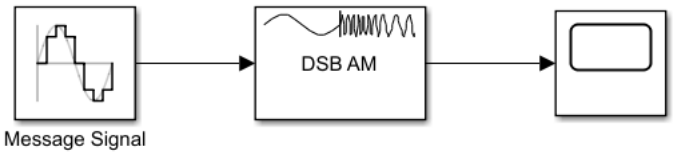
Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Technology** **Department of Information and Communication Technology**	
Subject: Analog and Digital Communications(01CT0404)	**Aim:** To acquire the result by varying the different parameter through simulation	
Simulation Project	**Date:-** 18-03-2024	**Enrollment No:-** 92200133030

Aim: - To acquire the result by varying the different parameters through simulation.

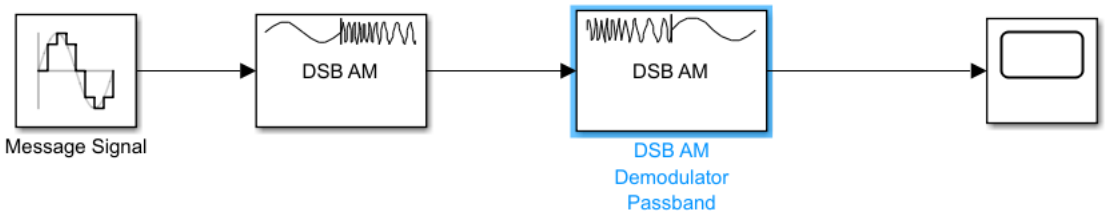
1) Amplitude Modulation:-

DSB-FC

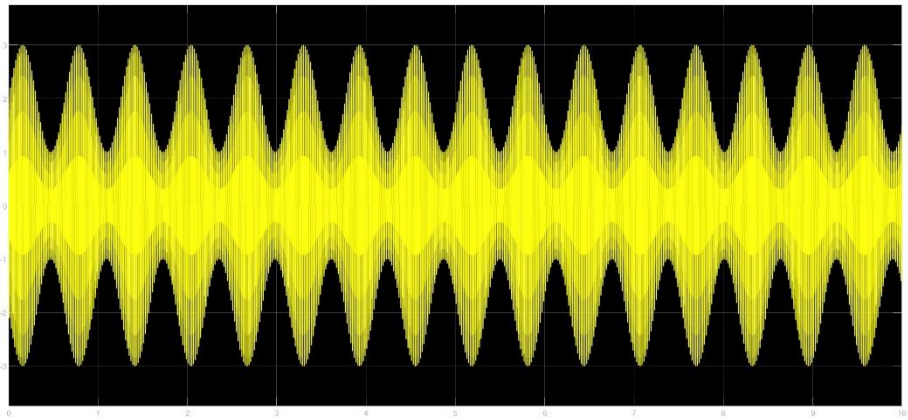
Modulator:-



Demodulator:-



Under Modulation :-



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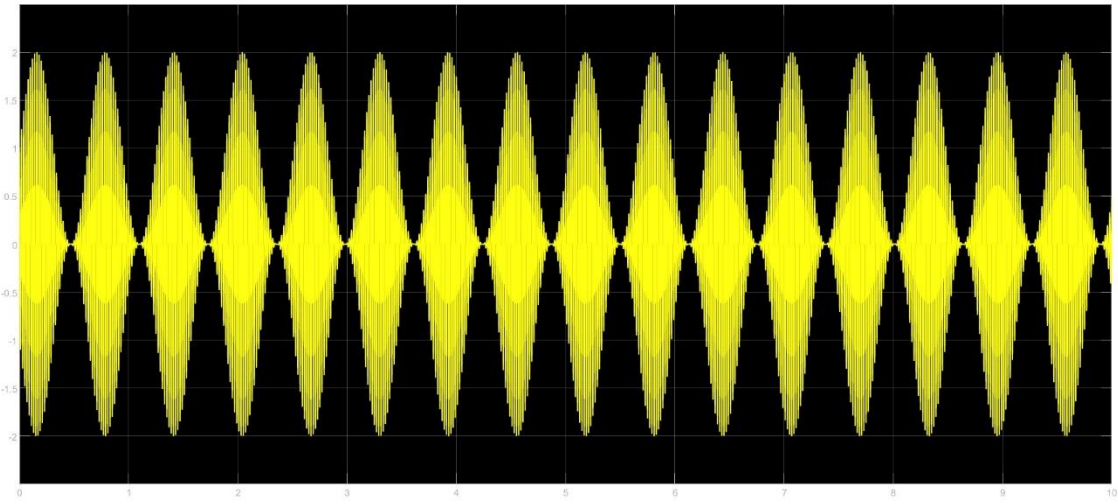
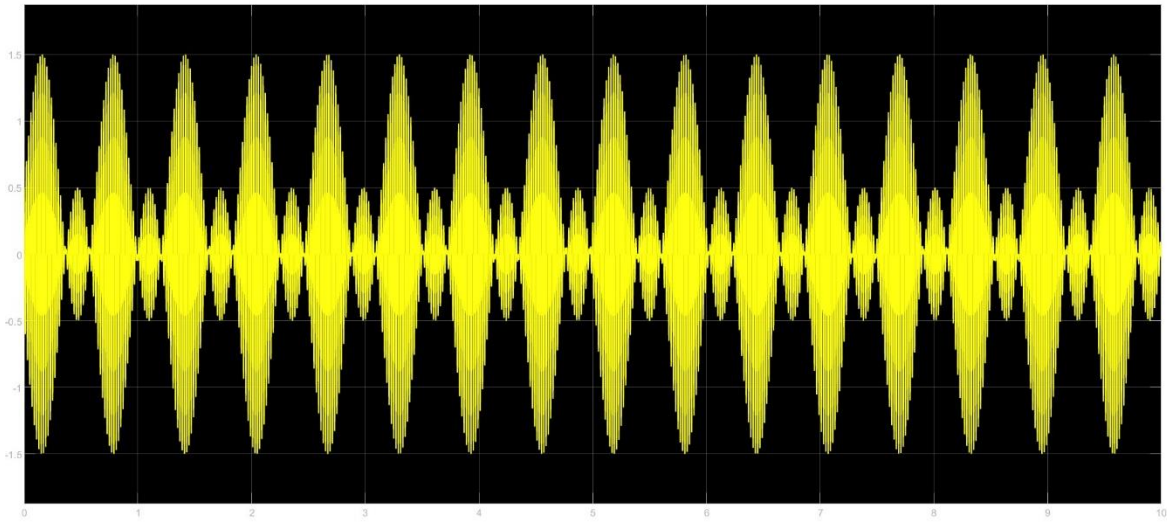
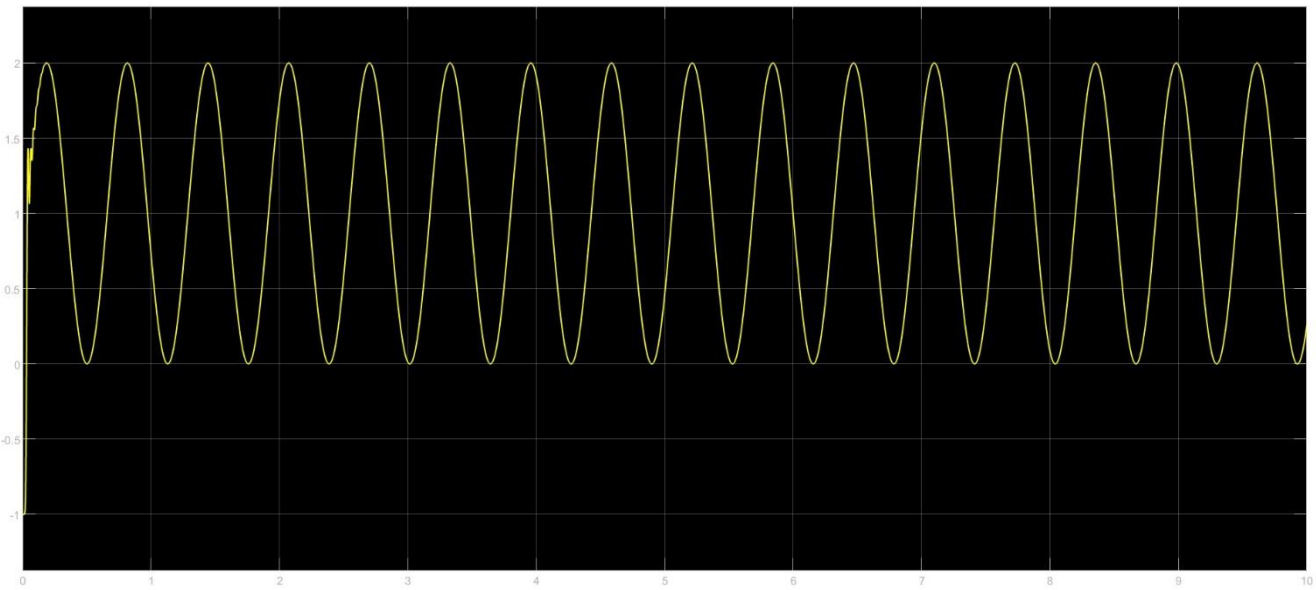
Perfect Modulation:-



