Department of

Electronic & Telecommunication Engineering

LAB MANUAL

Analog Communication System

B.Tech– IV Semester

KCT College OF ENGG AND TECH.

VILLAGE FATEHGARH

DISTT.SANGRUR

INDEX

EXPERIMENT-1

Aim: 1. To generate amplitude modulated wave and determine the percentage modulation.
2. To Demodulate the modulated wave using envelope detector.

Apparatus Required:
Transistor(BC 107), f_T = 300 MHz, P_d = 1W, I_c(max) = 100 mA, Diode(0A79), Max Current 35mA , Resistors 1K_, 2K_, 6.8K_, 10K, Capacitor 0.01 μ F, Inductor 130mH, CRO 20MHz, Function Generator 1MHz 2, Regulated Power Supply 0-30V, 1A

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

$$(s\ t)\ A\ [\ K\ m(t)\ (\ f\ t\ )]\ _{c\ a\ c} = 1 + \cos 2\pi$$

Where $_a K$ is a constant called the amplitude sensitivity of the modulator.

The demodulation circuit is used to recover the message signal from the incoming 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 receiver.

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 Diagram for modulation

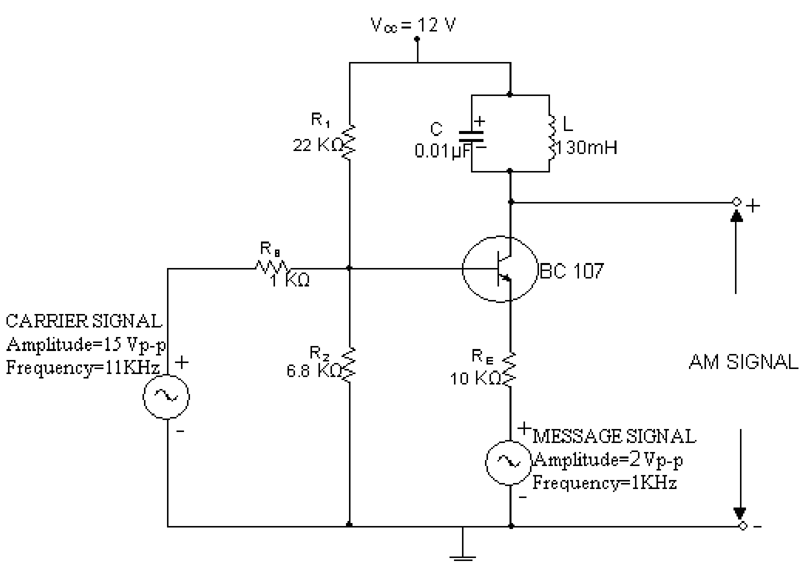


Fig. AM MODULATOR

Demodulation:-

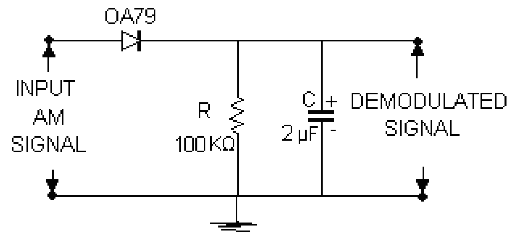


Fig. AM DEMODULATOR

Procedure:

1. The circuit is connected as per the circuit diagram shown in Fig.1.
2. Switch on + 12 volts V_{CC} supply.
3. Apply sinusoidal signal of 1 KHz frequency and amplitude 2 Vp-p as modulating signal, and carrier signal of frequency 11 KHz and amplitude 15 Vp-p.
4. Now slowly increase the amplitude of the modulating signal up to 7V and note down values of E_{max} and E_{min}.
5. Calculate modulation index using equation
6. Repeat step 5 by varying frequency of the modulating signal.
7. Plot the graphs: Modulation index vs Amplitude & Frequency
8. Connect the circuit diagram as shown in Fig.2.
9. Feed the AM wave to the demodulator circuit and observe the output
10. Note down frequency and amplitude of the demodulated output waveform.
11. Draw the demodulated wave form .,m=1

Observations

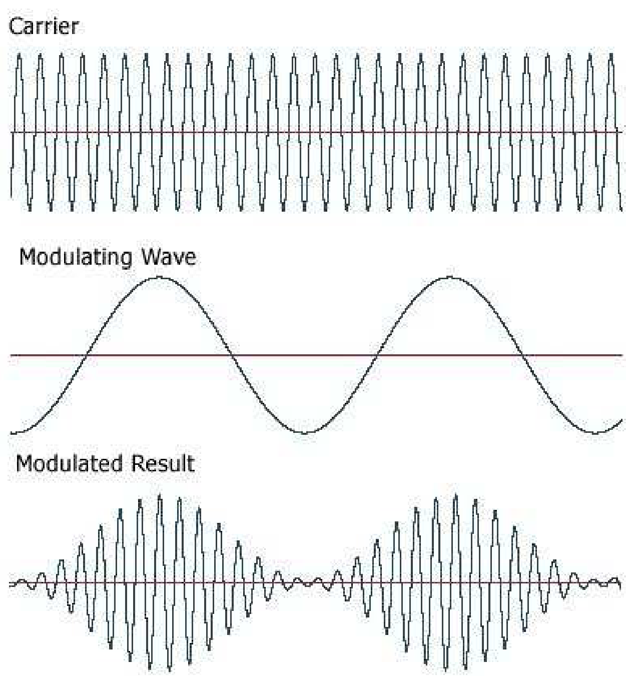
Table 1: f_m= 1KHz, f_c=11KHz, A_c=15 V p-p.

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

Table 2: A_m= 4 Vp-p f_c =11KHz, A_c=15 V p-p.

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

Waveforms and Graphs



Precautions:-

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

EXPERIMENT-2

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

Apparatus Required:
IC 1496, Resistors 6.8KΩ, 10 KΩ, 3.9 KΩ ,1 KΩ, 51 KΩ, Capacitors 0.1 μ F, Variable Resistor (Linear Pot) 0-50 KΩ, CRO, Function Generator, Regulated Power Supply.

