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| **Course Name:** | **Analogue Digital Systems** | **Semester:** | **IV** |
| **Date of Performance:** | **06 / 02 / 2024** | **Batch no.:** | **A - 2** |
| **Faculty Name:** | **Prof. Amrita Naiksatam** | **Roll no.:** | **16014022050** |
| **Faculty Sign & Date:** |  | **Grade / Marks:** | **\_\_\_ / 25** |

**Experiment no.: 5**

**Title: To implement PWM Modulator using Simulink**

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| **Aim and Objective of the Experiment:** |
| * To implement PWM modulator using Simulink. * To generate PWM (Pulse amplitude modulation) modulated signal. |

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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. |

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| **Theory (Pulse Amplitude Modulation (PAM)):** |
| Pulse width modulation (PWM) is a modulation method in between the digital and analogue, which can be used to process the digital and analogue data transmission. The amplitude of pulse width modulator is fixed, but the pulse width will be varied and controlled by the input audio signal amplitude.  If we control the time variation of the electric level, then this implies that we can control the width of the pulse. When the amplitude of the message signal (like audio) is getting larger, then the pulse width will become wide. On the other hand, when the amplitude of the signal is getting smaller, then the pulse width will become narrow. Therefore, the PWM can be applied in the fast and slow of the rotation rate of the motor, the strong and weak of the light source of the light bulb and so on. The relationship between audio signal and pulse width modulation signal is shown in Figure 4.1. Generally, pulse wave modulation can be classified as pulse amplitude modulation (PAM), pulse position modulation (PPM), pulse width modulation (PWM) |

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| **Step-Wise Procedure:** |
| 1. Make the block diagram using Simulink. 2. Observe the Output on Virtual CRO. |

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| **Block Diagram of Simulink / MATLAB code:** |
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| **Implementation of Circuit / Output:** |
| **Circuit:**    **Pulse Amplitude Modulation Graphs (Output):** |

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| **Post Lab Subjective / Objective type Questions:** |
| 1. **State the advantages and disadvantages of PWM.**   Advantages:   * Less noise interference compared to PAM. * Moderate complexity and power efficiency. * Supports higher power handling capabilities.   Disadvantages:   * Variable instantaneous power of the transmitter. * Requires semiconductor devices with low turn-ON and turn-OFF times, which can be expensive. * High switching losses due to higher PWM frequency.  1. **State the applications of PWM.**   **Few applications of PWM include –**   * Power Electronics: PWM is used in switching power supply circuits, such as buck converters and boost converters, to control the amount of power delivered to loads. * LED Lighting: PWM is used to control the brightness of LEDs. * Servo Motors: In servo motors, PWM is used to control the position of the motor shaft. * Audio Signal Processing: In audio equipment, PWM is used in digital-to-analog converters (DACs) to convert digital audio signals into analog signals.  1. **Draw the PWM modulation of the input signal given below –** |

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| **Conclusion:** |
| Through the experimental implementation on MATLAB Simulink, we effectively generated a PWM (Pulse Amplitude Modulation) modulated signal, demonstrating practical application and understanding of modulation techniques in digital signal processing. |

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