1. STUDY OF AMPLITUDE MODULATION (AM)

1. Course, Subject & Experiment Details

Academic Year	2018 – 2019	Estimated Time	Experiment No. 1 – 02 Hours
Course & Semester	S.E. (COMP) – Sem. III	Subject Name	Basic Electronics Lab
Chapter No. & Unit	04 – Unit 4.1	Chapter Title	Amplitude Modulation (AM)
Experiment Type	Hardware (Trainer Kits)	Subject Code	CSL 302

2. Aim & Objective of Experiment

This experiment enables the students to perform amplitude modulation (AM) on a high frequency carrier signal of certain amplitude & frequency, thereby observing the actual output amplitude modulated (AM) waveform. It also teaches them how to calculate the modulation index or modulation coefficient (m_a) for different amplitude values of the modulating signal (V_m) & carrier signal (V_c) using hardware approach.

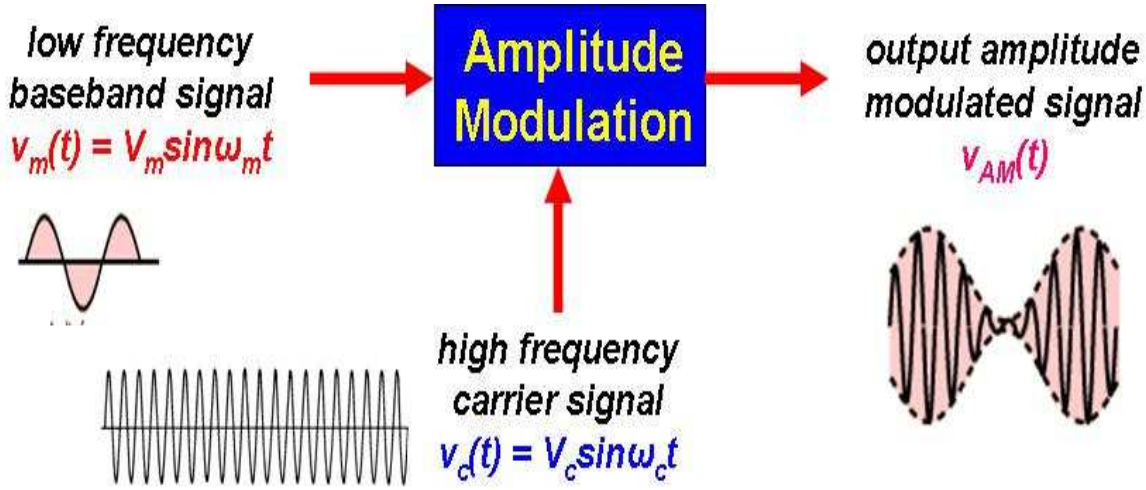
3. Expected Outcome of Experiment

The expected outcomes of this experiment include basic understanding of the process of amplitude modulation (AM) which is performed by both, hardware set-up & by using software simulation tools. The students are also expected to have a good hands-on practice of observing the output amplitude modulated (AM) waveform for the different values of modulation index or coefficient (m_a) understanding the practical process of AM generation.

4. Brief Theoretical Description

(a) Definition of Amplitude Modulation (AM) :-

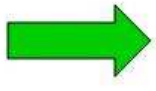
Amplitude modulation (AM) is analog modulation technique in which the amplitude of the high frequency carrier signal waveform is varied proportionally with respect to the instantaneous amplitude of modulating or baseband input signal, keeping the phase & frequency of the carrier signal constant. Here both the input modulating & the carrier signals are analog in nature, being low frequency & high frequency respectively.



(b) Definition of AM Modulation Index (m_a):-

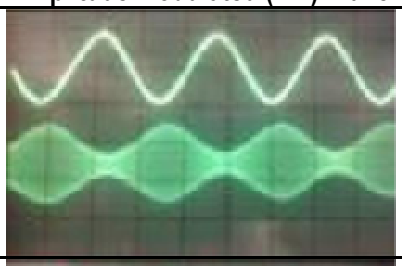
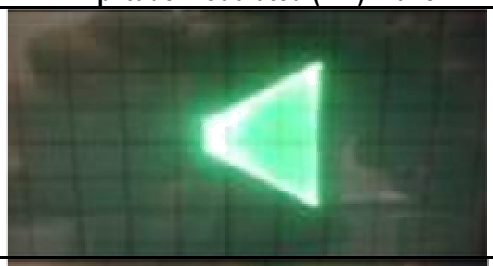
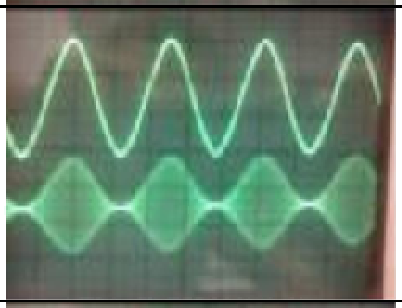
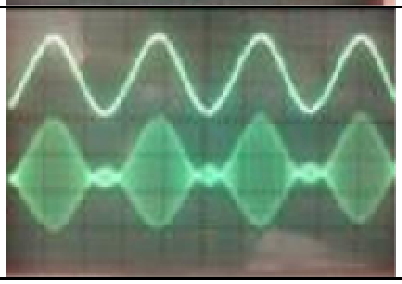
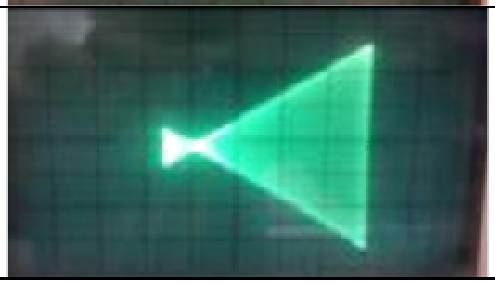
Modulation index, also called modulation coefficient or modulation factor & often expressed as percentage, is the depth of modulation of the carrier signal amplitude (V_c) by the instantaneous amplitude of the modulating signal (V_m) & is simply the ratio of the carrier signal peak amplitude to the modulating signal peak amplitude

$$m_a = \frac{V_m}{V_c}$$



mathematical definition of modulation index (m_a)