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:-

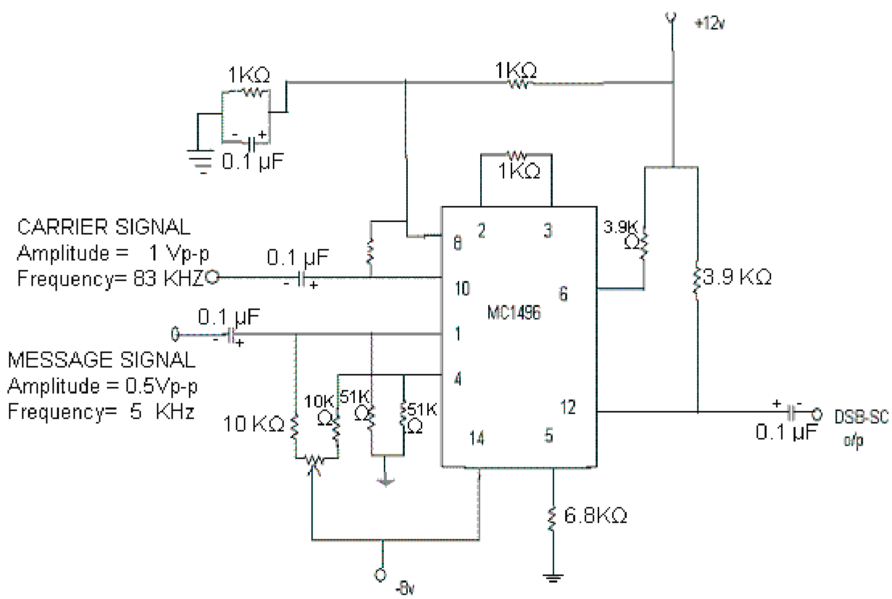
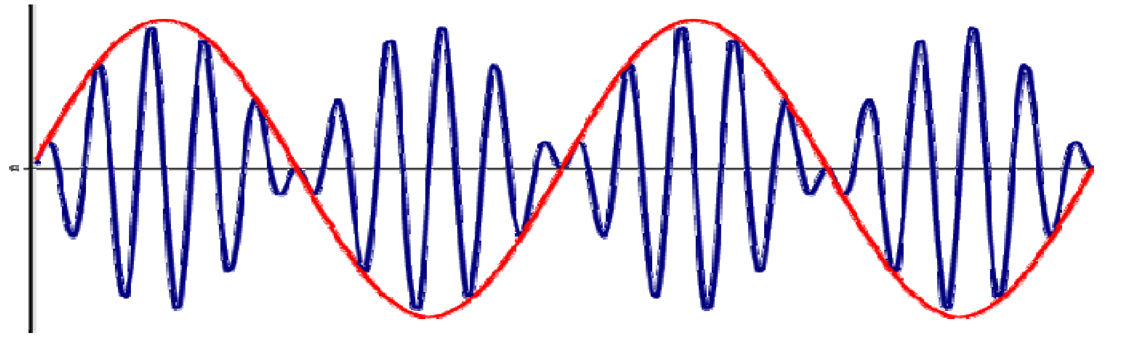


Fig. Balanced Modulator Circuit

Procedure:
1. Connect the circuit diagram as shown in Fig.
2. An Carrier signal of 1Vp-p amplitude and frequency of 83 KHz is applied as carrier to pin no.10.
3. An AF signal of 0.5Vp-p amplitude and frequency of 5 KHz is given as message signal to pin no.1.
4. Observe the DSB-SC waveform at pin no.12.

Waveforms:-



Precautions:-

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

EXPERIMENT-3

Aim: To generate the SSB modulated wave.

Apparatus Required:
SSB system trainer board, CRO 30MHz

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 sideband is entirely suppressed. This leads to single-sideband modulation (SSB). In SSB modulation bandwidth saving is accompanied by a considerable increase in equipment complexity.

Circuit Diagram:

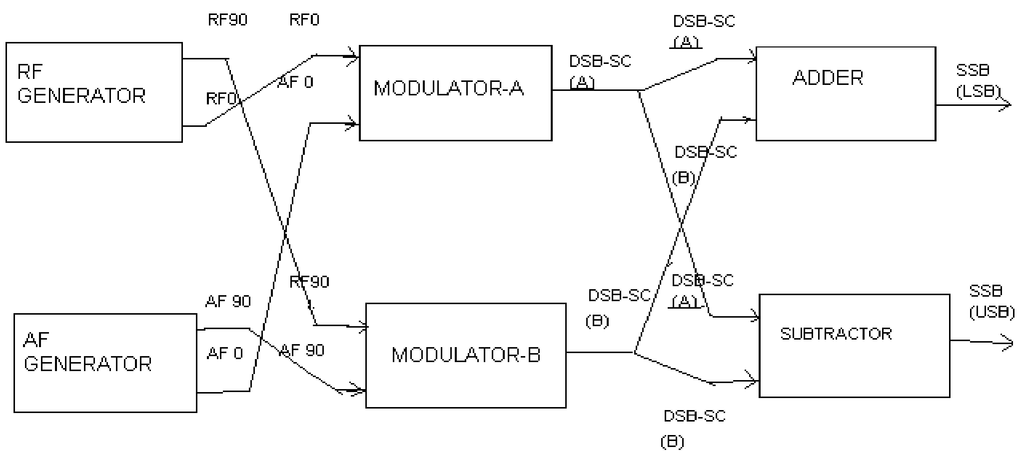


Fig. Single Side band

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 KHz and the amplitude is ≥ $0.2V_{PP}$. (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 modulator and 90_o phase shift signal to another balanced modulator.
6. Select the required frequency (2KHz, 4KHz or 6KHz) 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. Set the AF signal amplitudes to 8 V_{p-p} using amplitude control and connect to the balanced modulators.

9. Observe the outputs of both the balanced modulators simultaneously using Dual trace oscilloscope and adjust the balance control until desired output wave forms (DSB-SC).
10. To get SSB lower side band signal, connect balanced modulator output (DSB_SC) signals to subtract.
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 side band 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 theoretical 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.

EXPERIMENT-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:
IC 566, IC 8038, IC 565, Resistor, Capactior, CRO, Function Generator, Regulated Power Supply.

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

$$s(t) = A_c \cos(2\pi f_c t + \beta \sin 2\pi f_m t)$$

Where A_c is amplitude of the carrier signal, f_c is the carrier frequency, β is the modulation index of the FM wave.

Circuit Diagrams:

