3. AM MODULATOR AND DEMODULATOR

AIM:

To transmit a modulating signal after amplitude modulation using AM transmitter and receive the signal back after demodulating using AM receiver.

APPARATUS REQUIRED:

S.No.	Name of the Equipment/ Component	Range	Quantity
1.	AM Transmitter kit - ACL 01	-	1
2.	AM Receiver kit - ACL 01	-	1
3.	CRO	30 MHz	1
4.	Power supply	5V, ±12V	1
5.	Patch chords	-	Required

THEORY:

MODULATION THEORY:

Modulation is defined as 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. The carrier frequency fc must be much greater than the highest frequency components fm of the message signal m (t) i.e. fc>>fm. The modulation index must be less than unity. If the modulation index is greater than unity, the carrier wave becomes over modulated.

The modulating, carrier and modulated signals are given by

$V_m(t) = V_m \sin\omega_m t$; $V_C(t) = V_C \sin\omega_C t$; $V_{AM}(t) = V_C (1+m_a \sin\omega_m t) \sin\omega_C t$

The modulation index is given by, $m_a = V_m / V_C$.

$$V_m = V_{max} - V_{min} \text{ and } V_C = V_{max} + V_{min}$$

The amplitude of the modulated signal is given by,

Where V_m = maximum amplitude of modulating signal, V_C = maximum amplitude of carrier signal, V_{max} = maximum variation of AM signal, V_{min} = minimum variation of AM signal

DEMODULATION THEORY:

Demodulation is the reverse process of modulation. The detector circuit is employed to separate the carrier wave and eliminate the side bands. Since the envelope of an AM wave has the same shape as the message, independent of the carrier frequency and phase, demodulation can be accomplished by extracting envelope. The depth of modulation at the detector output

greater than unity and circuit impedance is less than circuit load (Rl>Zm) results in clipping of negative peaks of modulating signal. It is called "negative clipping ".

TABULATION:

Parameter	Amplitude (V)	Time Period in seconds	Frequency in Hz
Message signal			
Carrier signal			
Modulated signal			
Demodulated signal			

Calculation of modulation index:

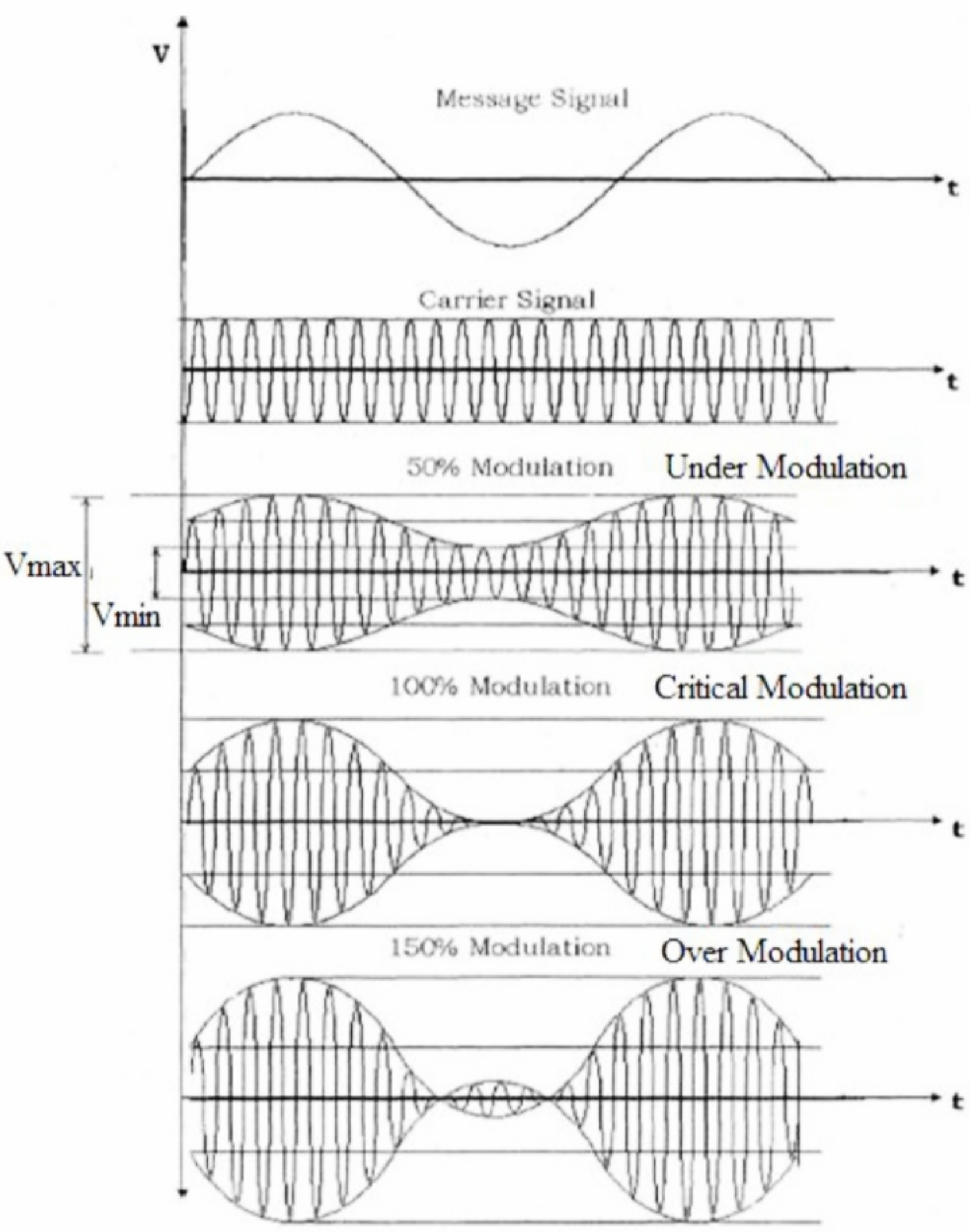
Practical calculation

$$MI = \frac{V\ max - Vmin}{Vmax + Vmin}$$

Theoretical calculation

$$MI = \left(\frac{Vc}{Vm}\right) * 100$$

MODEL GRAPH:



PROCEDURE:

1. The circuit wiring is done as shown in diagram
2. A modulating signal input given to the Amplitude modulator
3. Now increase the amplitude of the modulating signal to the required level.
4. The amplitude and the time duration of the modulating signal are observed using CRO.
5. Finally the amplitude modulated output is observed from the output of amplitude modulator stage and the amplitude and time duration of the AM wave are noted down.
6. Calculate the modulation index by using the formula and verify them.

7. The final demodulated signal is viewed using CRO at the output of audio power amplifier stage. Also the amplitude and time duration of the demodulated wave are noted down.

VIVA QUESTIONS:

1. What is the need of modulation and demodulation?
2. What is the range of frequency in commercial AM broadcasting?
3. What is analog modulation various techniques?
4. What is the difference between detector and demodulator?
5. Define the term Modulation index.
6. What are the main components of a RF receiver?
7. What is the Difference between Coherent and Non-coherent Demodulation?
8. Why the Intermediate Frequency Should is Carefully Chosen As?
9. What is the function of an Automatic Gain Control of the AM Receiver?
10. Define Amplitude Modulation?

RESULT:

Thus the AM signal was transmitted using AM trainer kit and the AM signal detected using AM detector kit. The calculated modulation index ma = _____.