5. Nature of Output Waveforms (AM)

No.	Modulation Index (m_a)	Time Domain Representation of Amplitude Modulated (AM) Wave	Trapezoidal Pattern (X – Y Mode of CRO) Amplitude Modulated (AM) Wave
1.	$m_a < 1$		
2.	$m_a = 1$		
3.	$m_a > 1$		

6. Apparatus Required

- DSB / SSB Amplitude Modulation (AM) Transmitter Trainer Kit
- Cathode Ray Oscilloscope (CRO)
- Patch Cords & CRO Probes
- AC Power Supply – 230 V & 50 Hz

7. Experimental Procedure

1. Connect & turn on the power supply to the amplitude modulation (AM) trainer kit.
2. Make appropriate connections as per the instruction manual & obtain AM wave on CRO.
3. Adjust both frequency & amplitude of modulating & carrier signals & observe AM wave.
4. In the time domain, measure maximum & minimum amplitudes (V_{max} & V_{min}) of AM wave.
5. From above values, measure amplitude modulation (AM) modulation index (m_a) for each.
6. Observe the trapezoidal pattern on the X – Y mode of CRO for each AM waveforms.
7. In X – Y mode, calculate the maximum & minimum (a & b) values of trapezoidal pattern.
8. Measure the AM modulation index (m_a) for each type of waveform seen on the CRO.
9. Compare the modulation indices in time-domain & trapezoidal mode for each AM wave.

8. Observation Table

No.	Time Domain Description		Modulation	Trapezoidal Method (X – Y Mode)		Modulation
	V_{max}	V_{min}	Index (m_a)	A	B	Index (m_a)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

9. Conclusions & Inferences

Students should explain in brief the concluded outcome from the experiment & its inference, as obtained from the observation table & the nature of the graph which explains the system behavior

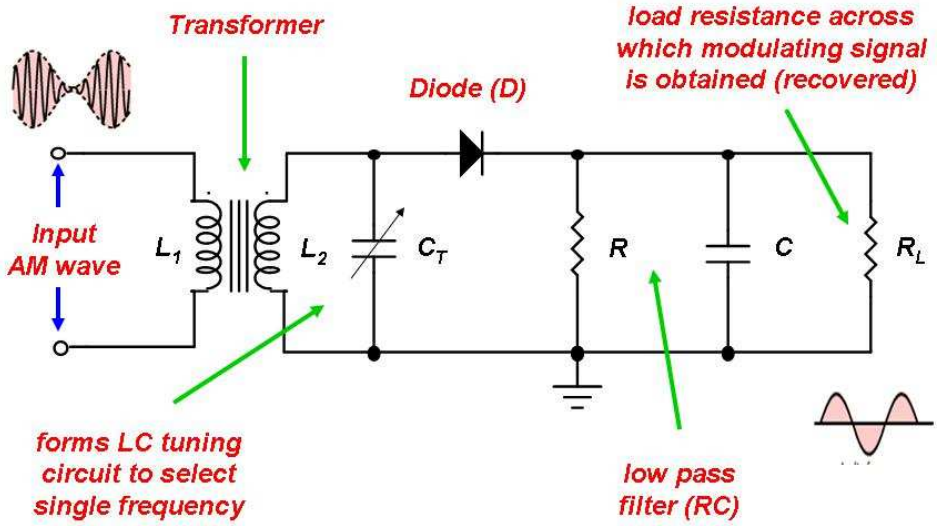
10. Practical & Real Life Applications

- Commercial (AM) Radio Broadcasting from 540 kHz to 1640 kHz
- Picture Transmission (Video Signal) in TV Broadcasting

11. Post Lab & Viva Questions

1. With a 25 V peak & 10 kHz carrier signal amplitude modulated simultaneously by linear combination of three modulating signals of 5 V, 10 V & 25 V peak amplitudes at respectively 1 kHz, 2 kHz & 5 kHz, obtain output equations of AM waveform, calculate & draw frequency spectrum, obtain expression for bandwidth.

2. The diagram below shows AM diode detector for demodulation of amplitude modulated (AM) waveform to recover the input baseband (modulating) signal. Explain the operation of entire circuit with all appropriate waveforms drawn at every necessary point.



3. Explain following characteristics (parameters or specifications) of radio receivers – sensitivity, selectivity, fidelity, image frequency & rejection, double spotting effect in detail wherever necessary.

4. With neat diagram & appropriate waveforms, explain the different types of distortions taking place in the AM diode detector & how they can be overcome to regenerate the input modulating (baseband) signal.

5. Draw & explain basic block diagram of tuned radio frequency (TRF) receivers. What were disadvantages of TRF receivers & also explain how these drawbacks / limitations could be overcome.

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