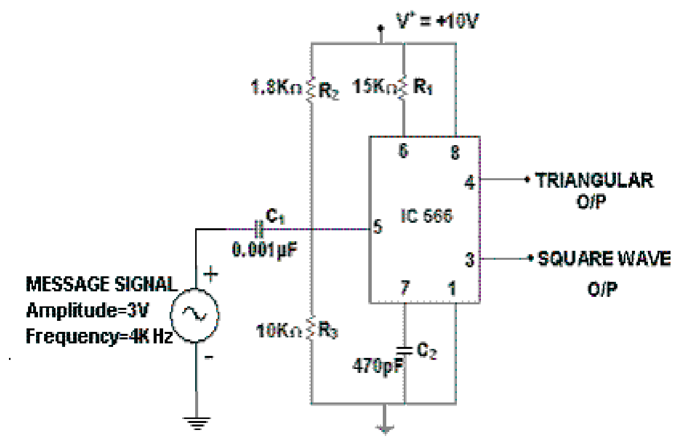


Fig. FM Modulator Using IC 566

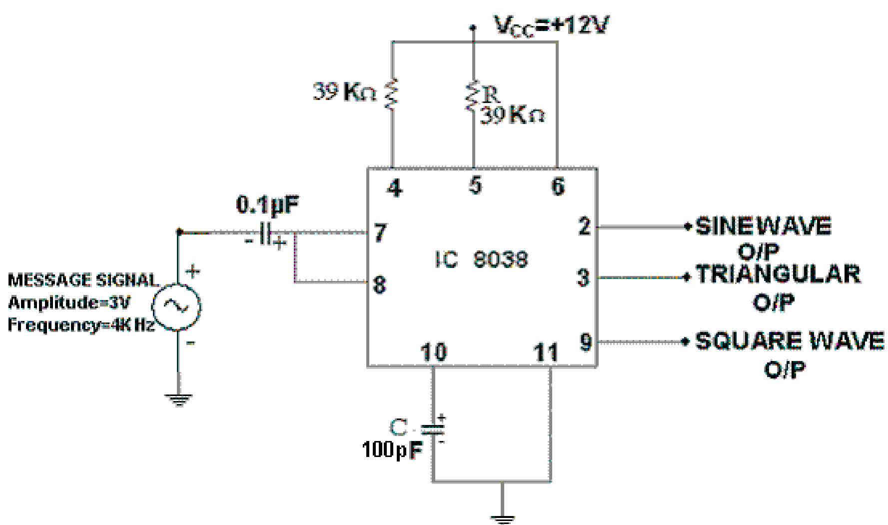


Fig. FM Modulator Circuit

Procedure: Modulation:

1. The circuit is connected as per the circuit diagram shown in Fig for IC 566.
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 $f = 1/(2\Pi RC)$ taking C=100pF.
3. Apply the sinusoidal modulating signal of frequency 4KHz and amplitude 3Vp-p at pin no.7. (pin no.5 for IC 566)
   Now slowly increase the amplitude of modulating signal and measure f_{min} and maximum frequency deviation Δf at each step. Evaluate the modulating index ($m_f = \beta$) using $\Delta f / f_m$ where $\Delta f = |f_c - f_{min}|$.
   Calculate Band width. $BW = 2(\beta + 1)f_m = 2(\Delta f + f_m)$
4. Repeat step 4 by varying frequency of the modulating signal.

Procedure: Demodulation:

1. Connections are made as per circuit diagram shown in Fig.
2. Check the functioning of PLL (IC 565) 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 wave form.

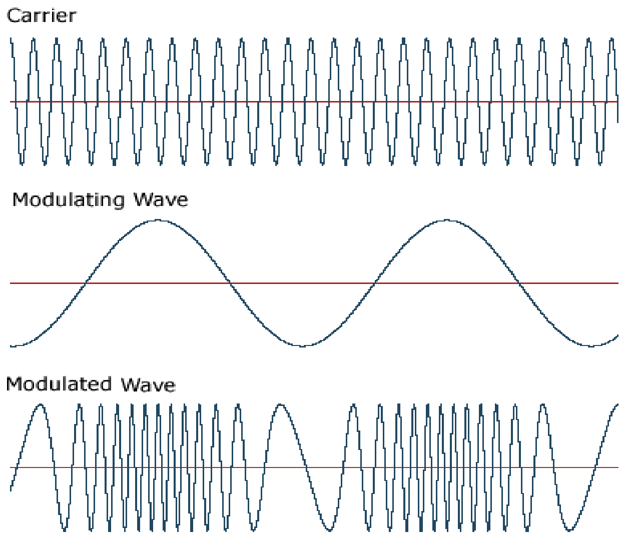
Table: 1 f_c = 45KHz

S.No.	f_m(KHz)	T_{max} (μ sec)	f_{min}(KHz)	f(KHz)	β	BW (KHz)

Table 2: f_m = 4 KHz, f_c = 45 KHz

S.No.	f_m(KHz)	T_{max} (μ sec)	f_{min}(KHz)	f(KHz)	β	BW (KHz)

Waveforms:-



Precautions:

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

EXPERIMENT-5

Aim: To verify the sampling theorem.

Apparatus Required:

1. Sampling theorem verification trainer kit
2. Function Generator (1MHz)
3. Dual trace oscilloscope (20 MHz)

Theory:

The analog signal can be converted to a discrete time signal by a process called sampling. The sampling theorem for a band limited signal of finite energy can be stated as, ''A band limited signal of finite energy, which has no frequency component higher than W Hz is completely described by specifying the values of the signal at instants of time separated by 1/2W seconds.'' It can be recovered from knowledge of samples taken at the rate of 2W per second.

Circuit Diagram:

