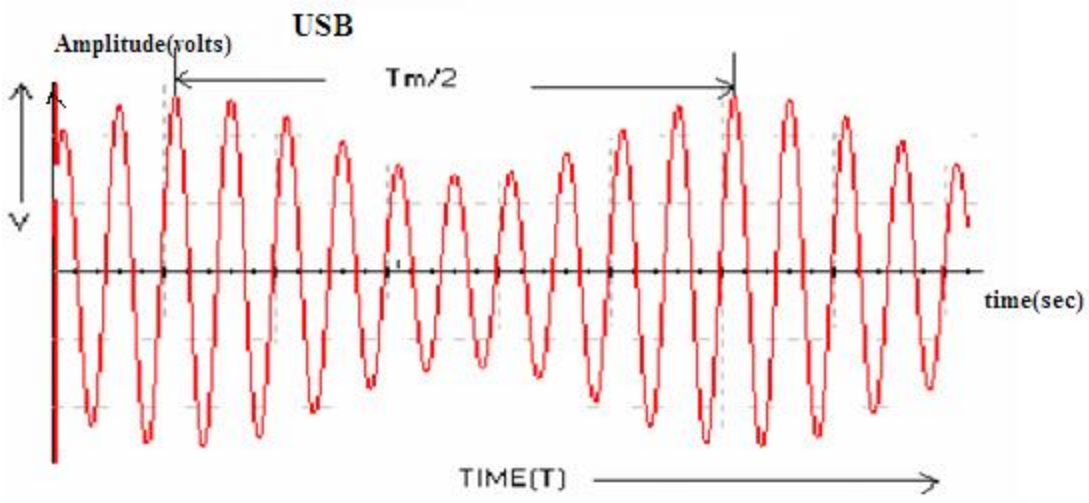


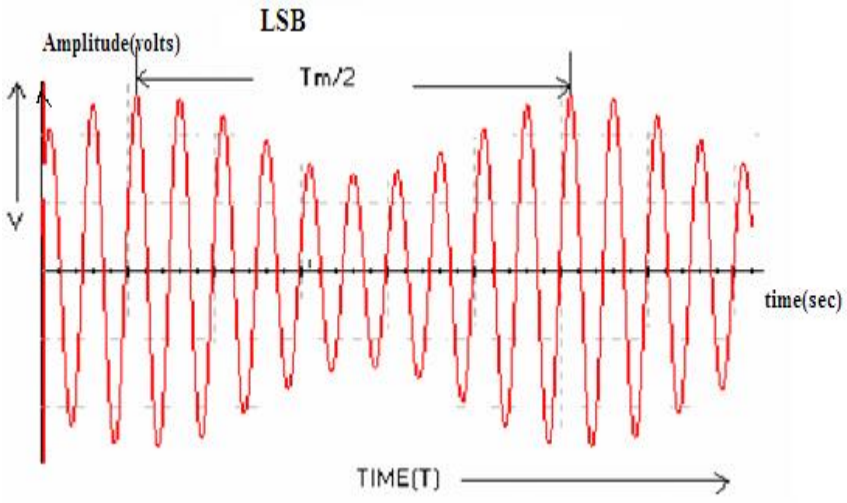


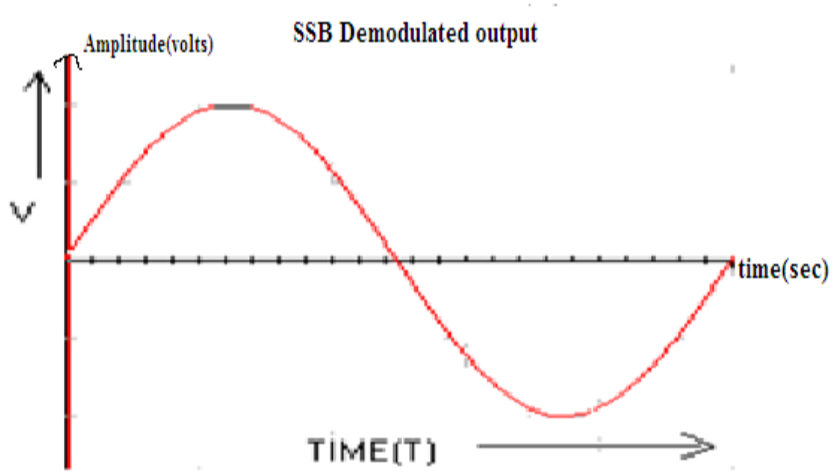

AF/Modulating Frequency (0 phase)
amplitude(volts)
V
time(sec)
TIME(T)