Over Modulation:-

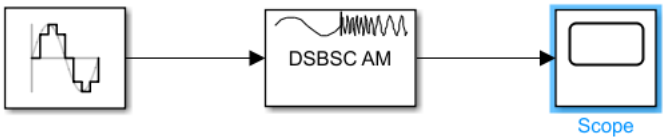


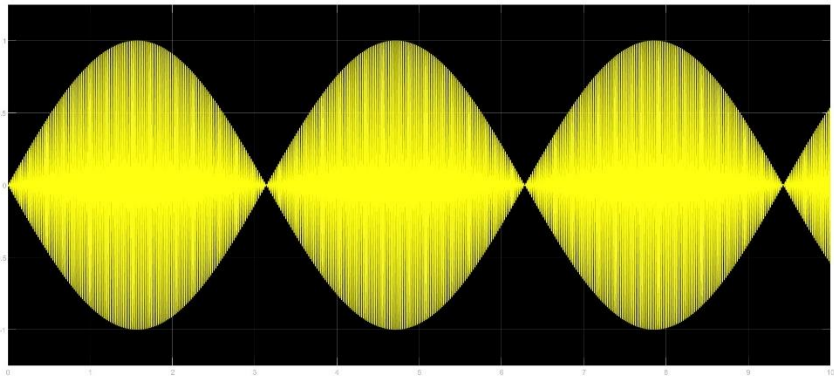
Demodulation:-



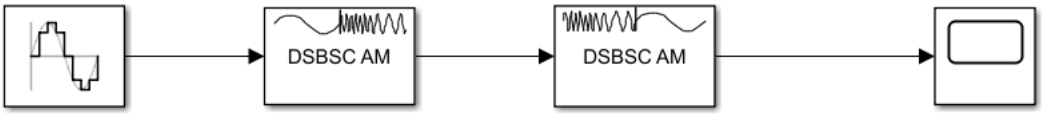
DSB-SC:-

Modulator:-





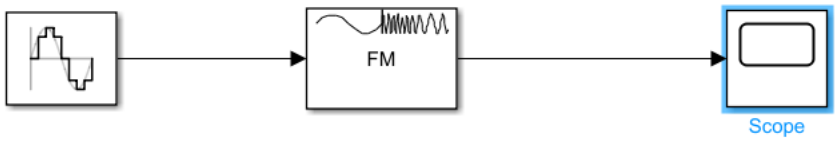
Demodulator:-



- **Parameter:** Modulation index
- **Effect:** Increasing the modulation index increases the amplitude variations in the modulated signal, resulting in a higher magnitude of sidebands, more power consumption
- **Conclusion:** A higher modulation index leads to a more power consuption.

2) Frequency Modulation:-

Modulation:-



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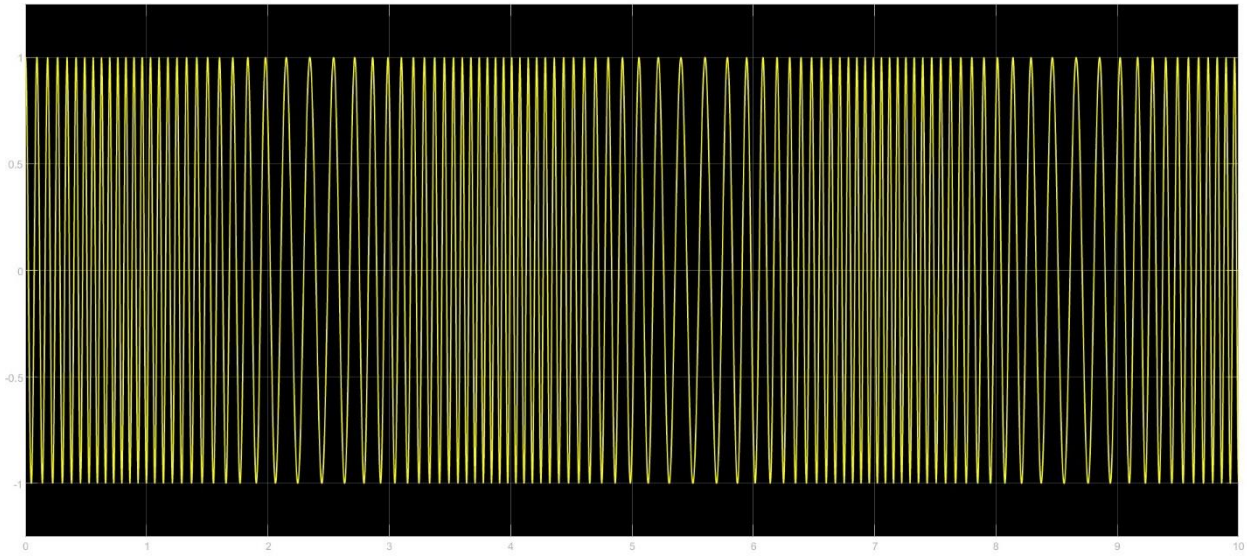
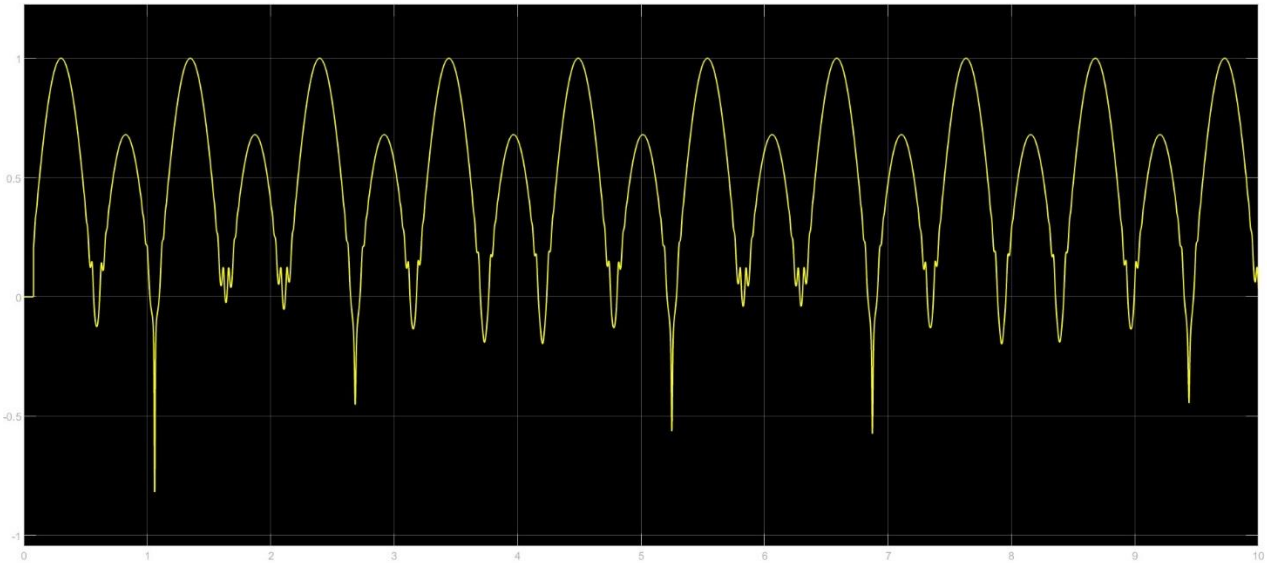