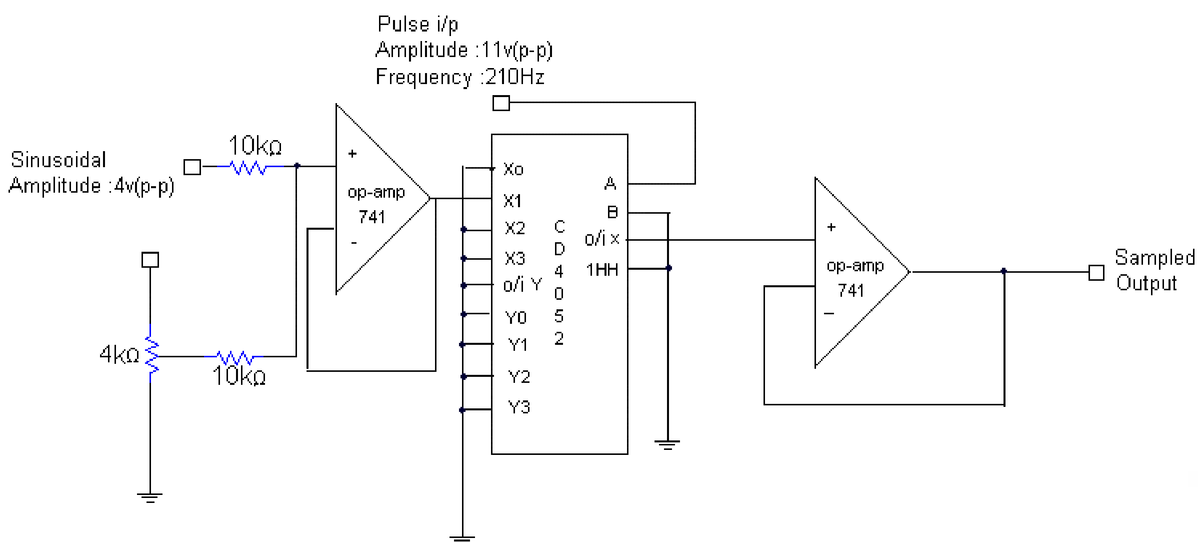


Fig: Sampling Circuit

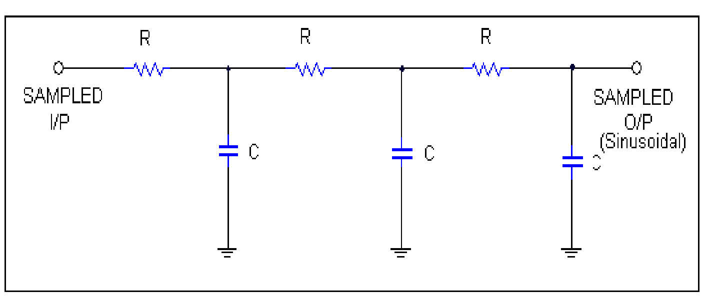
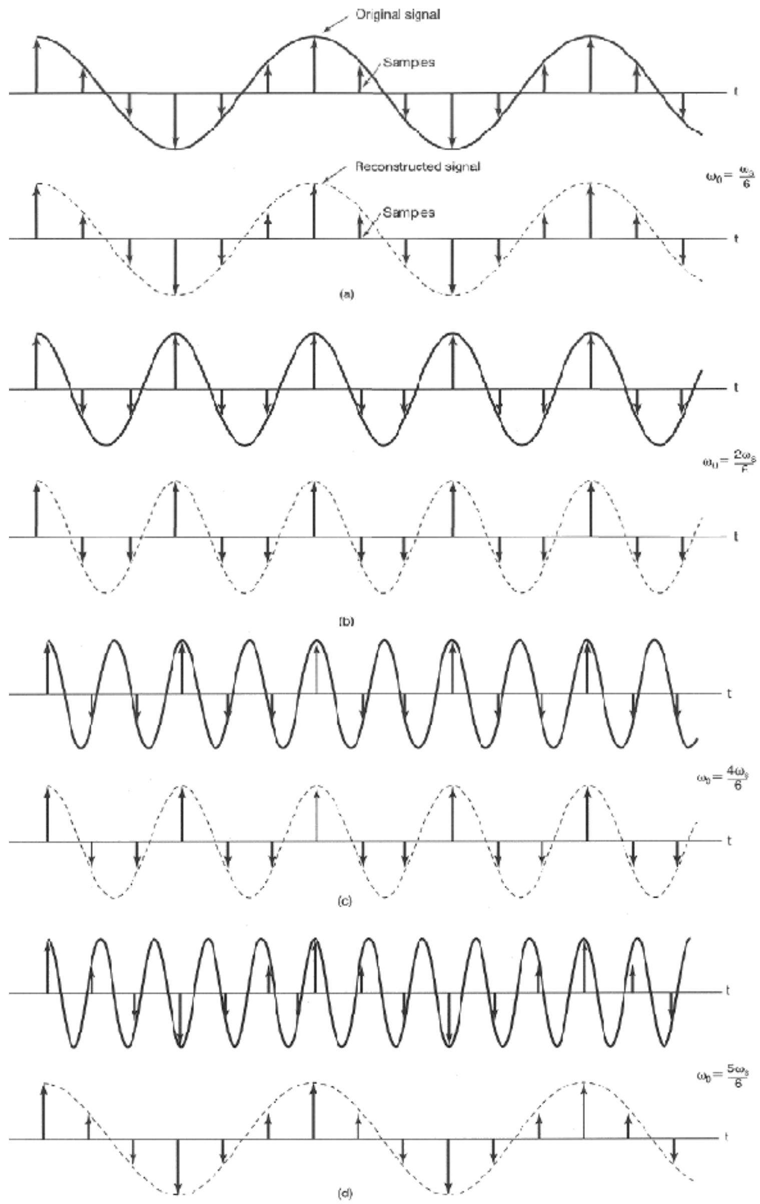


Fig: Reconstructing Circuit

Procedure:

1. The circuit is connected as per the circuit diagram shown in the fig 1.
2. Switch on the power supply. And set at +11V and -11V.
3. Apply the sinusoidal signal of approximately 4V (p-p) at 105Hz frequency and pulse signal of 11V (p-p) with frequency between 100Hz and 4 KHz.
4. Connect the sampling circuit output and AF signal to the two inputs of oscilloscope
5. Initially set the potentiometer to minimum level and sampling frequency to 200Hz and observe the output on the CRO. Now by adjusting the potentiometer, vary the amplitude of modulating signal and observe the output of sampling circuit. Note that the amplitude of the sampling pulses will be varying in accordance with the amplitude of the modulating signal.
6. Design the reconstructing circuit. Depending on sampling frequency, R & C values are calculated using the relations $F_s = 1/T_s$, $T_s = RC$. Choosing an appropriate value for C,R can be found using the relation $R=T_s/C$
7. Connect the sampling circuit output to the reconstructing circuit shown in Fig 2
8. Observe the output of the reconstructing circuit (AF signal) for different sampling frequencies. The original AF signal would appear only when the sampling frequency is 200Hz or more.



Precautions:

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

EXPERIMENT-6

Aim: To generate the pulse width modulated and demodulated signals.

Apparatus required:
Resistors 1.2 kΩ, 1.5 kΩ, 8.2 kΩ, Capacitors 0.01 μ F, 1 μ F, Diode 0A79, CRO 0-30 MHz, Function Generator 1MHz, RPS 0-30v,1A, IC 555 Operating tem :SE 555 -55$_o$C to 125$_o$C, CRO Probes.

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.

