

**Shri G.S. Institute of Technology & Science, Indore**  
**Department of Electronics & Telecommunication Engineering**



**Electronics Workshop  
(EC 25568)**

**Session- Aug 2022-Apr 2023**

**A Project Report on**

**“AM MODULATOR”**

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## **CERTIFICATE**

This is to certify that the following students:

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studying in B.Tech. 2<sup>nd</sup> year in session 2022-2023, have successfully completed the project “AM MODULATOR” of the Electronics Workshop and have submitted a report having satisfactory details of it.

**Date:-**

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## **ACKNOWLEDGEMENT**

We would like to take this opportunity to express our gratitude to all those people who have helped us in our project, for their valuable guidance and experience which they poured on us in right direction. Their persistent encouragement, everlasting experience and valuable inspiration helped us a lot in molding the present shape of the project.

We would like to express gratitude to our staff members for their support too.

## **INDEX**

- 1) INTRODUCTION
- 2) WORKING PRINCIPLE
- 3) CIRCUIT DIAGRAM
- 4) COMPONENTS USED
- 5) COMPONENT DETAILS
- 6) WORKING OF CIRCUIT
- 7) PCB LAYOUT
- 8) IMAGE OF HARDWARE
- 9) CONCLUSION
- 10) BIBLIOGRAPHY

## **INTRODUCTION**

The **AM modulation** is a kind of modulation technique which is in use since the very early days of wireless data transmission. In a radio transmission system there is a relation between the ranges of frequencies which can be transmitted wirelessly with the length of the transmitting antenna. The relation is inversely proportional to one another, means as the frequency of the signal to be transmitted increases the length of the antenna can be reduced and as the frequency of the signal to be transmitted decreases the length of the transmitting antenna should be increased accordingly.

The amplitude modulation is the simplest modulation technique among the wide variety of modulation techniques in use. The amplitude modulation of a high frequency signal is easy to achieve and the demodulation is also simple compared to other techniques. The high frequency signal which is modulated to carry the low frequency audio signals are called '**carrier frequency**' and the audio signals used for modulation is called 'modulating signal' or '**message signal**' or 'base band signal'.

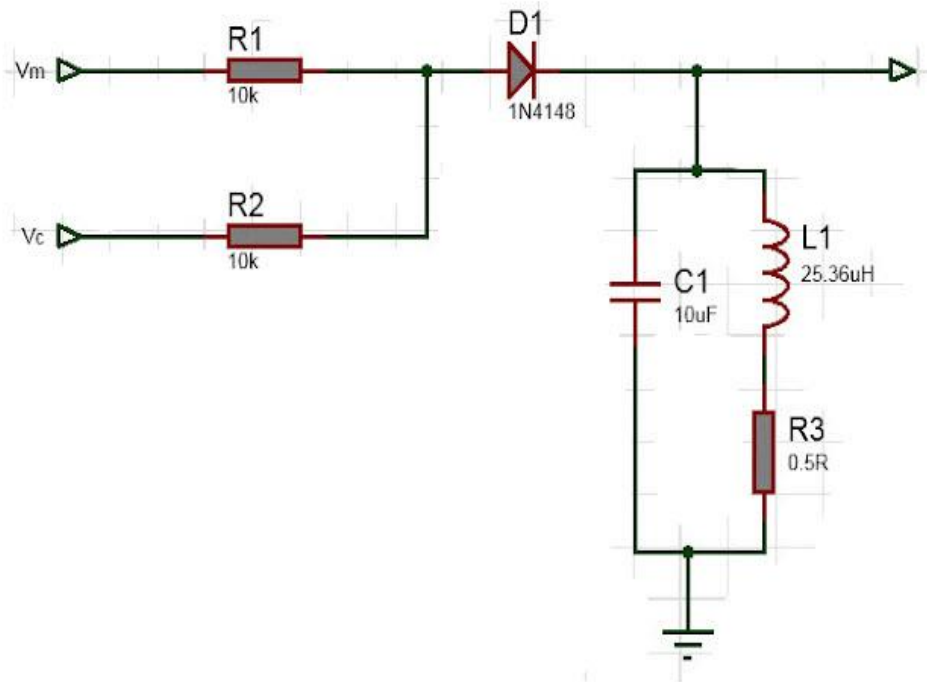
The modulation process involves varying the amplitude of the carrier wave in proportion to the amplitude of the information signal. This can be achieved using different modulation techniques such as double sideband suppressed carrier (DSB-SC), single sideband (SSB), or vestigial sideband (VSB).