AF/Modulating Frequency (90 phase)
amplitude(volts)
V
time(sec)
TIME (T)


amplitude(volts)
DSB-SC OUTPUT(A & B)
V
time(sec)
TIME(T)


USB
Amplitude(volts)
Tm/2
V
time(sec)
TIME(T)


LSB
Amplitude(volts)
Tm/2
V
time(sec)
TIME(T)



RESULT:

We have been studied the SSB system and we have been generate the SSB-SC signal with USB&LSB.

QUESTIONS

1. What are the different methods to generate SSB-SC signal?
2. What is the advantage of SSB-SC over DSB-SC?
3. What are the uses of synchronous or coherent detector?
4. Give the block diagram of synchronous detector?
5. Why the name synchronous detector?

EXPERIMENT NO-4

FREQUENCY MODULATION AND DEMODULATION

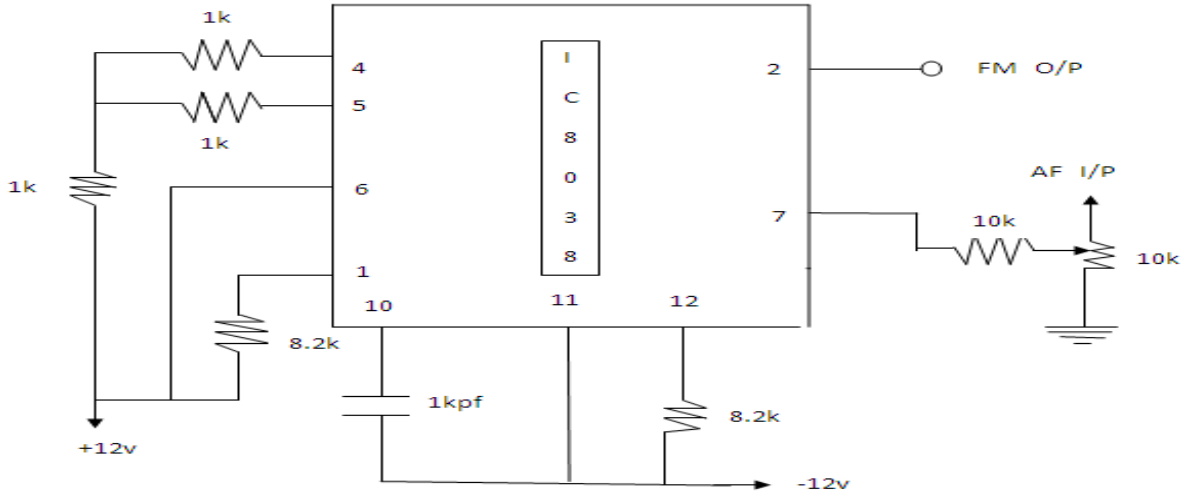
AIM: To study the function of frequency modulation and demodulation process involved in FM based communications and also calculate the modulation index.

APPARATUS:

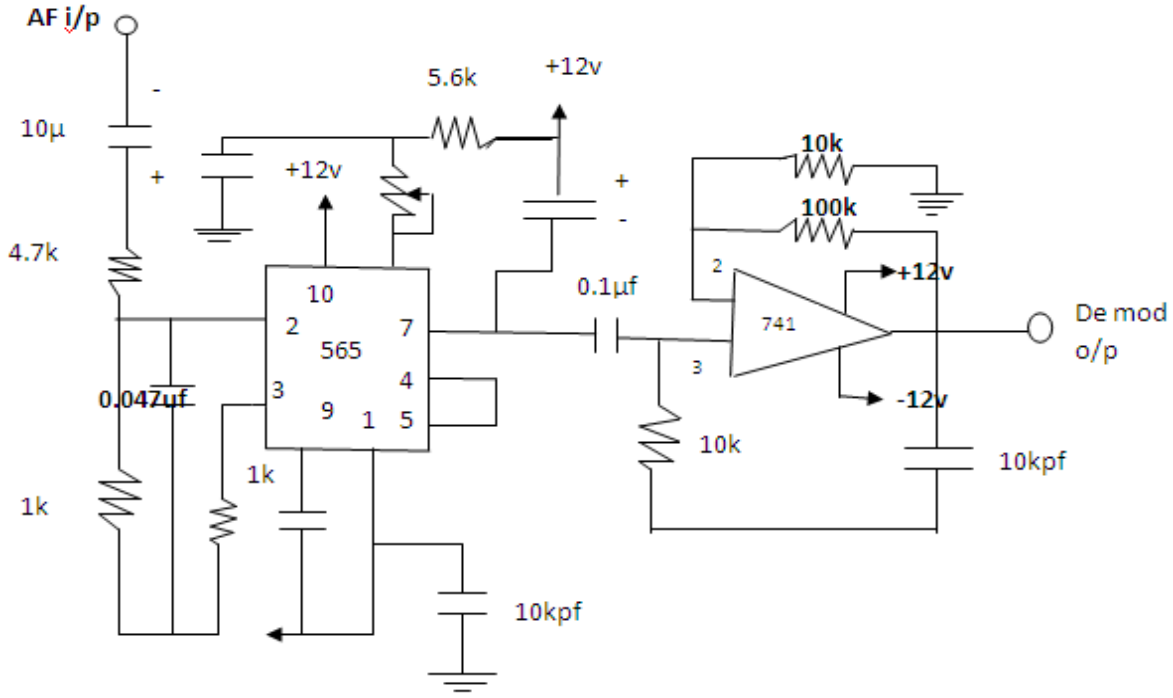
S No	Equipment Name	Specifications	Quantity
1	Frequency Modulation and demodulation Trainer Kit		1
2	Function Generator	10Hz to 1MHz	1
3	CRO	25MHz	1
4	Connecting Patch Cords & wires		As Required
5	Connecting Probes		2

CIRCUIT DIAGRAM:

FM MODULATOR



FM DEMODULATOR



THEORY:

The modulation system in which the modulator output is of constant amplitude, in which the signal information is super imposed on the carrier through variations of the carrier frequency.

The frequency modulation is a non-linear modulation process. Each spectral component of the base band signal gives rise to one or two spectral components in the modulated signal. These components are separated from the carrier by a frequency difference equal to the frequency of base band component. Most importantly the nature of the modulators is such that the spectral components which produce decently on the carrier frequency and the base band frequencies. The spectral components in the modulated wave form depend on the amplitude.

The modulation index for FM is defined as

Mf= max frequency deviation/ modulating frequency.

PROCEDURE:

FM Modulation:-`

1. Measure the frequency F_c of the carrier signal.
2. Connect the AF message to input of the modulator from function generator (1 kHz, 2V P-P) and note down the modulating signal frequency and amplitude of the AF signal.
3. Observe the FM output on CRO and calculate the modulation index.
4. Vary the AF signal frequency for different values repeat steps 2&3.
5. Observe the demodulation for all the above modulation cases.

OBSERVATIONS:

Message signal amplitude is constant				
S No	f_m	f_{max}	f_{min}	$\beta = (f_{max} - f_{min})/ f_m$

Message signal frequency is constant				
S No	A_m	f_{max}	f_{min}	$\beta = (f_{max} - f_{min})/ f_m$