Circuit Diagram:-

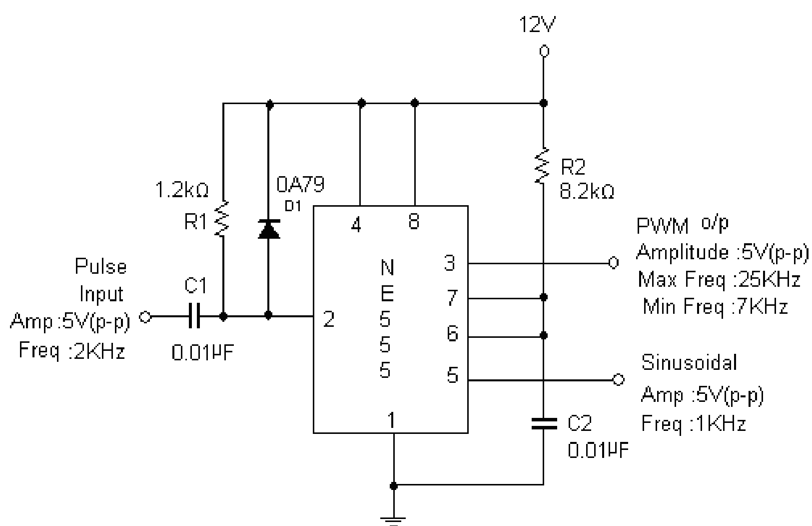


Fig: Pulse Width Modulation Circuit

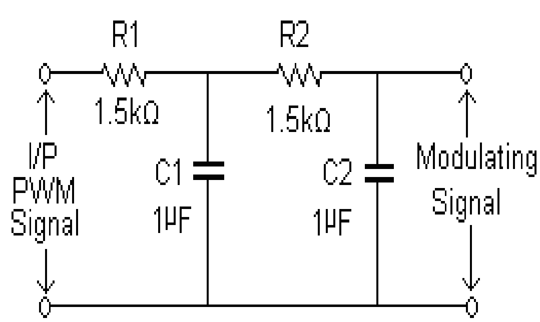
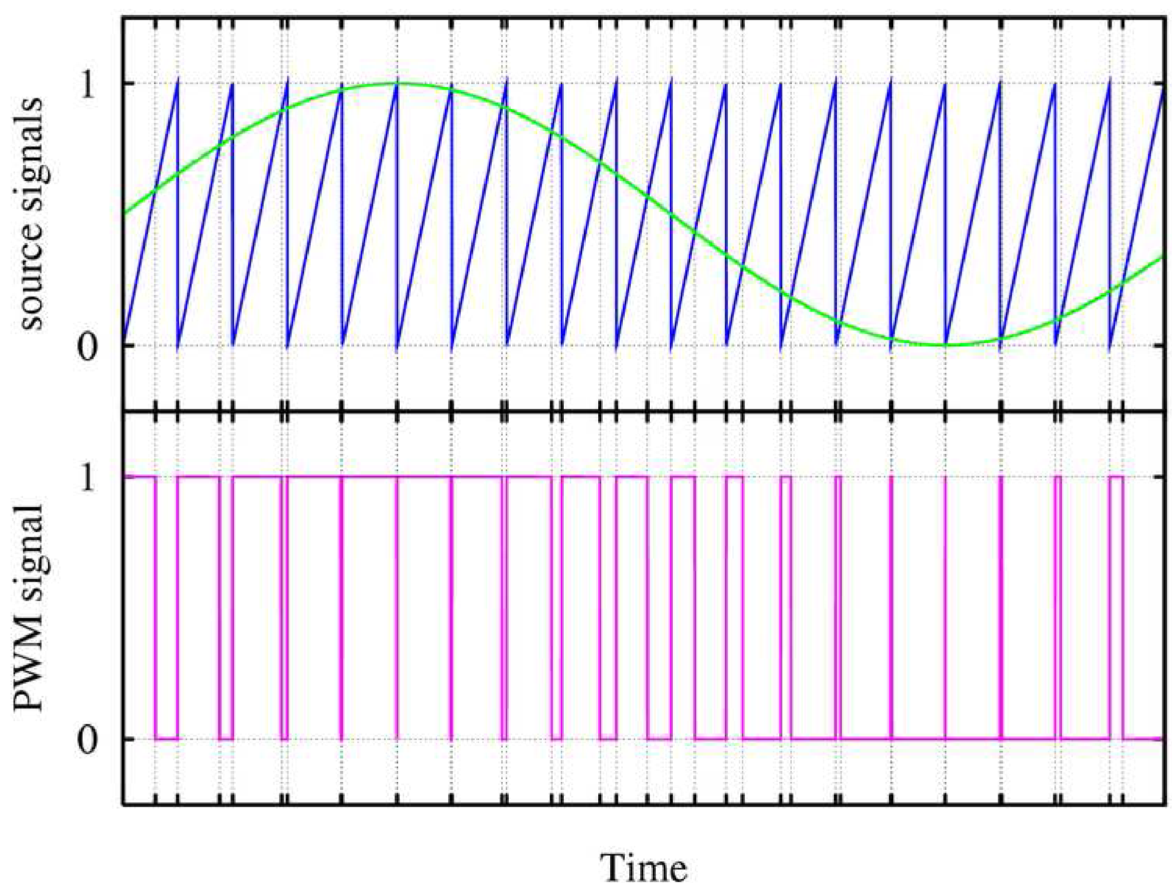


Fig: Demodulation Circuit

Procedure:

1. Connect the circuit as per circuit diagram shown in fig 1.
2. Apply a trigger signal (Pulse wave) of frequency 2 KHz with amplitude of 5v (p-p).
3. Observe the sample signal at the pin3.
4. Apply the ac signal at the pin 5 and vary the amplitude.
5. Note that as the control voltage is varied output pulse width is also varied.
6. Observe that the pulse width increases during positive slope condition & decreases under negative slope condition. Pulse width will be maximum at the +ve peak and minimum at the –ve peak of sinusoidal waveform. Record the observations.
7. Feed PWM waveform to the circuit of Fig.2 and observe the resulting demodulated waveform.

Waveforms:



Precautions:
1. Check the connections before giving the power supply.
2. observations should be done carefully.

EXPERIMENT-7

Aim: To generate pulse position modulation and demodulation signals and to study the effect of amplitude of the modulating signal on output.

Apparatus required:
Resistors 1.2 kΩ, 1.5 kΩ, 8.2 kΩ, Capacitors 0.01 μ F, 1 μ F, Diode 0A79, CRO 0-30 MHz, Function Generator 1MHz, RPS 0-30v,1A, IC 555 Operating tem :SE 555 -55$_o$C to 125$_o$C, CRO Probes.

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 signaling techniques that encodes the sample values of an analog 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 analog 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.