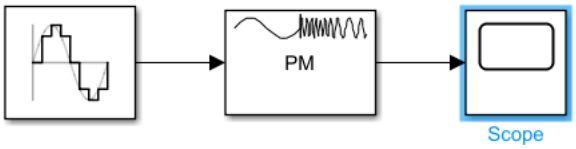
Demodulation:-



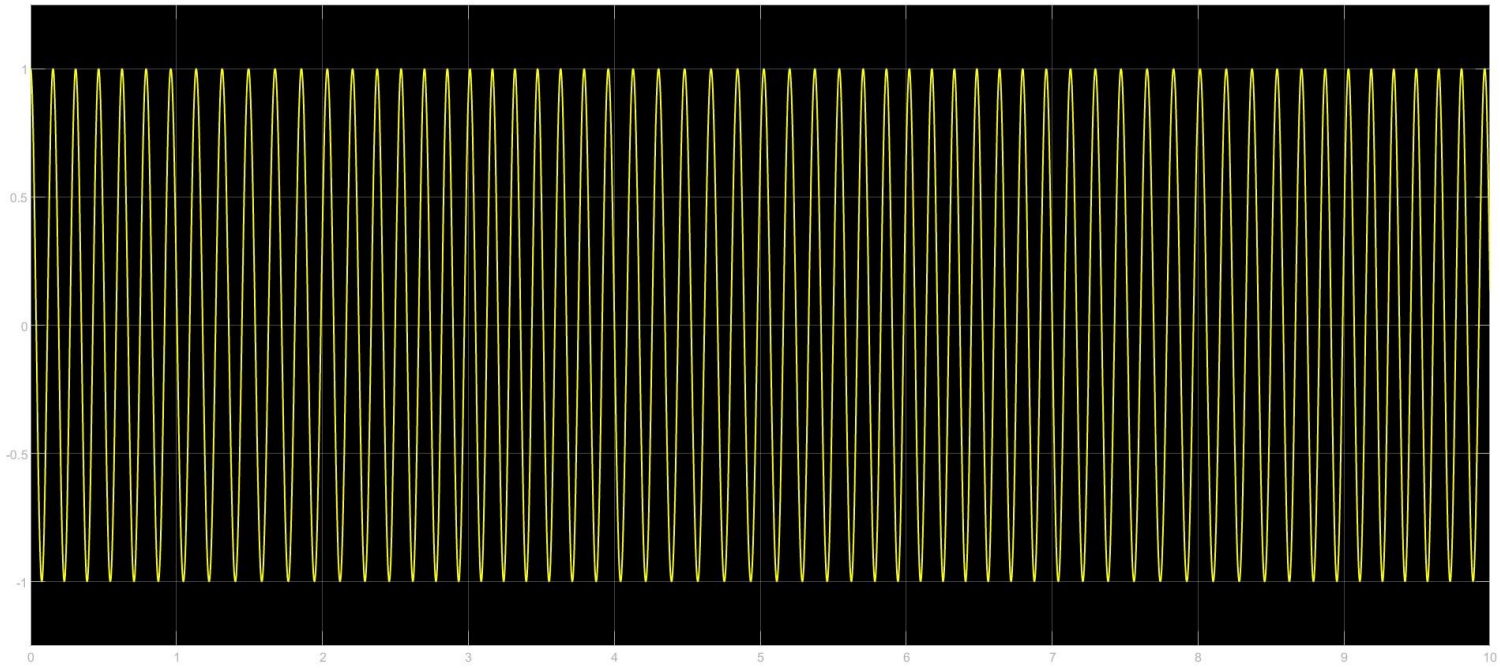
- **Parameter:** Deviation ratio (ratio of frequency deviation to modulating frequency).
- **Effect:** Increasing the deviation ratio leads to wider frequency swings in the modulated signal, resulting in a wider bandwidth.
- **Conclusion:** Higher deviation ratios result in a wider frequency spectrum, affecting bandwidth requirements.

3) Phase Modulation:-

Modulation:-



MO



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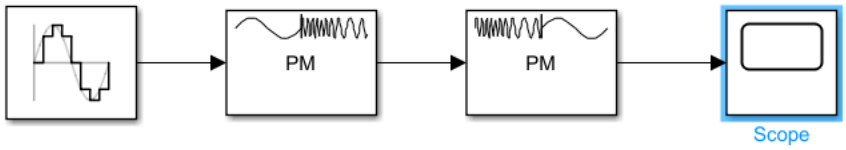
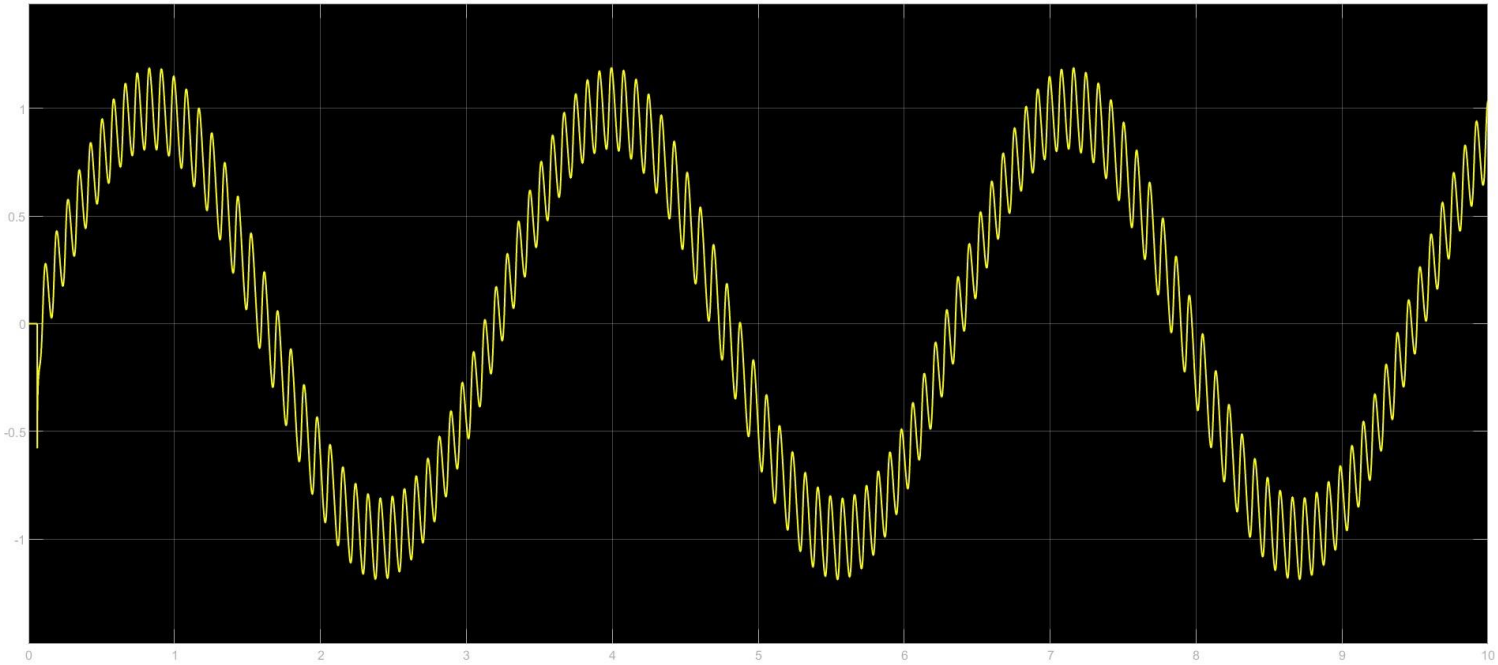
Demodulation:-

