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Prac:- ***6***

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Practical 6

Aim: To study the function of Amplitude Modulation and to calculated the modulation index.

Student Group Detail :- Dwij Desai , Kishna Patel and Trivedi Sanjari.

Apparatus:

1. C.R.O (20MHz)
2. Function generator (1MHz).
3. Connecting cords & probes.

Description:

Amplitude modulation can be produced by a circuit where the output is product of two input signals. Multiplication produces sum and difference frequencies and thus the side frequencies of the AM wave. Two general methods exist for achieving this multiplication, one involves a linear relation between voltage and current in a device and the second uses a linear device. A linear form of modulation of modulation causes a current I, of one frequency to pass through an impedance Z, whose magnitude varies at a second frequency. The voltage across this varying impedance is then given by

E = I sin1t * z sin2t

The above equation is the output is a result of multiplication of two frequencies. If one of them is carrier frequency and the other is the modulating frequency the result is an AM waveform. Modulated signal: The signal resulting from the process of modulation is referred to as modulated signal. Amplitude modulation is defined as a system of modulation in which the amplitude of the carrier is made proportional to the instantaneous amplitude of the modulating voltage . In AM, the amplitude of the carrier is varied by the modulating voltage. Whose frequency is lower than that of the carrier.

Let the carrier voltage Vc, the modulating voltage Vm represented as

Vc (t) = Vc sin(2πfct)

vm(t) = Vm sin(2πfmt)

Modulation Index = Vm / Vc

Modulation index in terms of Vmax and Vmin

Modulation Index =Vmax – Vmin / Vmax + Vmin

Because

Vm = Vmax – Vmin / 2

Vc = Vmax + Vmin / 2

Modulation index is lies between 0&1.

An AM wave described in its generated form as a function of time as follows:

$S(t) = Ac[1+Ka*m(t) \cos 2\pi fc\ t]$

Modulus of (Ka*m(t)) is less than 1. It ensures that the function (1+ Ka*m(t)) is always positive. The carrier frequency is much greater than the modulating frequency.

In a communication system a high frequency carrier is modulated by the low frequency signal. The modulated carrier is transmitted by the transmitter antenna. At the receiver we have to recover the information back from the modulated carrier. The process of separation of signal from the carrier is called demodulation or detection. the demodulation circuit diagram is a linear diode detector. In this circuit the linear portion of dynamic characteristics of diode is used and hence the circuit is a linear detector. It consists of a half wave rectifier followed by a capacitor input filter. Input to the circuit is an AM wave with a high frequency carrier and a low frequency envelope corresponding to the signal. The diode cuts-off the negative going portion of the AM wave. Capacitor „C" charges up to the peak of the carrier cycle through the low resistance rd and then during negative half cycle tries to discharge through relatively high resistance RL. Capacitor value is so chosen that this discharge is very small in time between carrier half cycles. Hence the capacitor voltage tends to follow the envelope of the carrier and the voltage available across RL is simply the modulation envelope superimposed on a constant level. A dc level in the output comes because the current through diode flows in the form of pulses occurring at the peak of each carrier cycle.

When the input to detector circuit is a AM waveform then the one of the component in VR cannot be assumed to be constant all the time. Actually it is constant over a few cycles of carrier in which time it is assumed that modulating signal being low frequency would not have changed appreciably. Due to this reason the measurement of detection efficiency can be done on an un modulated carrier because VR would be expected to be constant

Procedure:

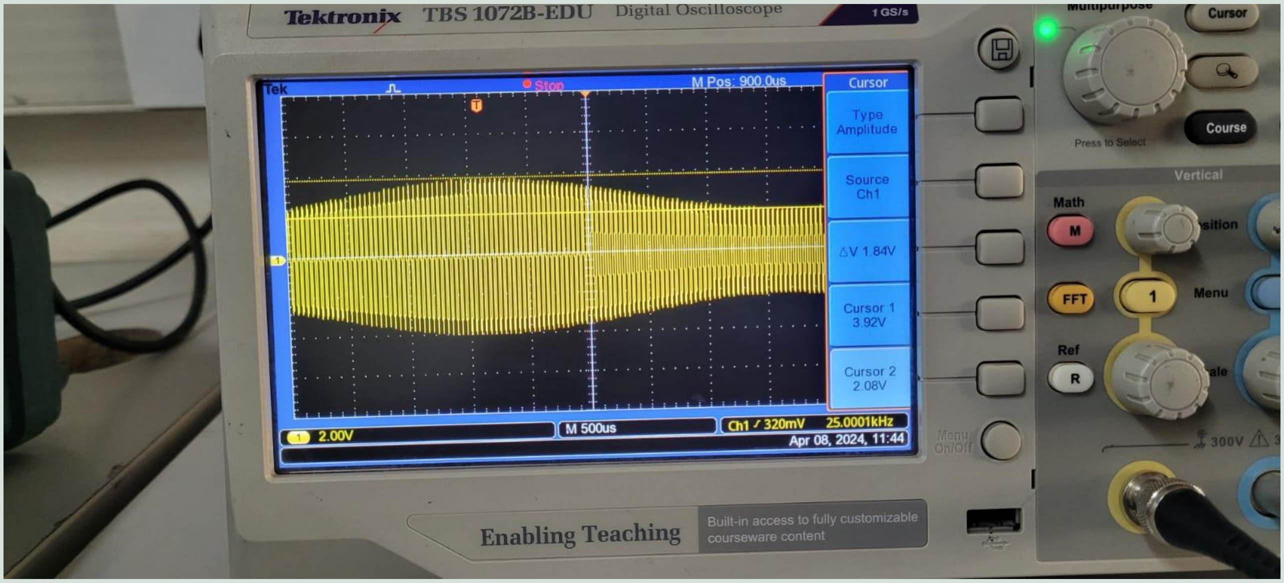
1. Measure the frequency & amplitude (p-p) of the fixed carrier signal present on the kit.
2. Connect the circuit as per the given circuit diagram.
3. Apply fixed frequency carrier signal to carrier input terminals.
4. Apply modulating signal from function generator of 1VP-P of 500Hz.
5. Note down and trace the modulated signal envelop on the CRO screen.
6. Find the modulation index by measuring Vmax and Vmin from the modulated (detected/traced) envelope.

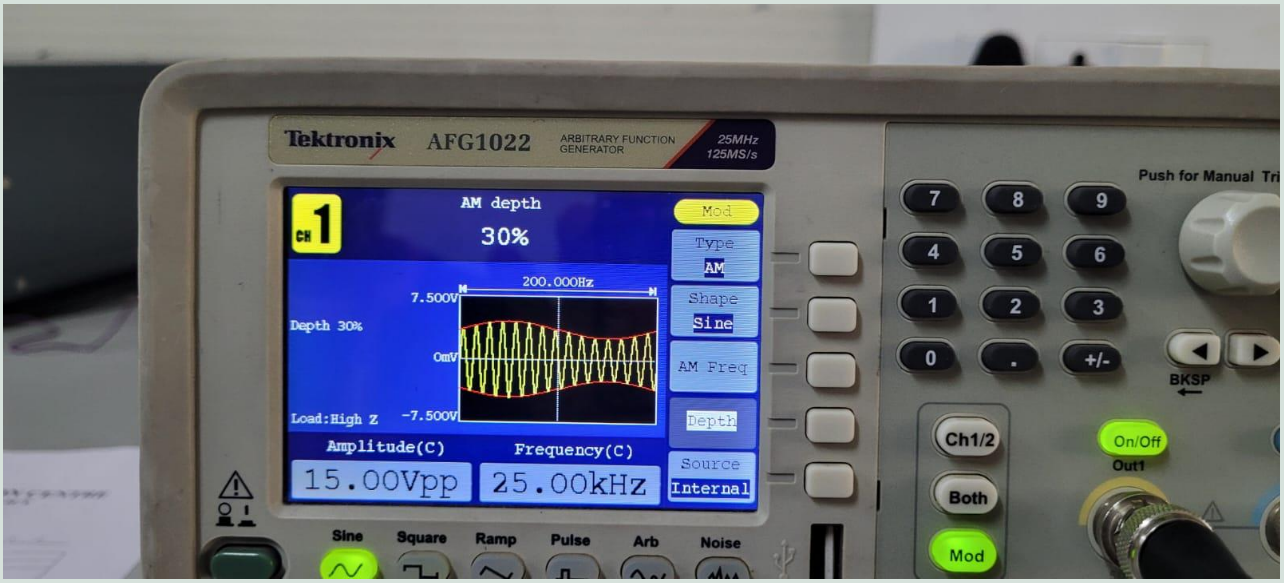
Modulation Index =Vmax – Vmin / Vmax + Vmin

7. Repeat the steps 5 & 6 by changing the frequency or/& amplitude of the modulating signal so as to observe over modulation, under modulating and perfect modulation.