EXPECTED WAVEFORMS:-

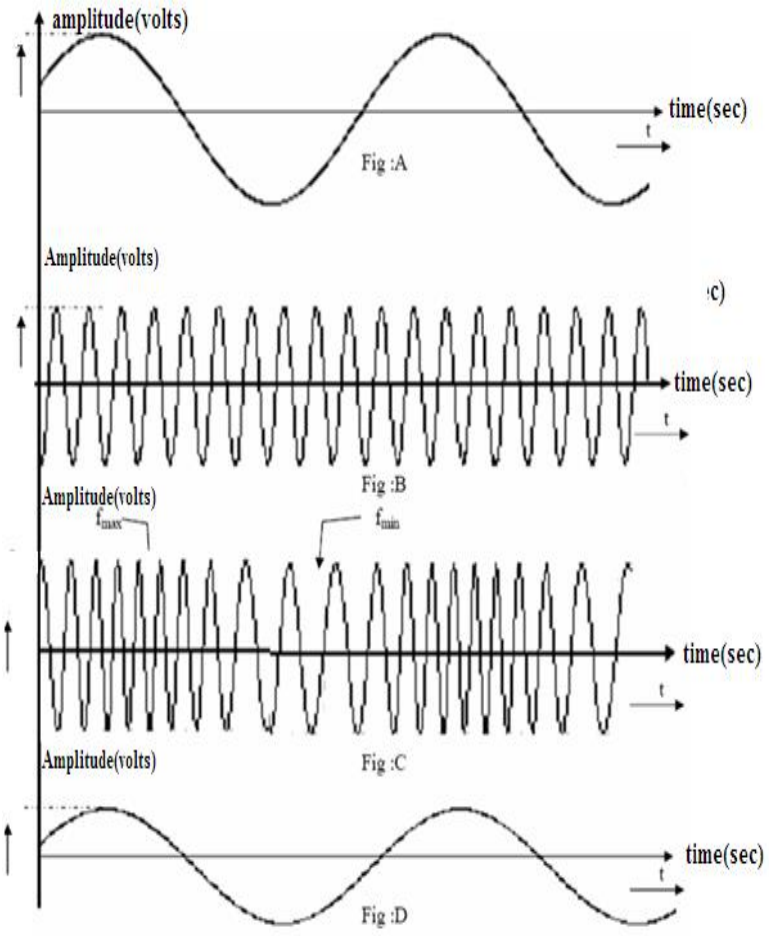
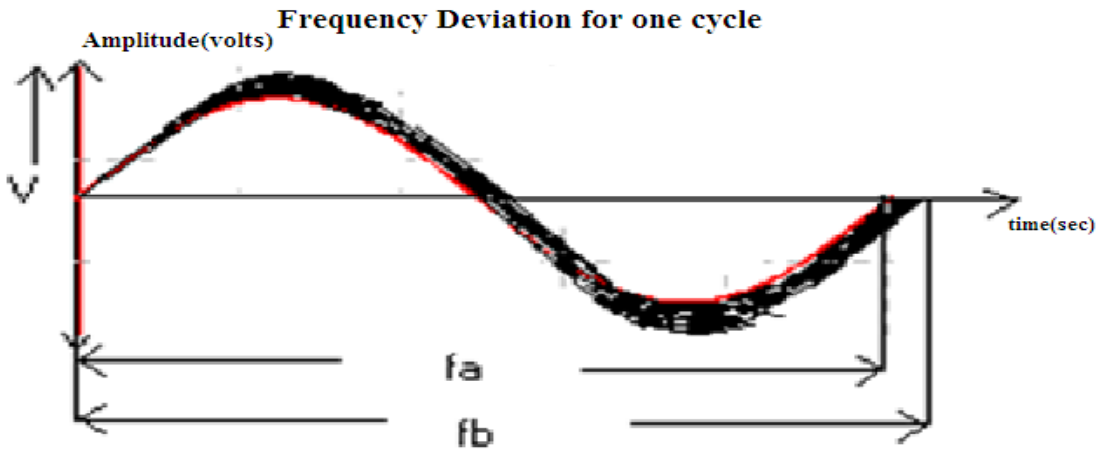


Figure A: Modulating Signal
Figure B: Carrier
Figure C: Modulated Signal
Figure D: Demodulated Signal



RESULT:

The frequency modulation and demodulation wave forms are observed.

QUESTIONS

1. Define Frequency modulation?

2. What are the advantages of frequency modulation?

3. What are the applications of FM?

4.Define modulation index β, frequency deviation?

5.How FM is different from AM?