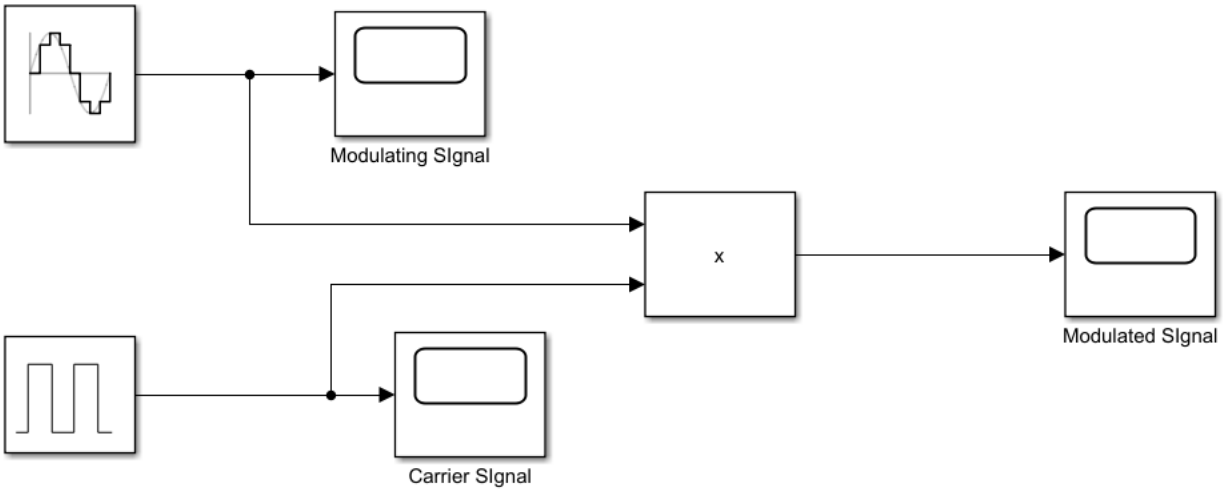




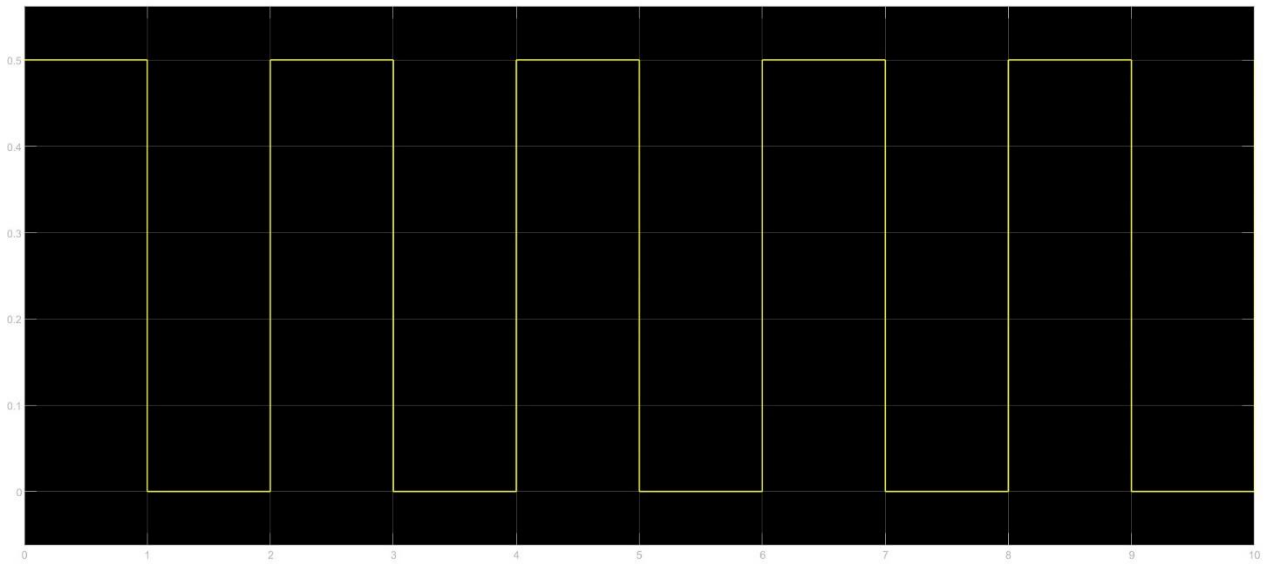
- **Parameter:** Phase deviation.
- **Effect:** Increasing phase deviation results in more significant phase changes in the modulated signal, leading to a wider spectrum.
- **Conclusion:** Higher phase deviation increases bandwidth requirements due to a broader frequency spectrum.

4) Amplitude Shift Keying:-

Modulation:-



Modulating Signal:-



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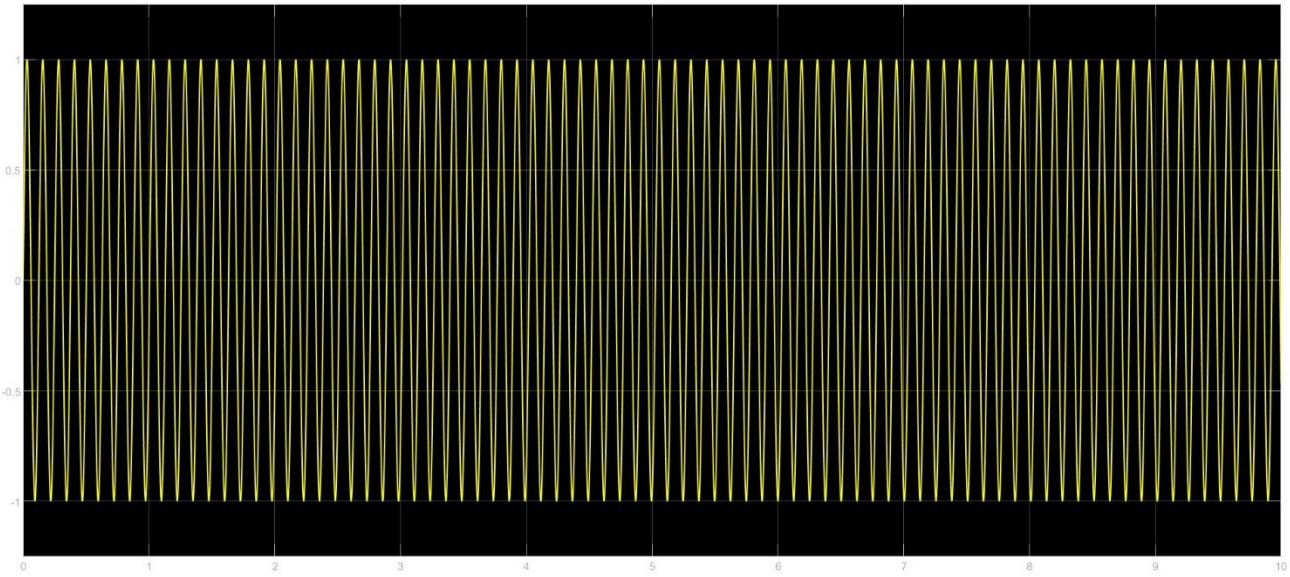
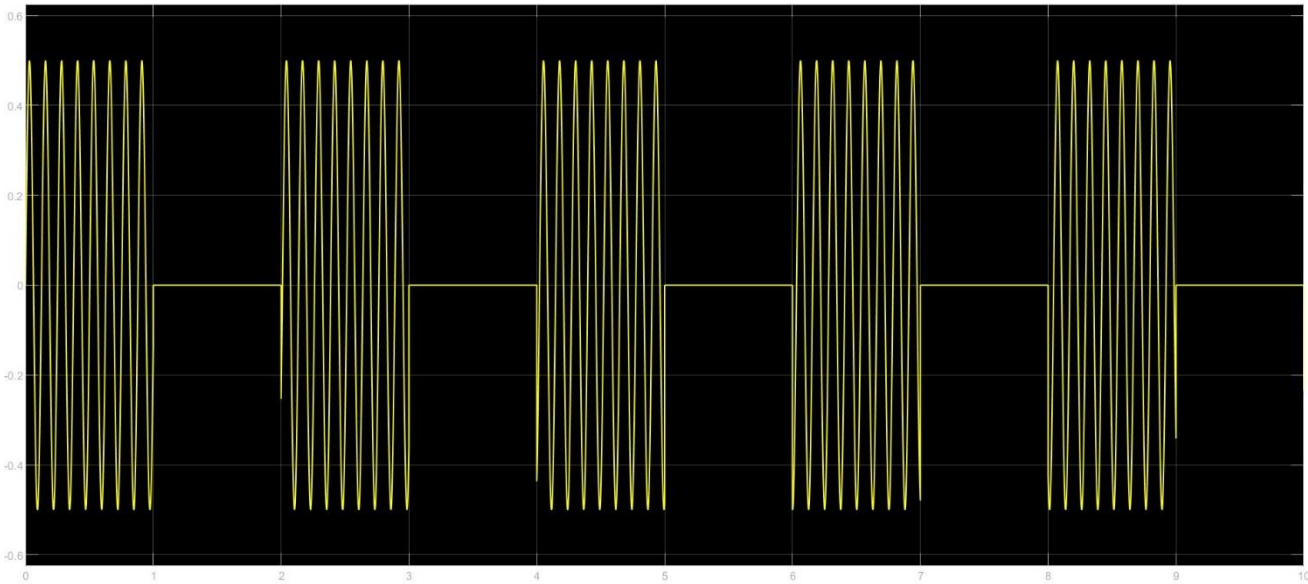
Carrier Signal:-



