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| **Course Name:** | **Analogue Digital Systems** | **Semester:** | **IV** |
| **Date of Performance:** | **09 / 01 / 2024** | **Batch no.:** | **A - 2** |
| **Faculty Name:** | **Prof. Amrita Naiksatam** | **Roll no.:** | **16014022050** |
| **Faculty Sign & Date:** |  | **Grade / Marks:** | **\_\_\_ / 25** |

**Experiment no.: 2**

**Title: To generate AM signal and reconstruct the original signal from Demodulation**

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| **Aim and Objective of the Experiment:** |
| * To Modulate carrier and generate AM signal. * To reconstruct original signal from demodulation. |

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| **COs to be achieved:** |
| CO1: Analyze and compare analog modulation schemes.CO2: Understand working of analog communication transmitter and receiver systems. **CO4:** Understand noise effect on the performance of Communication Systems. |

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| **Theory:** |
| AM diode detector or demodulator used for converting AM signals into useable audio. One of the advantages of amplitude modulation (AM) is that it is cheap and easy to build a demodulator circuit for a radio receiver. The simplicity AM radio receivers AM is one of the reasons why AM has remained in service for broadcasting for so long. One of the key factors of this is the simplicity of the receiver AM demodulator. A number of methods can be used to demodulate AM, but the simplest is a diode detector. It operates by detecting the envelope of the incoming signal. It achieves this by simply rectifying the signal. Current is allowed to flow through the diode in only one direction, giving either the positive or negative half of the envelope at the output. If the detector is to be used only for detection it does not matter which half of the envelope is used, either will work equally well. Only when the detector is also used to supply the automatic gain control (AGC) circuitry will the polarity of the diode matter. |

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| **Block Diagram of Simulink / MATLAB code:** |
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| **Implementation of Circuit:** |
| **Over – Modulation:**  **Vm = 2V, Vc = 1V**    **Critical – Modulation:**  **Vm = 2V, Vc = 2V**    **Under – Modulation:**  **Vm = 1V, Vc = 2V**    **Demodulation:** |

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| **Post Lab Subjective / Objective type Questions:** |
| 1. **What is the effect of RC time constant on the demodulation process?**   The RC time constant plays a crucial role in the demodulation process, especially in the context of amplitude modulation (AM) demodulation using a simple envelope detector. The envelope detector is a common demodulation technique used to recover the original message signal from an amplitude-modulated carrier wave. The RC time constant is associated with the capacitor-resistor (CR) circuit in the envelope detector.   * Smoothing of the Rectified Signal: The RC time constant determines the charging and discharging rate of the capacitor in the envelope detector circuit. A larger RC time constant results in slower charging and discharging, leading to better smoothing of the rectified signal. This smoothing is crucial for obtaining a stable and continuous envelope that closely resembles the original message signal. * Trade-off with Response Time: While a larger RC time constant provides better smoothing, it also increases the time it takes for the capacitor to respond to changes in the input signal. This can lead to a slower response to rapid variations in the amplitude of the modulated signal, causing distortion or loss of high-frequency components. * Optimization: The choice of the RC time constant involves a trade-off between smoothing and response time. Engineers often optimize this parameter based on the specific requirements of the demodulation system. In some cases, additional filtering techniques or circuits may be employed to enhance the performance of the demodulator.  1. **Discuss rectifier distortion and diagonal clippings.** 2. **Rectifier Distortion:** Rectifier distortion refers to the unwanted variations or distortions introduced during the rectification process, which is a key step in demodulation. In amplitude modulation (AM) demodulation, rectification is typically achieved using diodes. However, diodes introduce nonlinearities that can result in distortion of the demodulated signal. 3. Harmonic Generation: Diodes exhibit nonlinear characteristics, leading to the generation of harmonics in the rectified signal. These harmonics can introduce unwanted frequency components that were not present in the original modulating signal. 4. Solution: To mitigate rectifier distortion, additional filtering stages or more sophisticated demodulation techniques, such as synchronous detection, may be employed. These methods aim to reduce the impact of nonlinearities introduced by the rectification process. 5. **Diagonal Clippings:** Diagonal clippings can occur in the demodulation process, especially in scenarios where the received signal suffers from interference or noise. Diagonal clipping refers to the distortion caused when the instantaneous amplitude of the modulated signal exceeds the voltage limits imposed by the rectifier. 6. Effect: When the amplitude exceeds the clipping level, the signal is "clipped" or truncated, resulting in a distorted output. This distortion can affect the fidelity of the demodulated signal, introducing artifacts and degrading the quality of the recovered message signal. 7. Prevention: Adequate signal conditioning, filtering, and proper adjustment of system parameters can help minimize the impact of diagonal clippings on the demodulation process. Additionally, choosing appropriate levels for the amplitude of the modulated signal can reduce the likelihood of clipping. |

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| **Conclusion:** |
| In conclusion, this experiment served as a foundational exploration of analog communication principles, providing hands-on experience in the modulation and demodulation processes. The use of MATLAB and Simulink proved instrumental in visualizing and understanding these fundamental concepts, laying the groundwork for further studies in communication systems. |

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| **Signature of faculty in-charge with date:** |