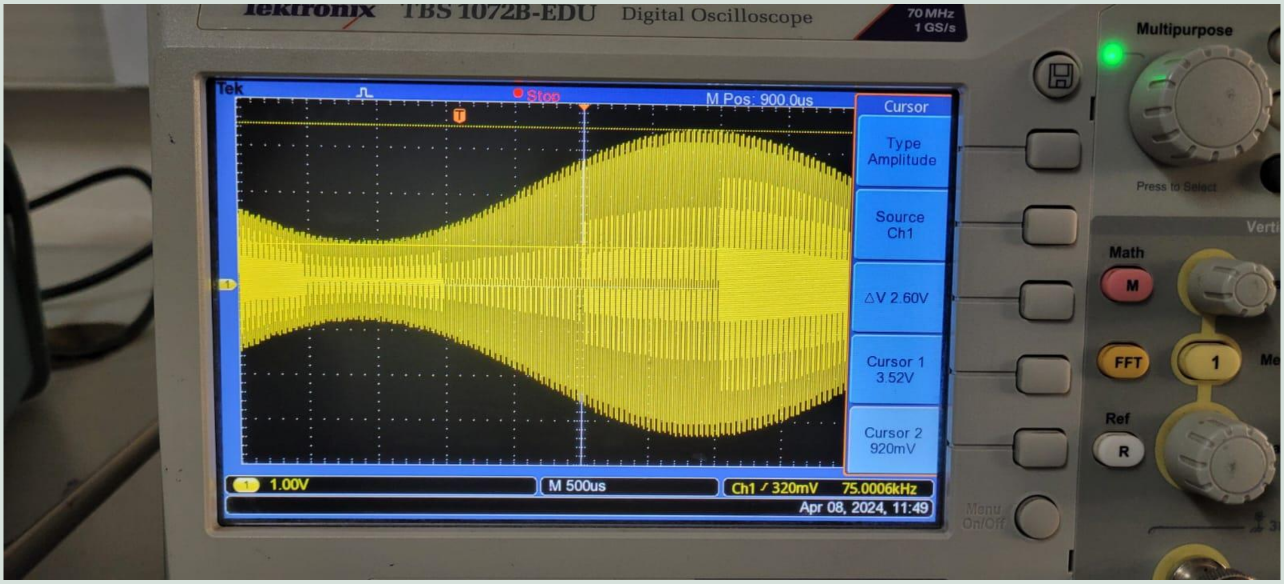
PRACTICAL SCREENSHOT:-

CASE 1 :- [Done by Trivedi Sanjari](less then 50%)