Modulated Signal:-



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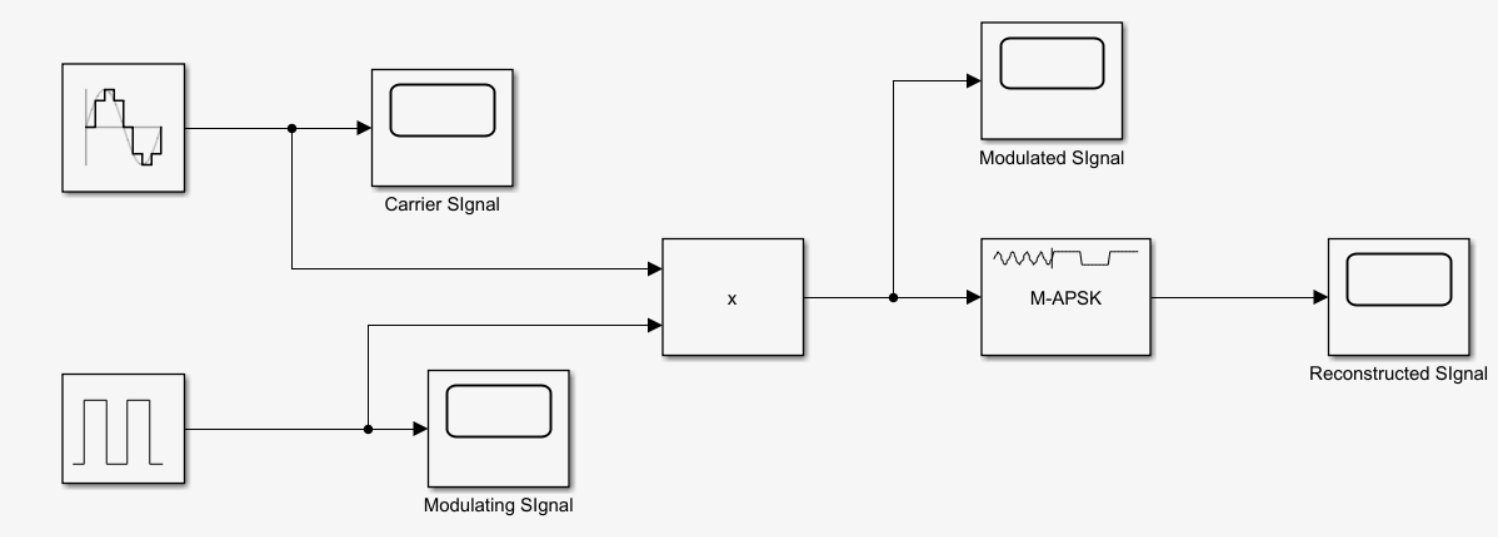
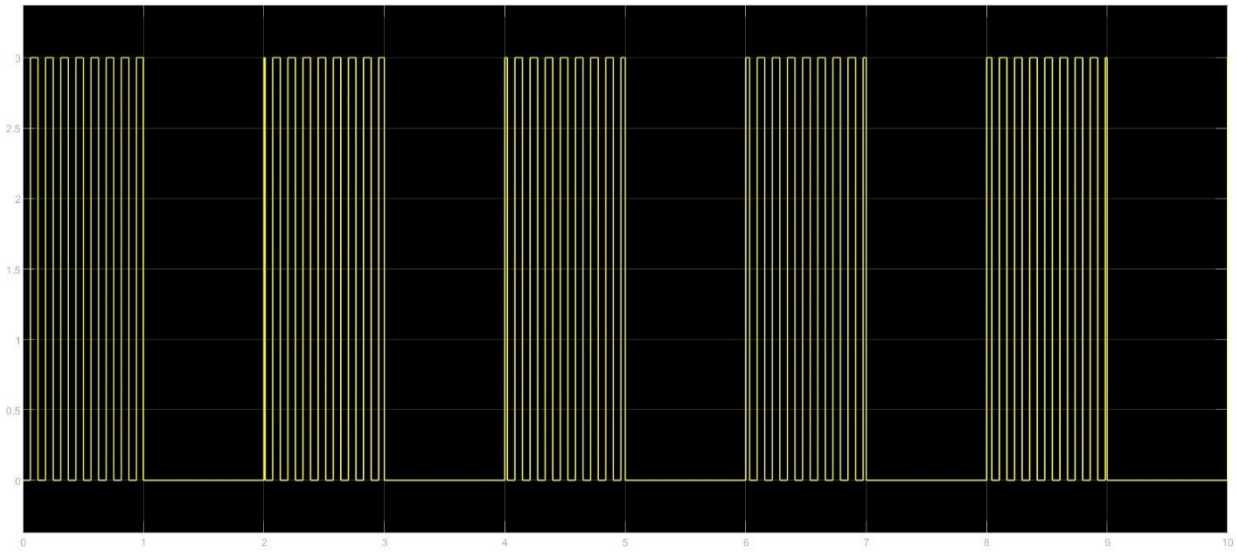
Demodulated Signal:-



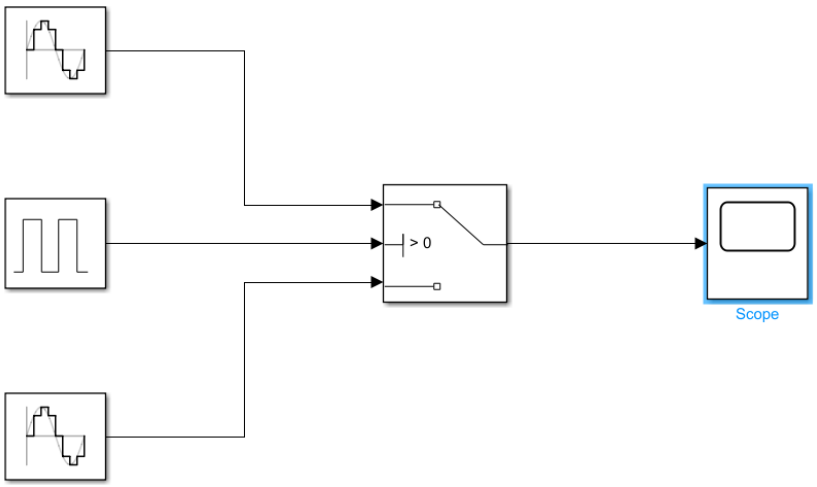
Reconstructed Signal:-



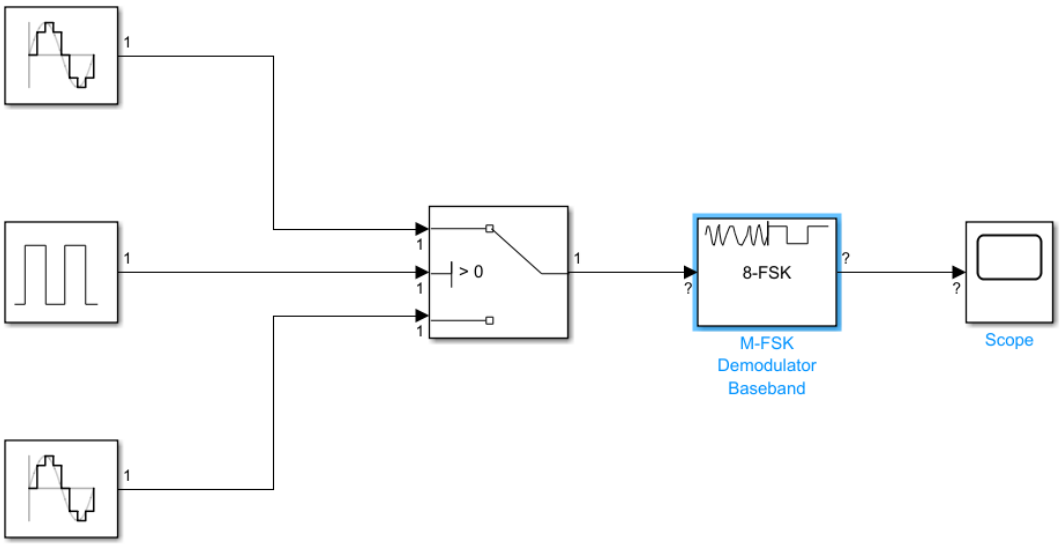
- **Parameter:** Amplitude levels of the carrier signal.
- **Effect:** Increasing the number of amplitude levels increases the number of bits that can be encoded per symbol.
- **Conclusion:** Higher amplitude levels allow for encoding more information per symbol but increase susceptibility to noise.

