LAB - 1

AMPLITUDE MODULATION AND DEMODULATION

1.1 OBJECTIVE

In this lab, you will learn how to perform the amplitude modulation and demodulation and to calculate the modulation index for various modulating voltages.

1.2 HARDWARE REQUIRED

Transistor BC108, Resistors, Capacitors, AFO, CRO, Diode 0A79, Multimeter, Regulated power supply, Breadboard and connecting wires.

1.3 PREPARATION (PRE-LAB)

Do the complete revision of Amplitude modulation and Demodulation and find the modulation index for the modulating voltage of 6v and given Vc=60mv, fc=500 KHz, fm=1KHz.

1.4 AMPLITUDE MODULATION

1.4.1 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.

Amplitude modulation is defined as the process in which is the amplitude of the carrier wave is varied about a means values linearly with the base band signal. The envelope of the modulating wave has the same shape as the base band signal provided the following two requirements are satisfied

1. The carrier frequency fc must be much greater then the highest frequency components fm of the message signal m (t) i.e.   fc >> fm

2. The modulation index must be less than unity. if the modulation index is greater than unity, the carrier wave becomes over modulated.
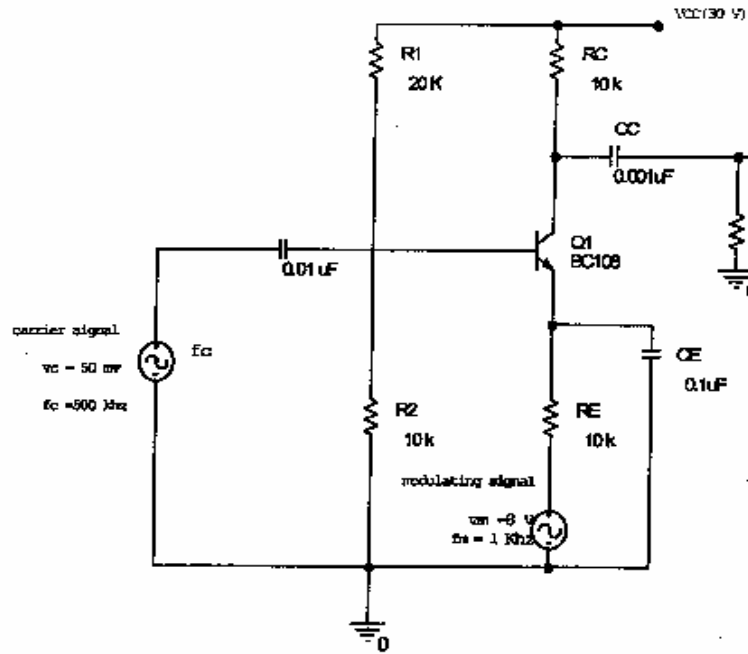
1.4.2 Circuit diagram
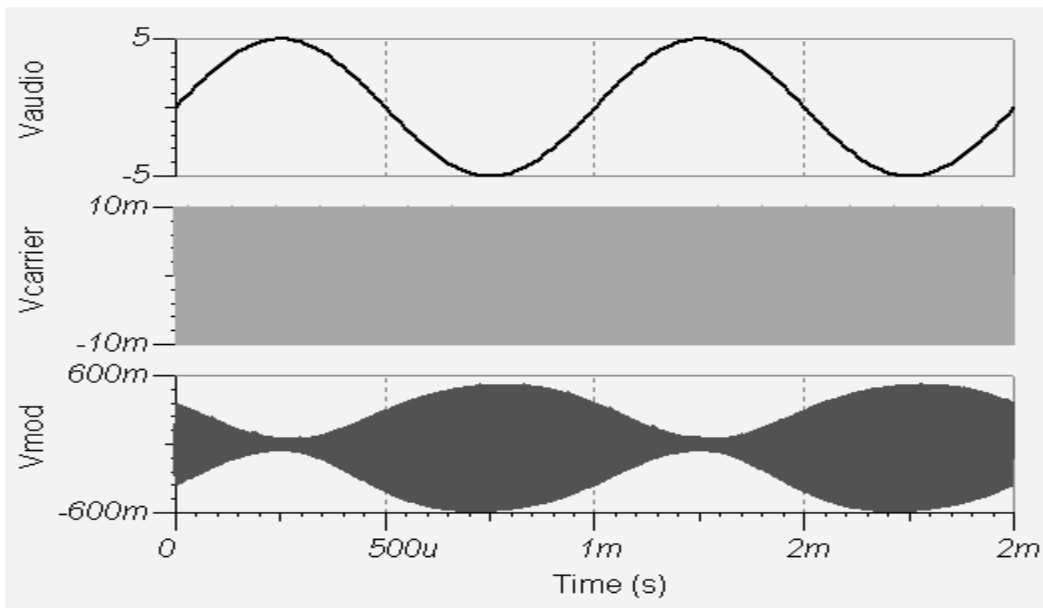
AMPLITUDE MODULATION

Fig 1-1 Amplitude modulation

Fig 1-2 Amplitude modulation model graph

1.4.3 Design procedure

Given V_C = 50mV, f_c = 500 KHz, f_m = 1KHz.

Set modulating voltage V_m = 10 V.