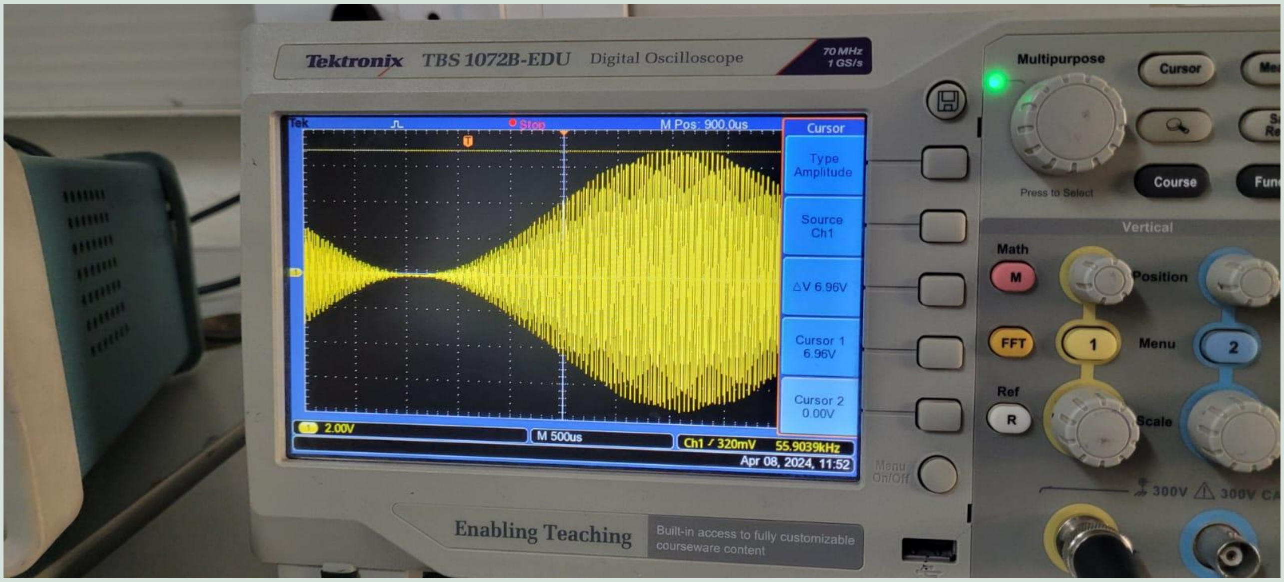


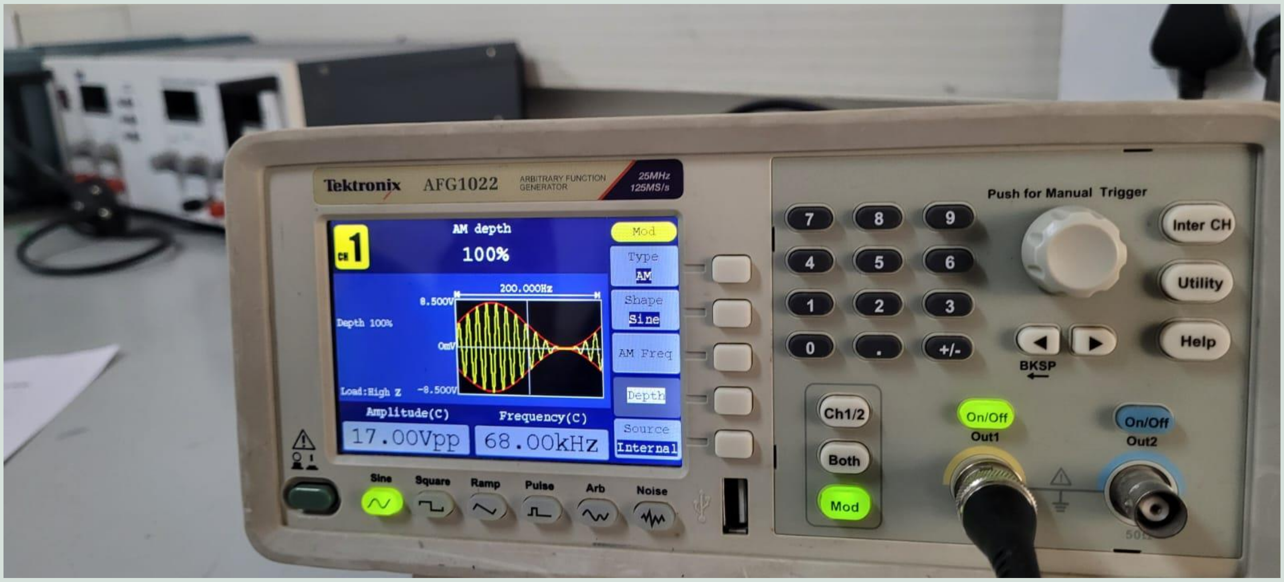


CASE 2 :- [Done by Dwij Desai](more then 50%)



CASE 3 :- [Done by Kishna Patel](at 100%)