5) Frequency Shift Keying:-

Modulator:-



Demodulator:-



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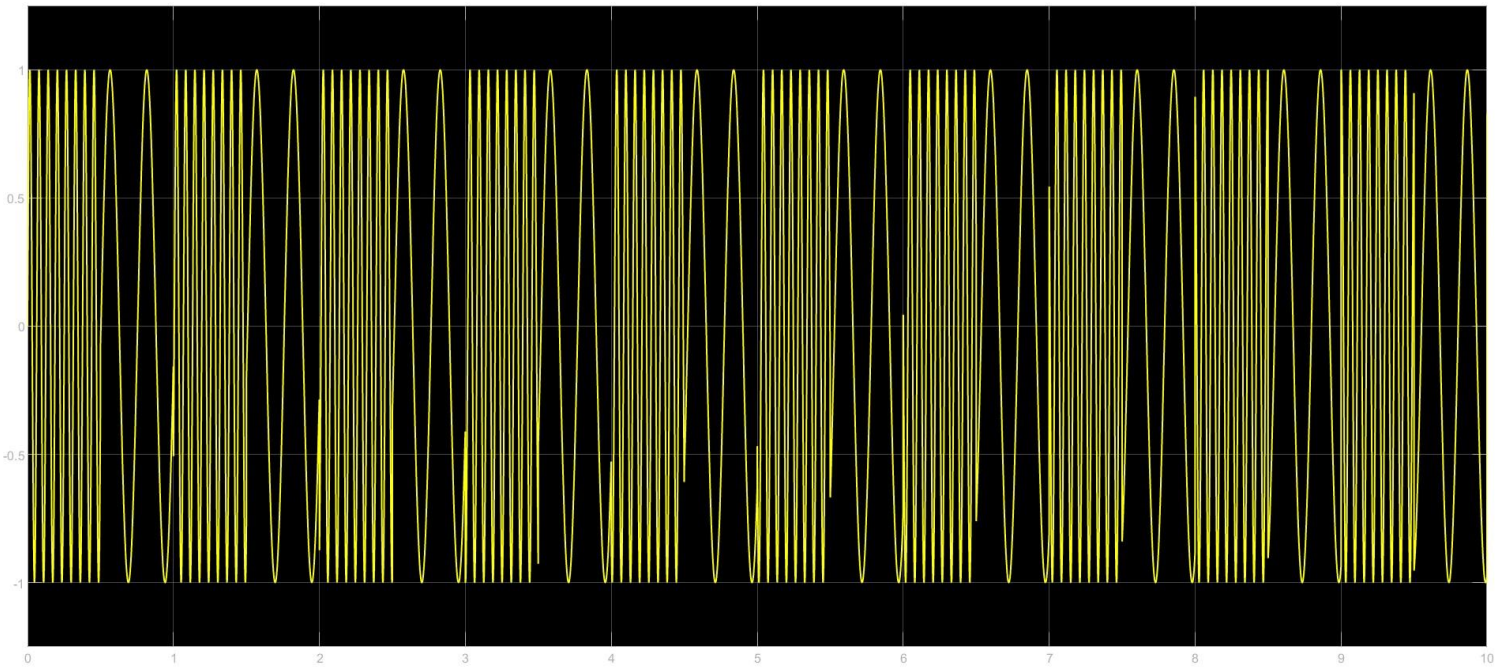
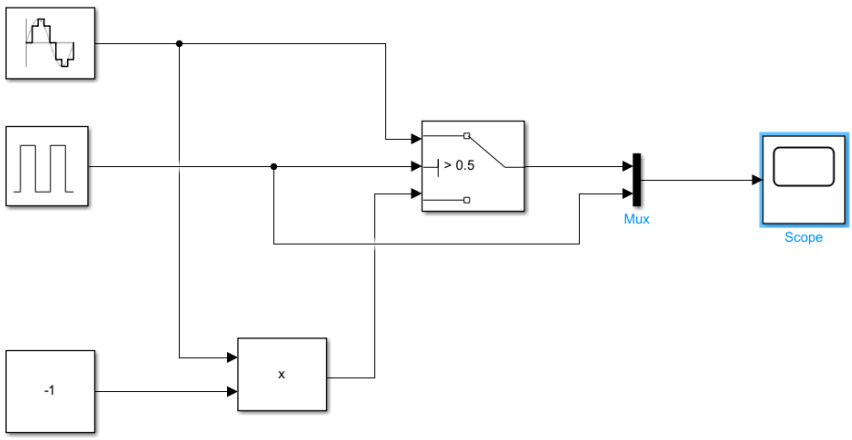
Modulator:-



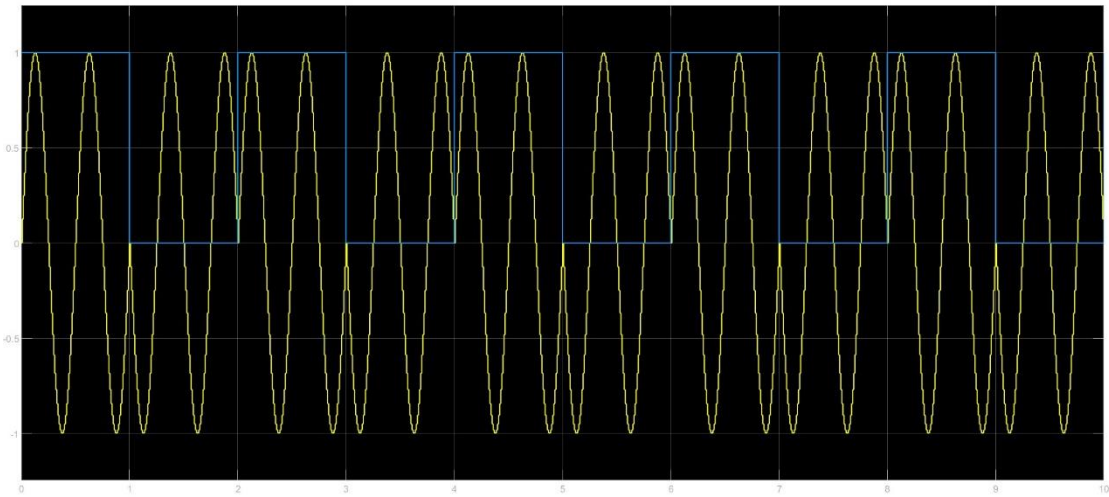
- **Parameter:** Frequency separation between different symbols.
- **Effect:** Increasing the frequency separation allows for better discrimination between symbols but also increases the required bandwidth.
- **Conclusion:** Larger frequency separations enhance noise immunity but increase bandwidth requirements.

6) Phase Shift Keying:-

Modulator:



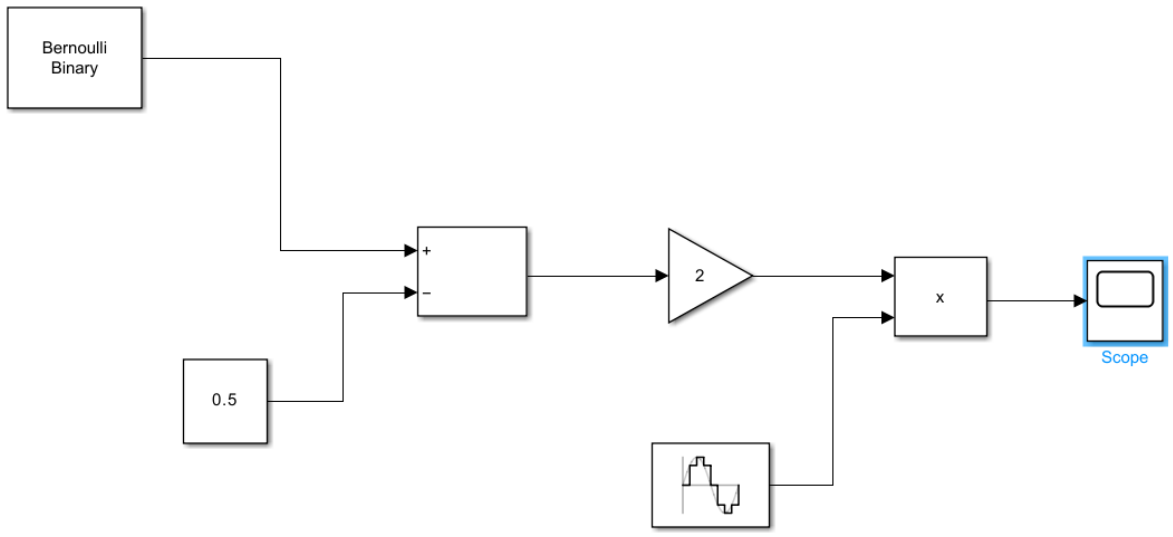
Modulated Signal:-



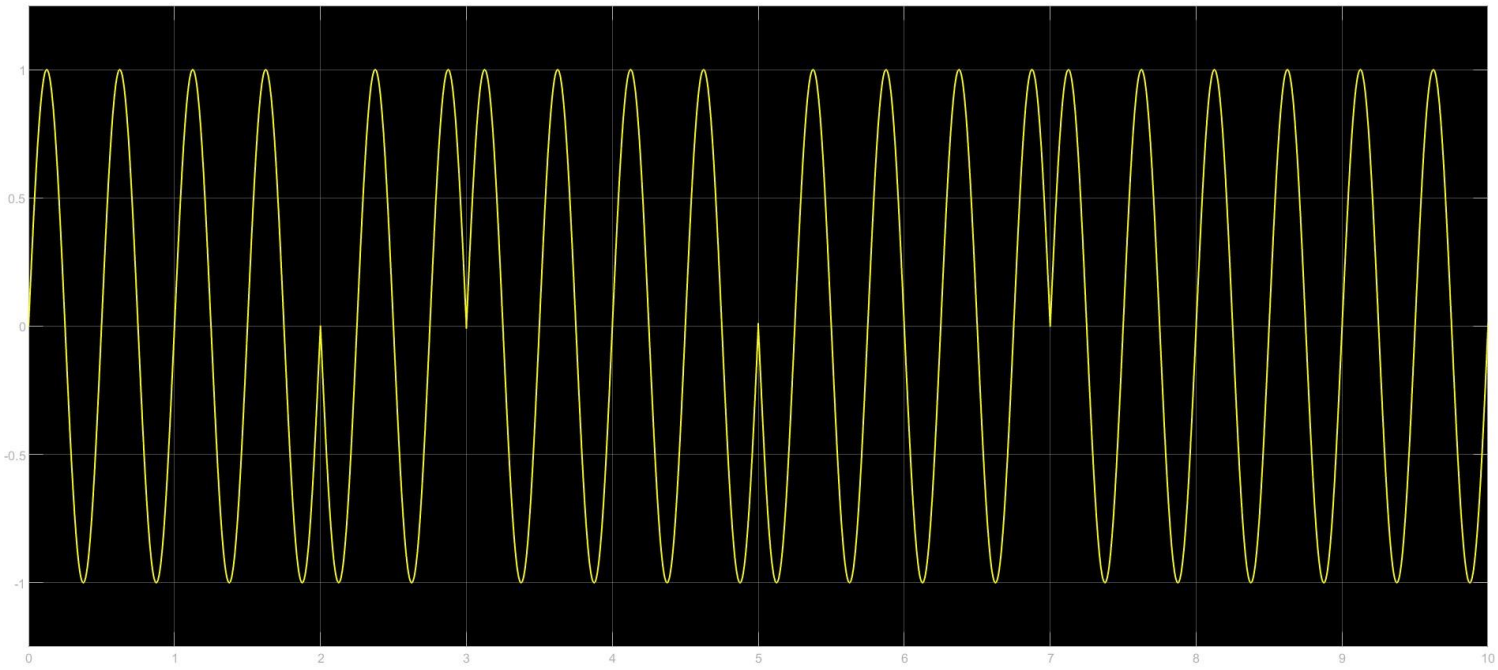
- **Parameter:** Phase difference between symbols.
- **Effect:** Increasing the phase difference allows for encoding more bits per symbol but may increase susceptibility to phase errors.
- **Conclusion:** Larger phase differences enable higher data rates per symbol but may require more sophisticated demodulation techniques.

7) Binary Phase Shift Keying:-

Modulator:-



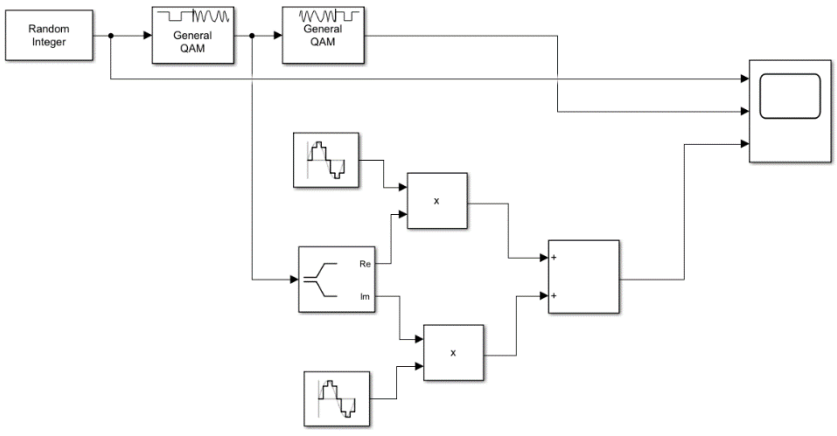
Modulated Signal :-



- **Parameter:** Phase difference between the two symbols.
- **Effect:** Changing the phase difference alters the spectral characteristics and affects noise performance.
- **Conclusion:** Adjusting the phase difference allows for optimization between data rate and noise performance.

8) Quadrature Amplitude Modulation:-

Modulator:-



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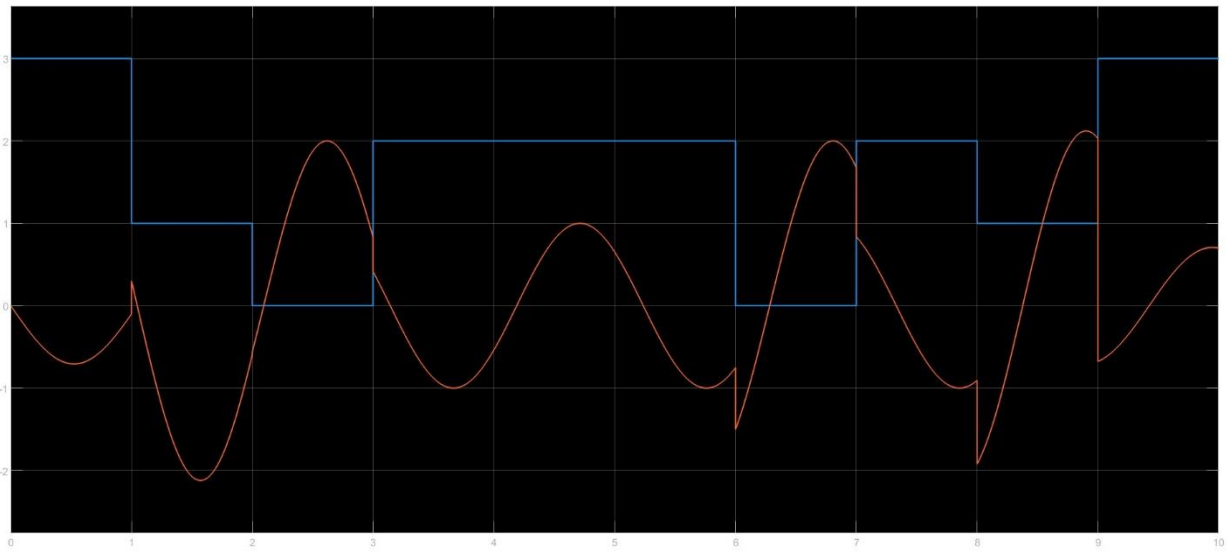
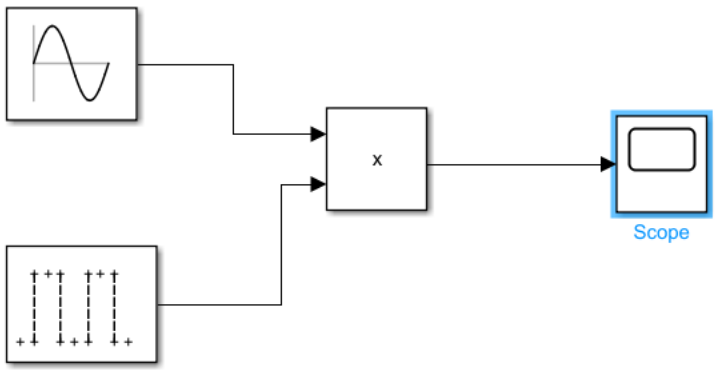
Modulated Signal :-