E_{max} = 1.6 V, E_{min} = 0.7 V

Modulation index (m) = $\dfrac{E_{max} ? E_{min}}{E_{max} ? E_{min}} X100$ = 39.13%

1.4.4 Test procedure

1. The circuit connection is made as shown in the circuit.
2. The power supply is connected to the collector of the Transistor.
3. Modulated Output is taken from the collector of the Transistor.
4. Calculate E_{max} and E_{min} from the output waveform.

1.5 AMPLITUDE DEMODULATION

**1.5.1 Theory**

The process of detection provides a means of recovering the modulating Signal from modulating signal. 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.

An increased time constant RC results in a marginal output follows the modulation envelope. A further increase in time constant the discharge curve become horizontal if the rate of modulation envelope during negative half cycle of the modulation voltage is faster than the rate of voltage RC combination ,the output fails to follow the modulation resulting distorted output is called as diagonal clipping : this will occur even high modulation index.

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 "

1.5.2 Circuit diagram

AM DETECTOR
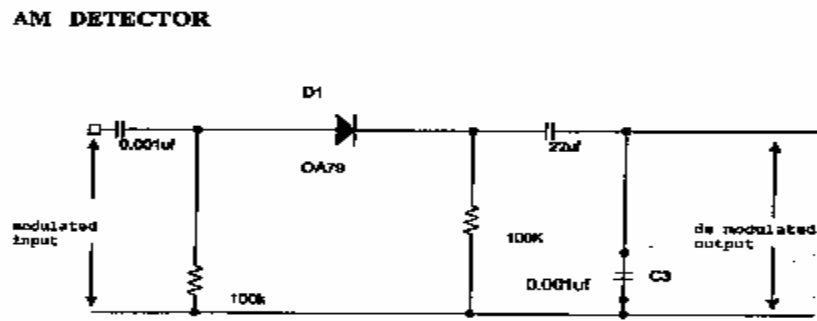
Fig. 1-3 Amplitude Demodulation

MODEL GRAPH
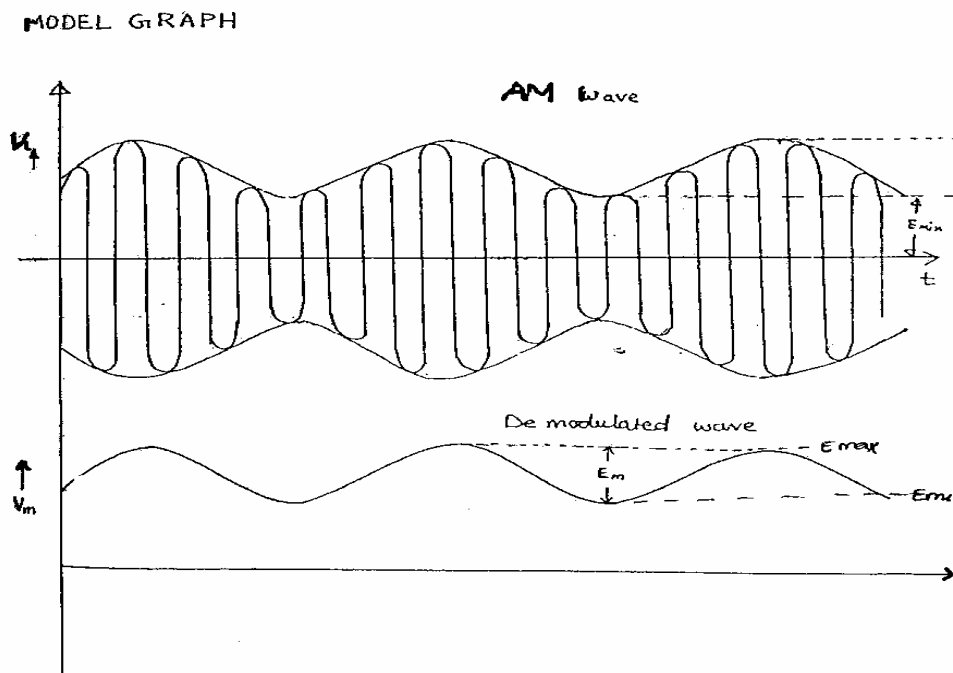
Fig. 1-4 Amplitude Demodulation Waveform

1.5.3 TEST PROCEDURE

1. The circuit connections are made as shown in the circuit diagram.

2. The amplitude modulated signal from AM generator is give as input to the circuit.

3. The demodulated output is observed on the CRO.

4. The various values of modulating voltage signal frequency corresponding demodulated voltage and freque ncy are noted and the readings are tabulated.

1.6 LAB RESULT

Thus the amplitude modulation and demodulation were performed and the modulation index for various modulating voltage were calculated.

1.7 POST LAB QUESTIONS

1. Based upon your general knowledge of AM and FM broadcasting by listening to the radio name the frequency occupied by AM and FM broadcast stations?
2. What will happen, if modulation index is greater than 100%?
3. Audio signals are not transmitted by electromagnetic waves. Justify the statement.
4. An amplitude modulated amplifier has a radio frequency output of 50w at 100% modulation. The internal loss in the modulator is low. What output power is required from the modulator?
5. In what stage modulation is done in high – power A.M transmissions?

ASSESSMENT

Prelab   : 30 marks
(design (10), circuit (10), tabulation (10))
Lab performance   : 30 marks
Viva-voce   : 15 marks