## **WORKING PRINCIPLE**

The basic principle behind AM modulation can be explained as follows:

1. The message signal is an analog signal, typically a voice or music signal, with a frequency range of 20 Hz to 20 kHz.
2. The carrier signal is a high-frequency sine wave with a fixed frequency typically in the range of 500 kHz to 1.5 MHz.
3. The modulator circuit multiplies the message signal with the carrier signal, resulting in an output signal with varying amplitude. This output signal is the modulated signal.
4. The modulated signal contains the original message signal as well as the carrier signal.
5. The modulated signal is then amplified and transmitted over a communication channel, such as a radio or television broadcast.
6. At the receiver end, the modulated signal is demodulated to recover the original message signal.

# CIRCUIT DIAGRAM



## **COMPONENTS USED**

<b>Sr.</b>	<b>Name of components</b>	<b>Specifications</b>	<b>Quantity</b>	<b>Cost per piece (in Rs.)</b>
1.	Resistor1	10k $\Omega$ , ¼ W	2	2/-
2.	Resistor2	0.47 $\Omega$ , ¼ W	1	2/-
3.	Diode	1N4148	1	5/-
4.	Capacitor	Electrolytic 25V, 10uF	1	6/-
5.	Inductor	22uH	1	5/-
6.	PCB	3.9 x 3.9 inch	1	30/-



## **COMPONENT DETAILS**

- Diode - 1N4148 diode is a Zener high-speed switching diode with small size and fast switching. Its applications mainly include single supply isolation for high-frequency signal circuits, industrial control circuits, computer boards, communication, TV.
- Inductor - 22uH inductor used is an axial inductor is also referred to as a color ring inductor. It is a two-terminal passive electronic component that is used for filtering, tuning, power electronics and spike suppression. Inductors are ideal to use in the previously listed applications because they have an innate ability to store energy in the form of a magnetic field as long as current is flowing through them.
- Capacitor - 10uF 25V capacitor is a good quality radial polarized Electrolytic capacitor. Electrolytic capacitors are widely used in switched-mode power supplies, DC-DC converters, and power supplies. This capacitor has a long life, low leakage current, and wide operating range.
- Resistor - A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. In this project 2 values of resistor has been used 10k  $\Omega$  and 0.47  $\Omega$ .

## **WORKING OF CIRCUIT**

The AM modulator circuit is made up simple resistor network mixer ( $10k\Omega$ ,  $0.47\Omega$ ) and the diode(1N4148). The modulating signal ( $V_m$ ) and carrier signal ( $V_c$ ) are applied to the resistive network mixer. Then the mixed signal enters the non-linear diode element. The diode causes non-linear mixing of the two-input signal. The output from the diode mixer is a rectified am signal. For example if the modulating signal or message signal ( $V_m$ ) is a cosine wave of frequency 1KHz, carrier signal ( $V_c$ ) is a cosine wave of 10KHz then the resulting signal from the single diode mixer is a rectified amplitude modulated signal of 10KHz.

The modulating signal can be written as,

$$V_m = A_m \cos(2\pi f_m t)$$

And carrier signal may be written as,

$$V_c = A_c \cos(2\pi f_c t)$$

Equation of AM wave can be written as,

$$S(t) = [A_c + A_m \cos(2\pi f_m t)] \cos(2\pi f_c t)$$

The frequency of the modulated signal is same as the carrier signal.