Circuit Diagram:-

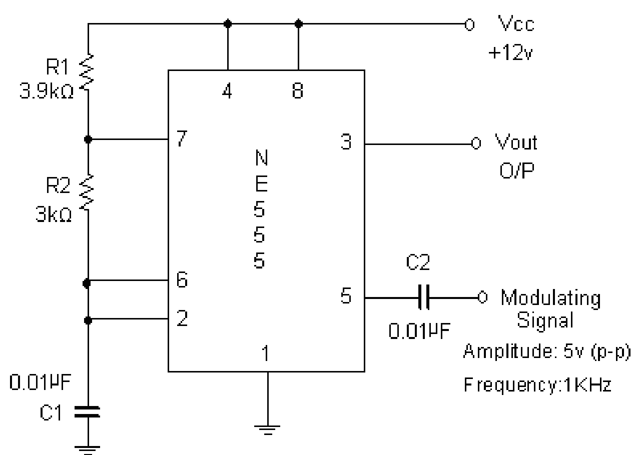


Fig: Pulse Position Modulation Circuit

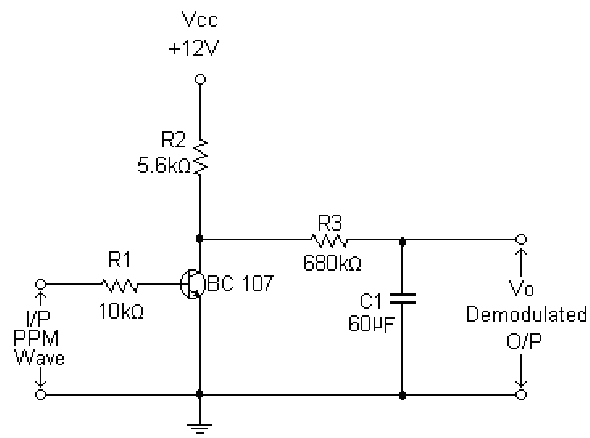


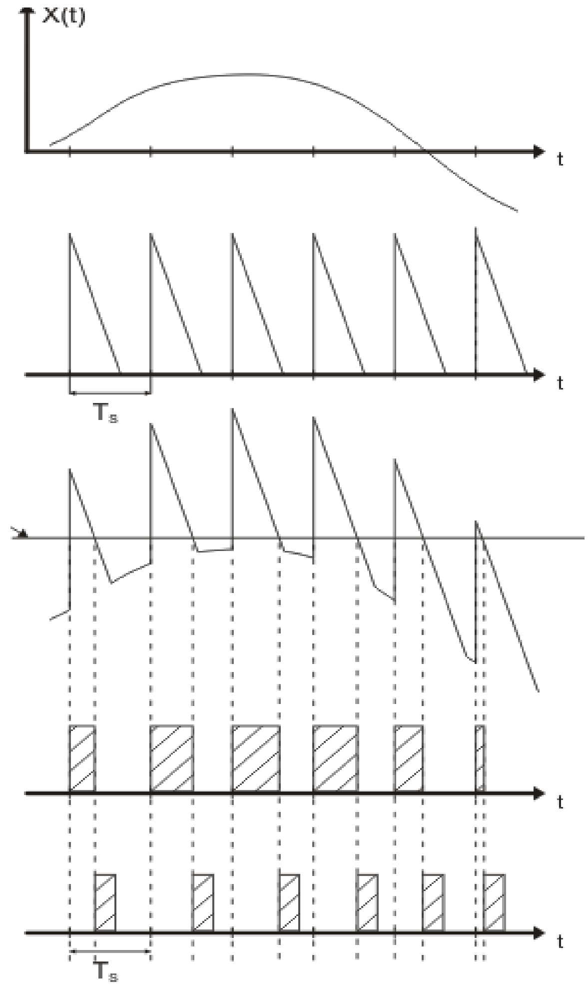
Fig: Demodulation Circuit

Procedure:

1. Connect the circuit as per circuit diagram as shown in the fig 1.
2. 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.
3. Apply the modulating signal, sinusoidal signal of 2V $_{(p-p)}$ (ac signal) 2v (p-p) to the control pin 5 using function generator.
4. Now by varying the amplitude of the modulating signal, note down the position of the pulses.
5. During the demodulation process, give the PPM signal as input to the demodulated circuit.
6. Observe the o/p on CRO.
7. Plot the waveform.

Observations:

Modulating signal Amplitude(V_{p-p})	Pulse width ON (ms)	Pulse width OFF (ms)	Total Time period(ms)


X(t)
t
t
T_s
t
t
T_s

EXPERIMENT-8

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

Apparatus required: Resistors 3.9 kΩ, 3 kΩ, 10 kΩ, 680 kΩ, Capacitors 0.01 μF, 1 μF, CRO 0-30 MHz, Function Generator 1MHz, RPS 0-30v,1A, IC 555 Operating tem :SE 555 -55ₒC to 125ₒC, CRO Probes.

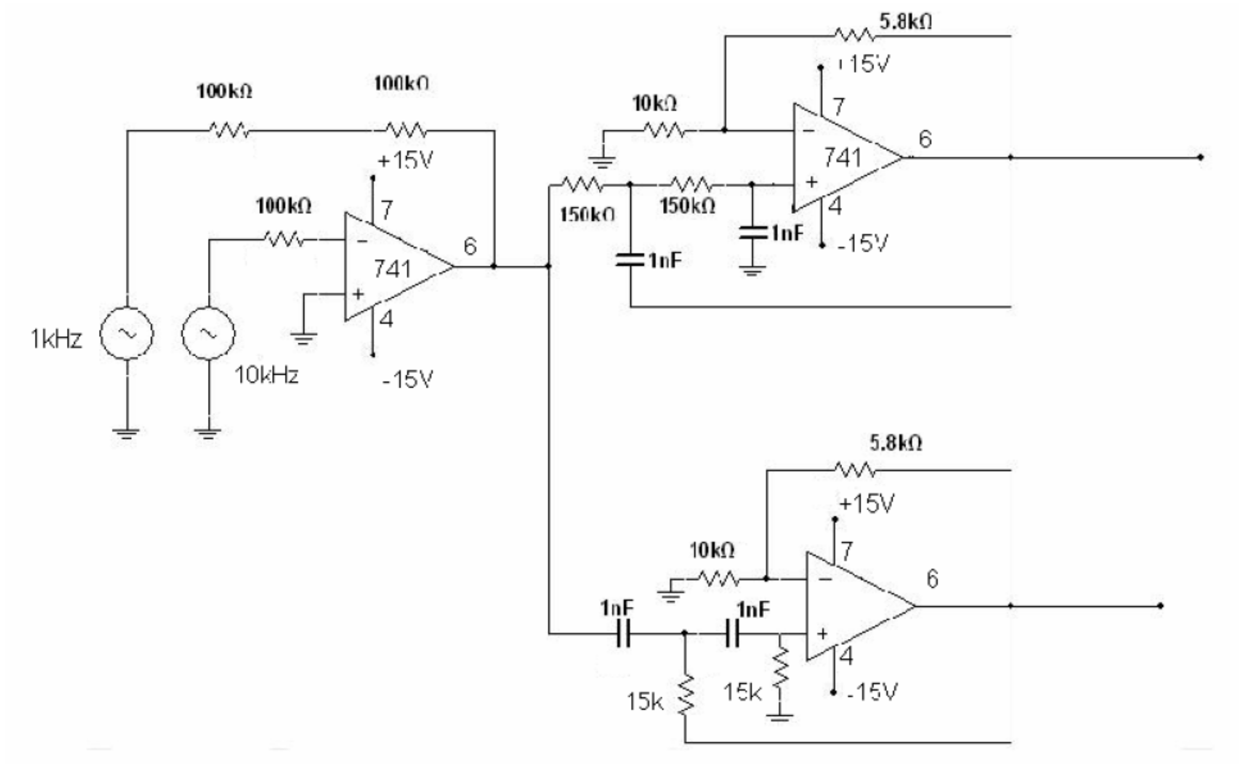
Theory:

When several communications channels are between the two same point's significant economics may be realized by sending all the messages on one transmission facility a process called multiplexing. 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 of them. The modulated signals are then summoned to produce the baseband signal 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's in the system, which cause 1 message signal to appear as modulation on subcarrier. Consequently, standard practice calls for negative feedback to minimize amplifier non linearity 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 2 signals are fed to op-amp which performs adder operation.
4. The filter is designed in such a way 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		

Precautions:
1. Check the connections before giving the power supply.
2. observations should be done carefully.