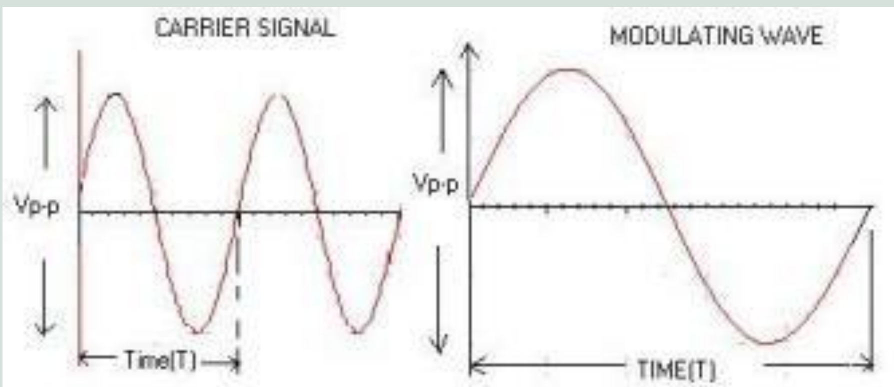


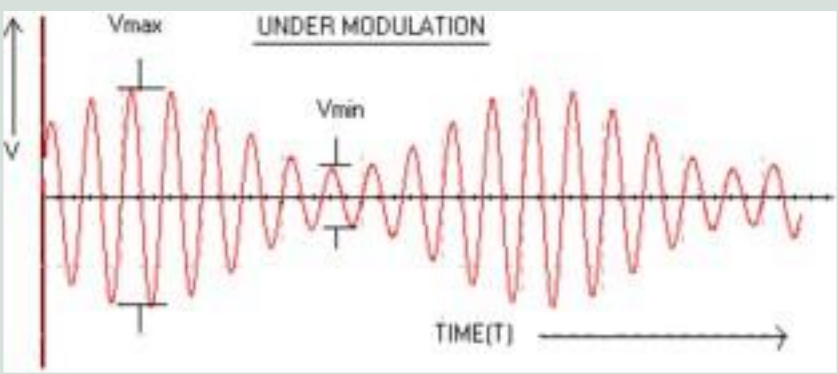


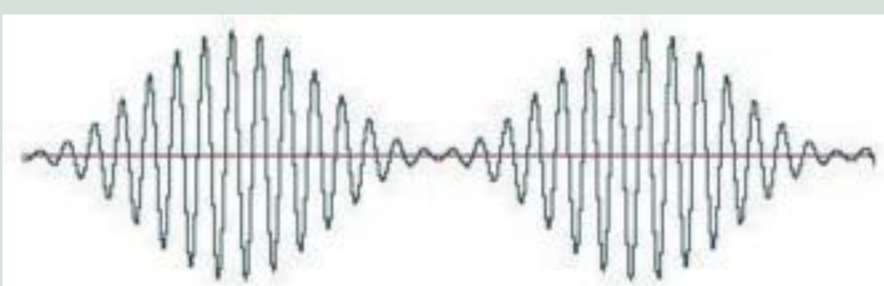
Observation Table:

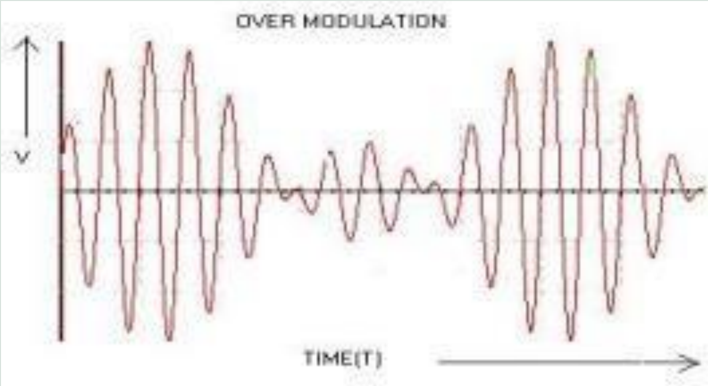
Modulation	Vmax	Vmin	Vmax-Vmin	Vmax+Vmin	$M = \frac{Vmax-Vmin}{Vmax+Vmin}$
Case 1	3.92 V	2.60 V	1.84 V	6.56 V	1.84/6.56=0.306 =30.6%
Case 2	4.04 V	1.20 V	2.8 V	5.2 V	0.59 ~ 60%
Case 3	6.96 V	0 V	6.96 V	6.96 V	1.0 = 100%

Expected Waveform :-

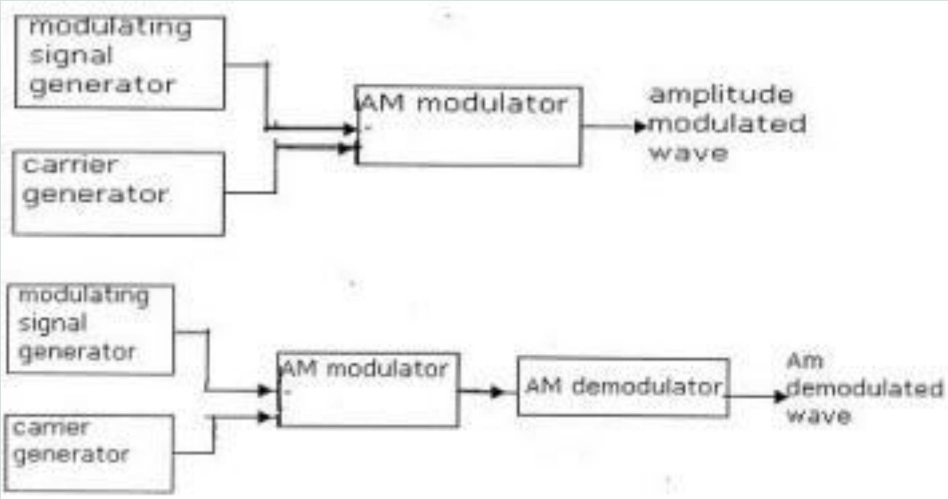








Block Diagram :-



Post Practical questions:

1. Why modulation is needed?

A. Modulation and its types prevent the interference of the message signal from other signals. It is because a person sending a message signal through the phone cannot tell such signals apart. As a result, they will interfere with each other.

2. What are different types of analog modulation techniques?

A. The following techniques—amplitude modulation, frequency modulation, and phase modulation—are analog modulation techniques. That is, they work by modulating a continuous carrier wave, rather than a signal encoded in binary digits as with digital techniques.