Cutoff frequency (also known as corner frequency, or break frequency) is defined as a boundary in a system's frequency response at which energy flowing through the system begins to be attenuated (reflected or

reduced) rather than passing through. Cutoff frequency can be calculated as:

$$f_c = \frac{1}{2\pi RC}$$

Where,

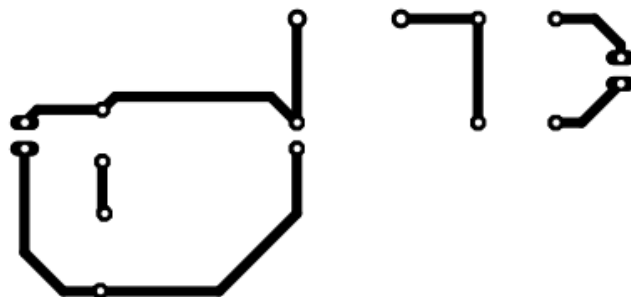
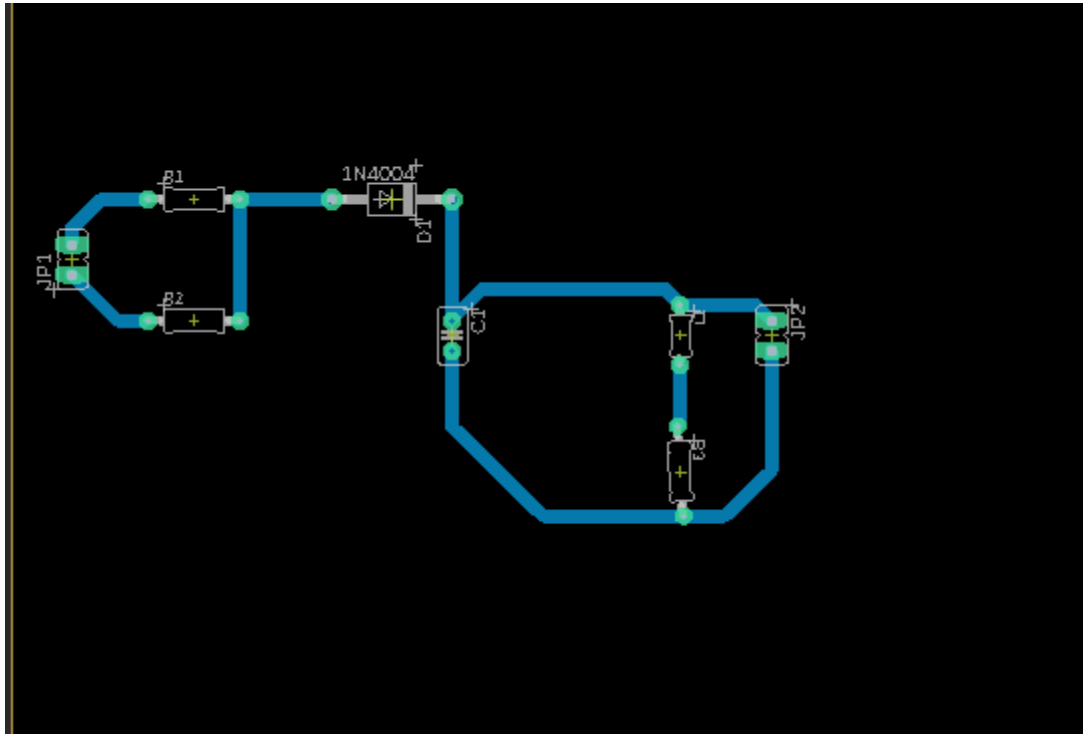
R=0.47Ω, resistor