EXPERIMENT-9

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

Apparatus Required:- PLL Kit, Connecting Wires.

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 f out , . 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 3 states.

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 cantinues to change (output frequency) until it equals the input frequency and the PLL is then in the 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 : (f C) : Is the range of frequencies in the vicinity of ‘f O’ over which the loop will acquire lock with an input signal initially starting out of lock .

Circuit Diagrams:

Circuit Diagram :

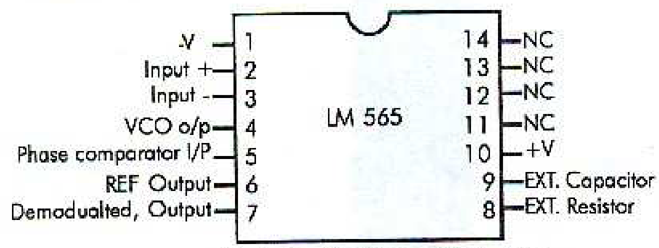


Fig.1 Pin Diagram of LM 565

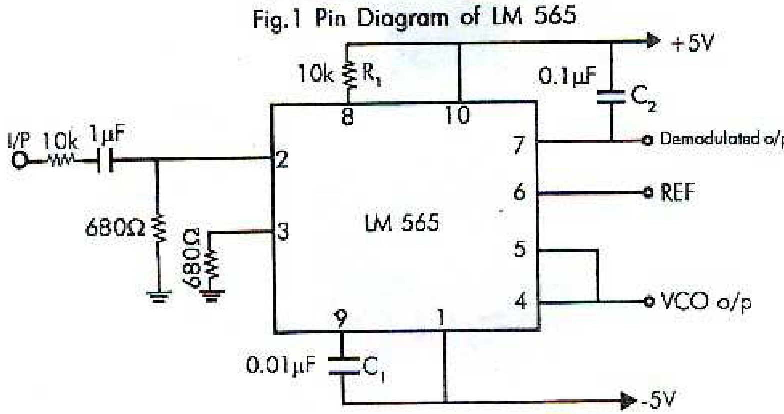


Fig.2 Circuit Diagram of LM 565

Procedure:

1. Connect + 5V to pin 10 of LM 565.
2. Connect -5V to pin 1.
3. Connect 10k resistor from pin 8 to + 5V
4. Connect 0.01 µf capacitor from pin 9 to – 5V
5. Short pin 4 to pin 5.
6. Without giving input measure(f O) free running frequency.
7. Connect pin 2 to oscillator or function generator through a 1µf capacitor, adjust the amplitude aroung 2Vpp.
8. Connect 0.1 µf capacitor between pin 7 and + 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 wave form will be phase locked.
12. Change R-C components to shift VCO center frequency and see how lock range of the input varies.

Precautions:

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

EXPERIMENT-10

Aim: Measurement of directivity & gain of antennas : Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).

Apparatus Required : Power supply, VCO, 50 ohm transmission line, dipole antenna, patch antenna, yagi antenna, oscilloscope or VSWR meter.

Theory:

The simplest practical antenna is the half wave dipole. In its original form it consists of two thin straight wires, each $\lambda/4$ in lengths, by a small gap. For this simple antenna, under fairly realistic approximations, closed form expressions are available for radiated fields, power, directivity etc.

The important feature of Yagi antenna is that it is an end-fire antenna, ie the direction of maximum radiation is tangential to the plane formed by the parallel antenna elements.

The design of a rectangular microstrip patch antenna begins with (a) choice of a substrate, (b) selecting the feed mechanism, (c) determining patch length L, (d) determining patch width w and (e) selecting the feed location.

Procedure:

1.Setup the system as shown in the figure for a standard dipole antenna.

2. Keeping the voltage at min, switch on the power supply and keeping the gain control knob maximum, switch on VCO.

3.Vary the tuning voltage and check the output for different VCO frequencies.

4. Keeping at the resonant frequency calculate and keep the min distance for field between the transmitting & receiving antennas using the formula

$$S = \frac{2d^2}{\lambda_0}$$

where d is the length of the dipole and $\lambda = c/f = 6$cm.
where L is the length of the dipole.
The calculated value is 2.25cm.

5.Keeping the line of sight properly (0 degree at the turn table)

6. Note the readings on the CRO, convert the voltage reading into dB by using the formula 20 log (V/V_0) where V_0 = voltage at zero degree.

7.Rotate the turn table in clockwise & anti-clockwise for different angle of deflection & tabulate the output for every angle(E_ϕ).

8.Plot a graph : angle vs output .
9.Take a reading in the E and H planes.

10.Find the half power beam width (HPBW) from the points where the power becomes half (3db points or 0.707V points)

Directivity of the antenna can be calculated using the formula :

$$\mathbf{D} = \frac{41253}{(2XHPBW)} \quad \text{or} \quad \frac{72}{\sum\left[\frac{E_m}{E_\phi}\right]^2}$$

where HPBW is the half power beam width in degrees,

Find out two HPBW in two planes one principal plane and the other orthogonal plane. Em & Eф are the output signals at the receiving antenna for 0 degree and for different angles respectively.

Gain of the antenna can be calculated using the formula :

$$G = \frac{4\pi S}{\lambda}\left[\sqrt{\frac{P_r}{P_t}}\right] = \frac{4\pi S}{\lambda}\left[\frac{E_r}{E_t}\right]$$

Gain in dB =10 log G

Where Et and Er are the signal strength measured using an oscilloscope at the transmitting end at the receiving end respectively, when the line of sight is proper. S is the actual distance kept between the antennas and λ is the wavelength found using the formula λ=c/f (f = frequency of operation)
Repeat the experiment for patch antenna and a yagi antenna.

Table 1

Angle	O/P on on oscilloscope or VSWR meter	O/P on oscilloscope or VSWR meter
	OUTPUT (R)	OUTPUT (L)
0 Degree		
5 Degree		
10 Degree		
15 Degree		
20 Degree		

Results :- Directivity and gain of the given antennas are properly measured

EXPERIMENT-11

Aim:- To study the Superhetrodyne receiver & parameters i.e. sensitivity/selectivity/fidelity of a given receiver.

Apparatus required:- Superhetrodyne receiver kit, Connecting leads.

