1. Amplitude Modulation & Demodulation

Aim: 1. To generate amplitude modulated wave and determine the percentage modulation.

2. To Demodulate the modulated wave using envelope detector.

Apparatus Required:

Name of the Component/Equipment	Specifications/Range	Quantity
Transistor(BC 107)	f_T = 300 MHz P_d = 1W I_c(max) = 100 mA	1
Diode(0A79)	Max Current 35mA	1
Resistors	1KΩ, 2KΩ, 6.8KΩ, 10KΩ	1 each
Capacitor	0.01µF	1
Inductor	130mH	1
CRO	20MHz	1
Function Generator	1MHz	2
Regulated Power Supply	0-30V, 1A	1

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

$$s(t) = A_c\left[1 + K_a m(t)\cos(2\pi f_c t)\right]$$

Where K_a 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 envelop 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 receivers.

The Modulation Index is defined as, m = $\dfrac{(E_{max} - E_{min})}{(E_{max} + E_{min})}$

Where E_{max} and E_{min} are the maximum and minimum amplitudes of the modulated wave.

Circuit Diagrams:

For modulation:

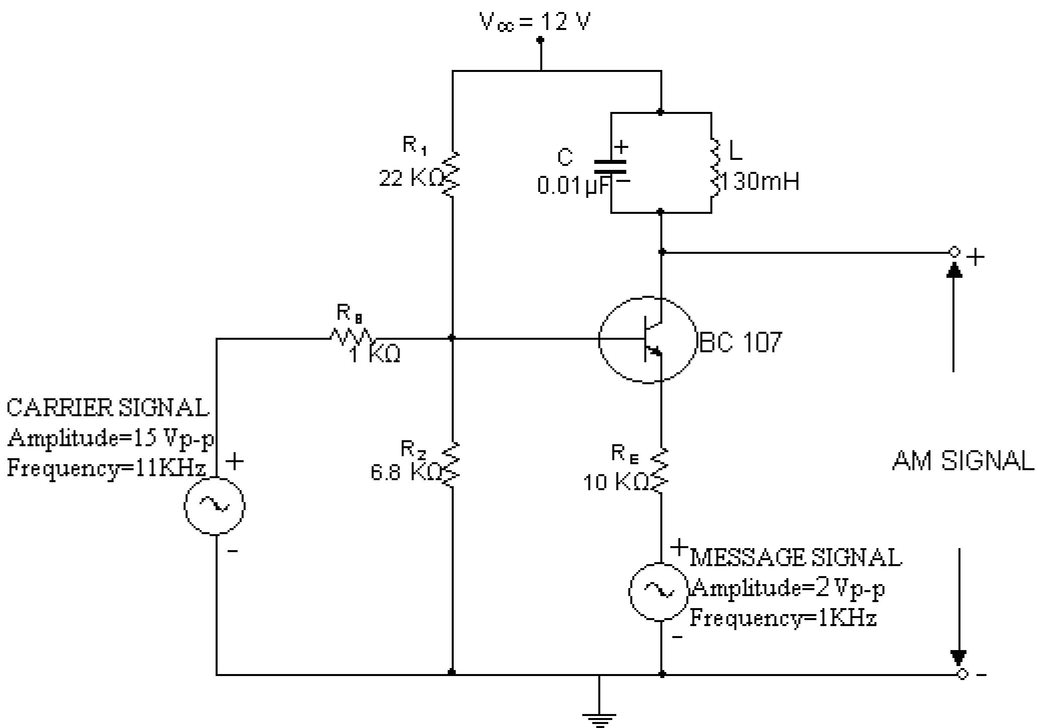


Fig.1. AM modulator

For demodulation:

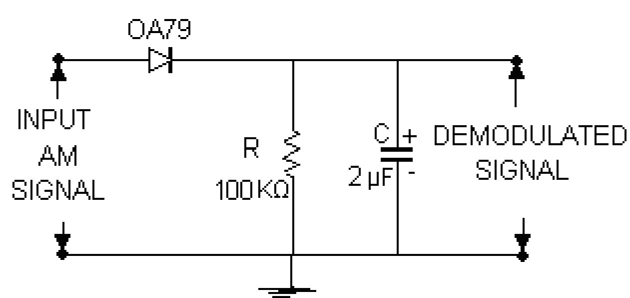


Fig.2. AM demodulator

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. Find the value of R from $f_m = \frac{1}{2\pi RC}$ taking C = 0.01μF
9. Connect the circuit diagram as shown in Fig.2.
10. Feed the AM wave to the demodulator circuit and observe the output
11. Note down frequency and amplitude of the demodulated output waveform.
12. Draw the demodulated wave form .,m=1

Observations

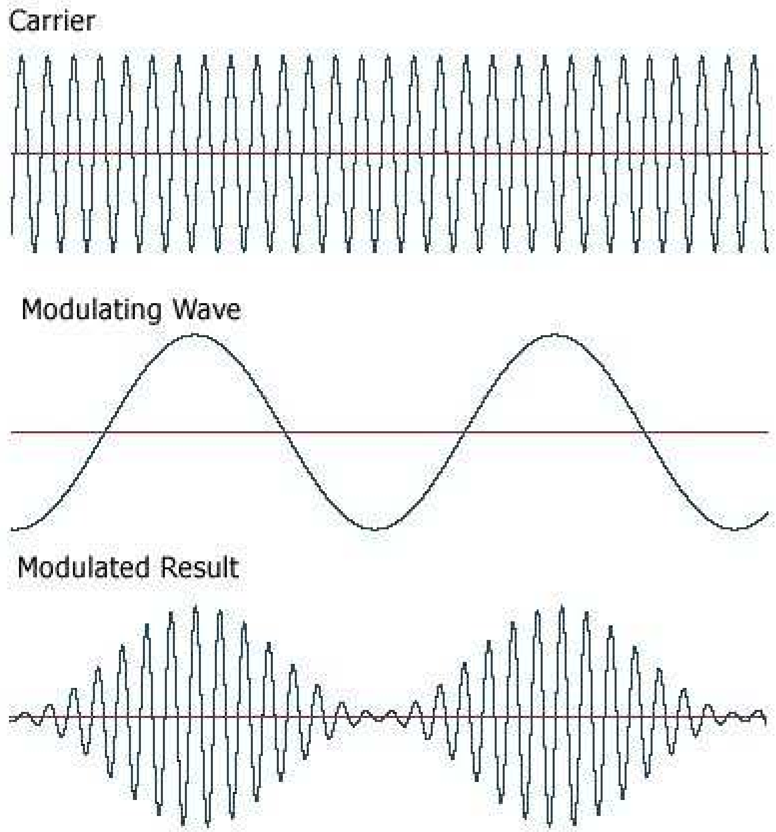
Table 1: f_m= 1KHz, f_c=11KHz, A_c=15 V p-p.

S.No.	V_m(Volts)	E_{max}(volts)	E_{min} (Volts)	m	%m (m x100)

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

S.No.	f_m(KHz)	E_{max}(volts)	E_{min}(Volts)	m	%m (m x100)

Waveforms and graphs:



Precautions:

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