C=10μF, capacitance

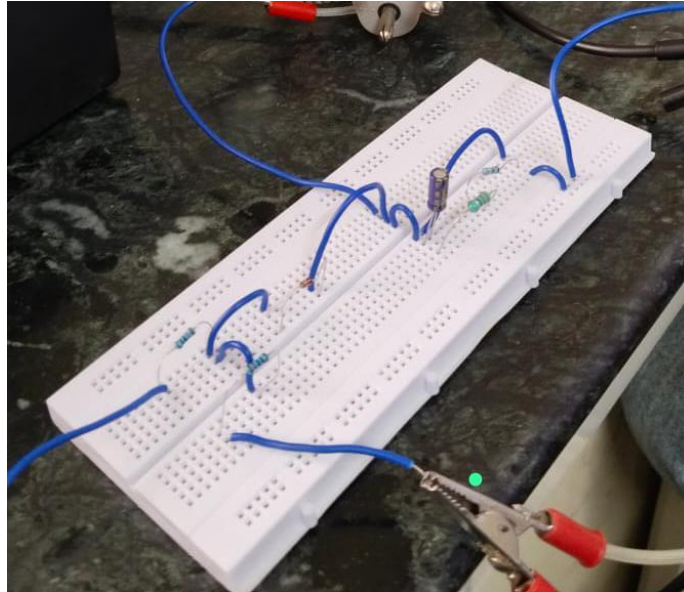
After calculating,

$$f_c = 0.397 \text{ MHz}$$

# PCB LAYOUT

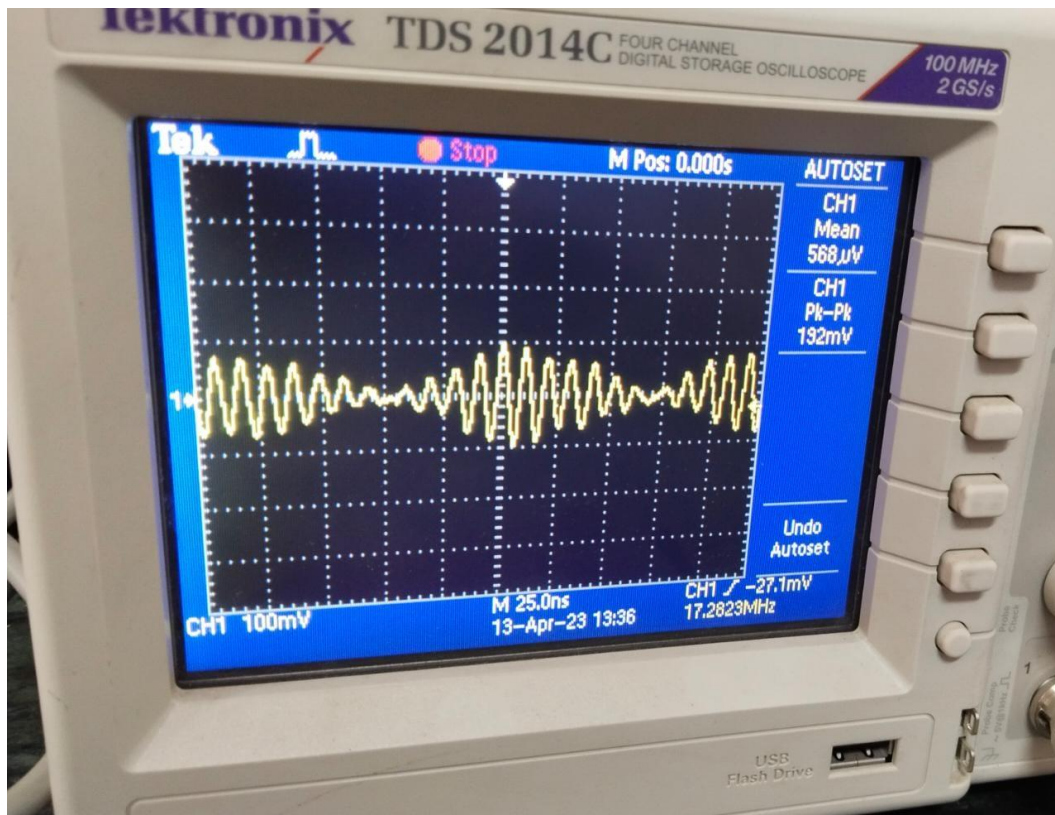


## IMAGE OF HARDWARE



## CONCLUSION:

The AM Modulator was built and fabricated on PCB and the following modulated waveform was observed on DSO.



## **BIBLIOGRAPHY**

We have taken references from following book and website:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. <https://www.ee-diary.com/2021/12/simple-amplitude-modulation-am-circuit.html>