Circuit Diagram:-

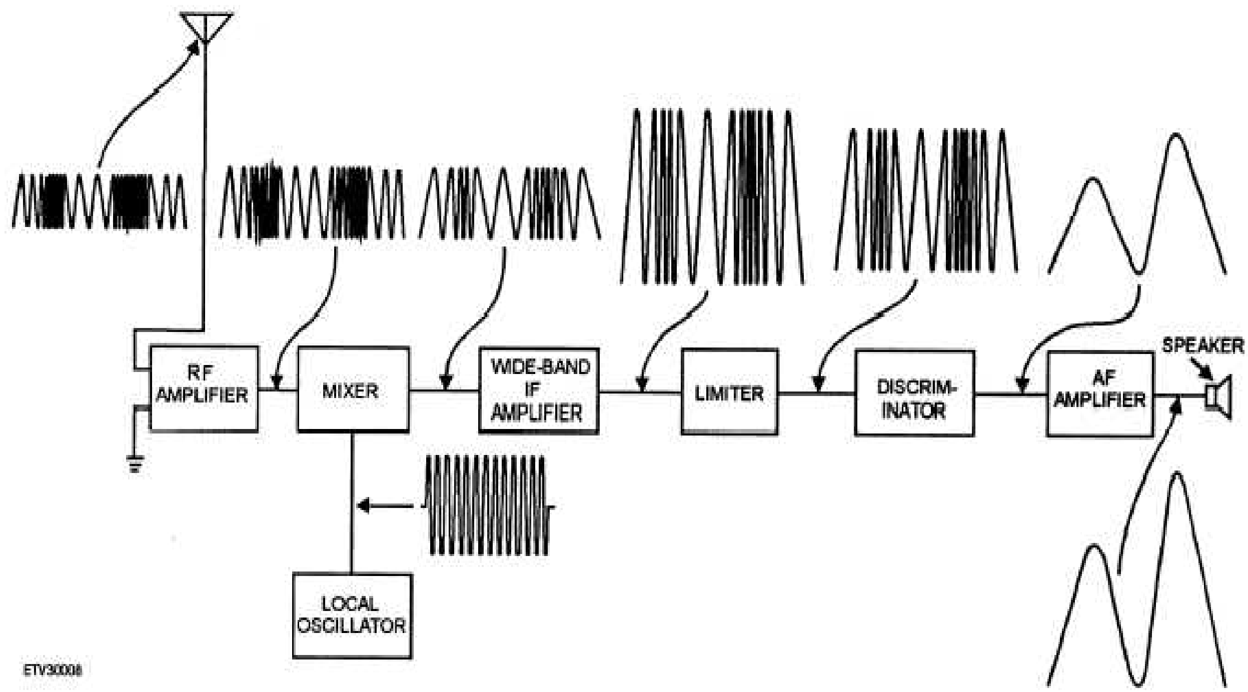


Fig. SUPERHETERODYNE RECEIVER

Theory:-

SUPERHETERODYNE RECEIVER The superheterodyne receiver was developed to overcome the disadvantages of earlier receivers. A block diagram of a representative superheterodyne re- ceiver is shown in fig. Superheterodyne receivers may have more than one frequency-converting stage and as many amplifiers as needed to attain the desired power output. FM and AM receivers function similarly. However, there are important differences in component construction and circuit design because of differences in the modulating techniques. Comparison of block diagrams shows that electrically there are two sections of the FM receiver that differ from the AM receiver: the discriminator (de- tector) and the accompanying limiter. FM receivers have some advantages over AM re- ceivers. During normal reception, FM signals are static- free, while AM is subject to cracking noise and whistles. Also, FM provides a much more realistic reproduction of sound because of the increased number of sidebands.

Procedure: -

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.

Selectivity: -

The ability to reject adjacent unwanted signals. The spacing between the carrier frequencies allocated to different transmitters is limited by the available frequency spectrum. e.g. 9 kHz for broadcast in the medium waveband. The selectivity of a receiver is its ability to reject signals at carrier frequencies adjacent to the wanted carrier frequency. In the superheterodyne receiver see later) the selectivity is mainly determined by the gain versus frequency characteristics of the IF amplifier. The **adjacent channel** ratio is the ratio, in decibels of the input voltages at the wanted and adjacent channel signal frequencies necessary to produce the same output power.

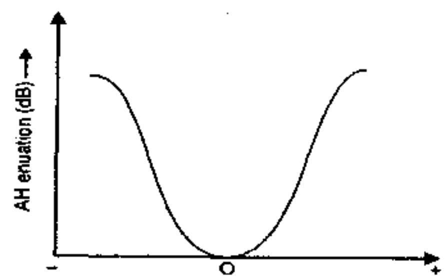


Fig. 5

Procedure:

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. changing the carrier frequency at 805, 810, 815 and 795, 790, 785 KHz.
7. Plot a graph of carrier frequency of AM signal Vs the amplitude of the output signal (Vo Vs fc).

Sensitivity: -

The ability to receive very small signals and produce an output of satisfactory signal to noise ratio. Usually expressed as the minimum input signal (generally in micro volts), modulated at 400 Hz required to produce 50 mW output power with a signal to noise ratio of 15 dB It is necessary to include a signal to noise in the measurement of sensitivity because it would otherwise be possible for the output power to consist mainly of noise.

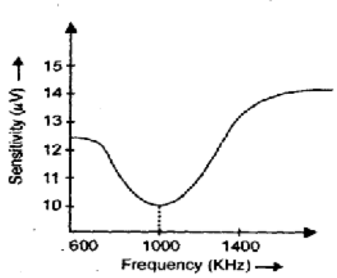


Fig. 4

Procedure:-

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. Vary the amplitude of the AM signal to get a standard value of output voltage (Volts). All the other parameters are kept constant (i.e., fc, fm, m). Note the change in the amplitude of the output signal.
7. Plot a graph of amplitude of input signal v/s carrier frequency of AM signal (Vi v/s fc).

Fidelity: -

The ability to preserve the exact shape of the information envelope of the carrier while the signal progresses through the receiver circuits

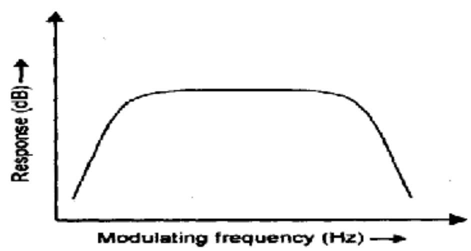


Fig. 6

Procedure:-

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. Vary the frequency of the modulating signal keeping all other parameters constant (i.e., fc, VAM, m). Note the change in the amplitude of the output signal.
7. Plot a graph of amplitude of output signal Vs frequency of the modulating signal (Vo Vs fm).

Result:-