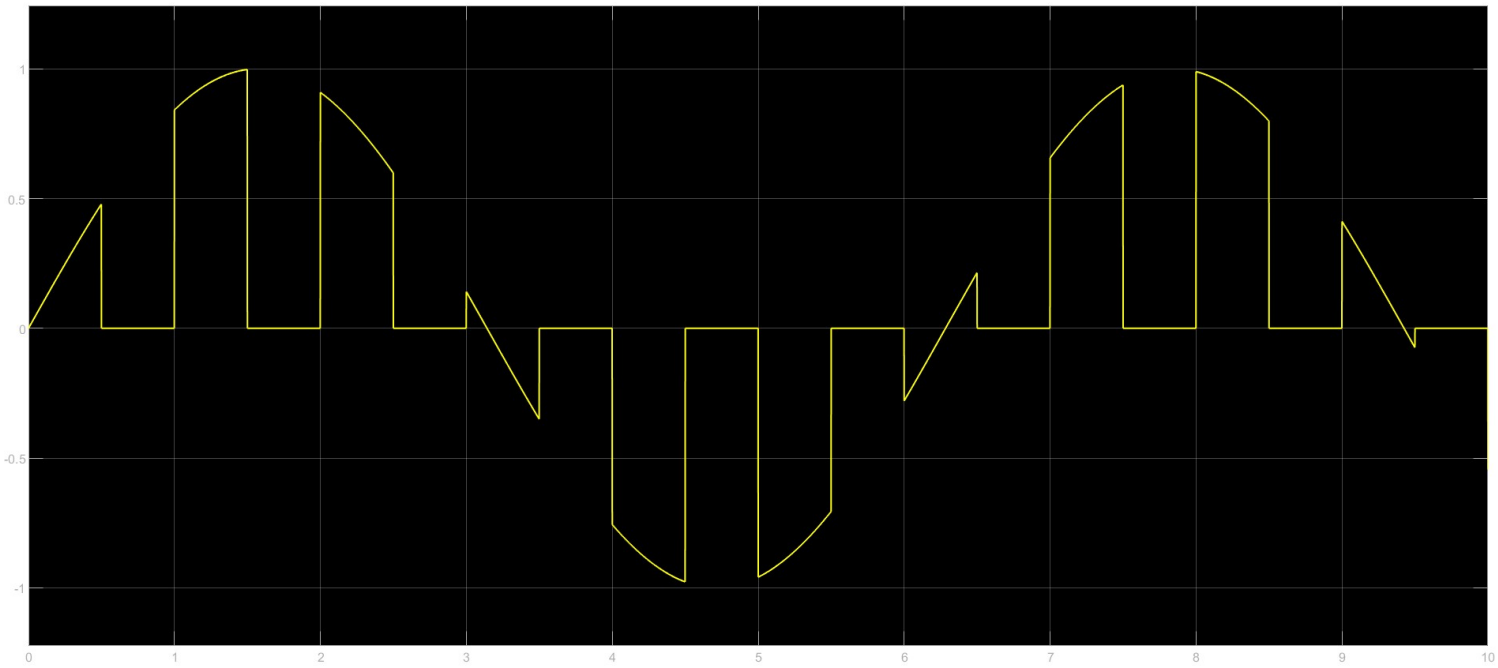
- **Parameter:** Amplitude and phase levels.
- **Effect:** Increasing the number of amplitude and phase levels allows for higher data rates but increases the complexity of modulation and demodulation.
- **Conclusion:** Higher levels enable higher data rates but require more sophisticated signal processing techniques.

9) Sampling:-

Sampler Circuit:-



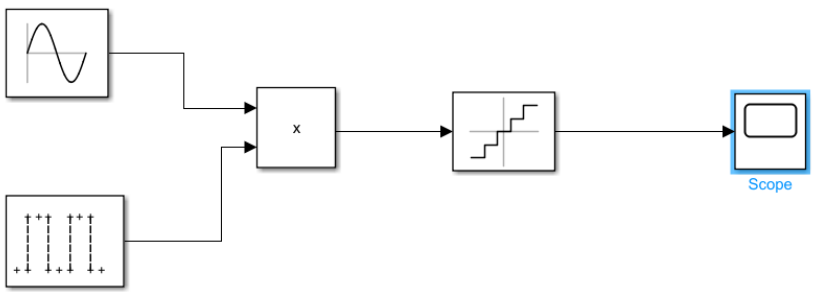
Sampled Output:-



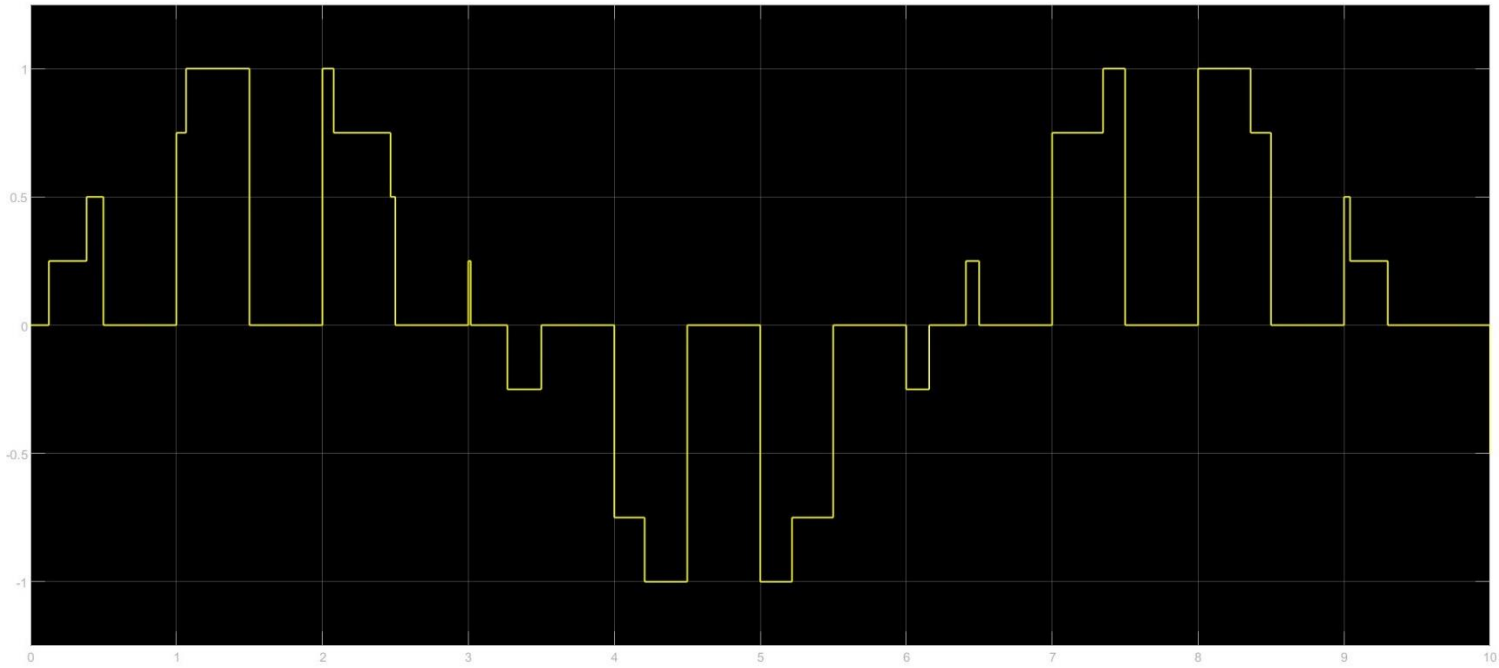
- **Parameter:** Sampling frequency.
- **Effect:** Increasing the sampling frequency captures more information but also increases the data rate and processing requirements.
- **Conclusion:** Higher sampling frequencies improve signal fidelity but require more resources.

10) Quantization:-

Quantizer:-



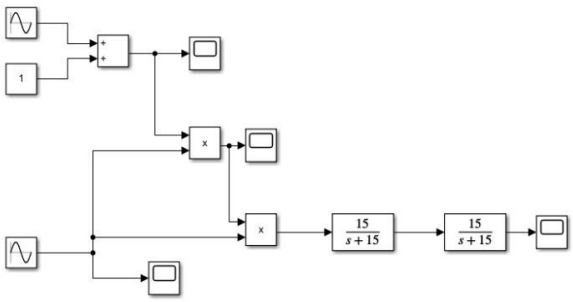
Quantized Output :-



- **Parameter:** Number of quantization levels.
- **Effect:** Increasing the number of quantization levels improves signal resolution but also increases the required data rate and processing complexity.
- **Conclusion:** Higher quantization levels result in better fidelity but require more resources for processing and transmission.

11) Analog Communication System:-

Pulse Amplitude Modulation:-



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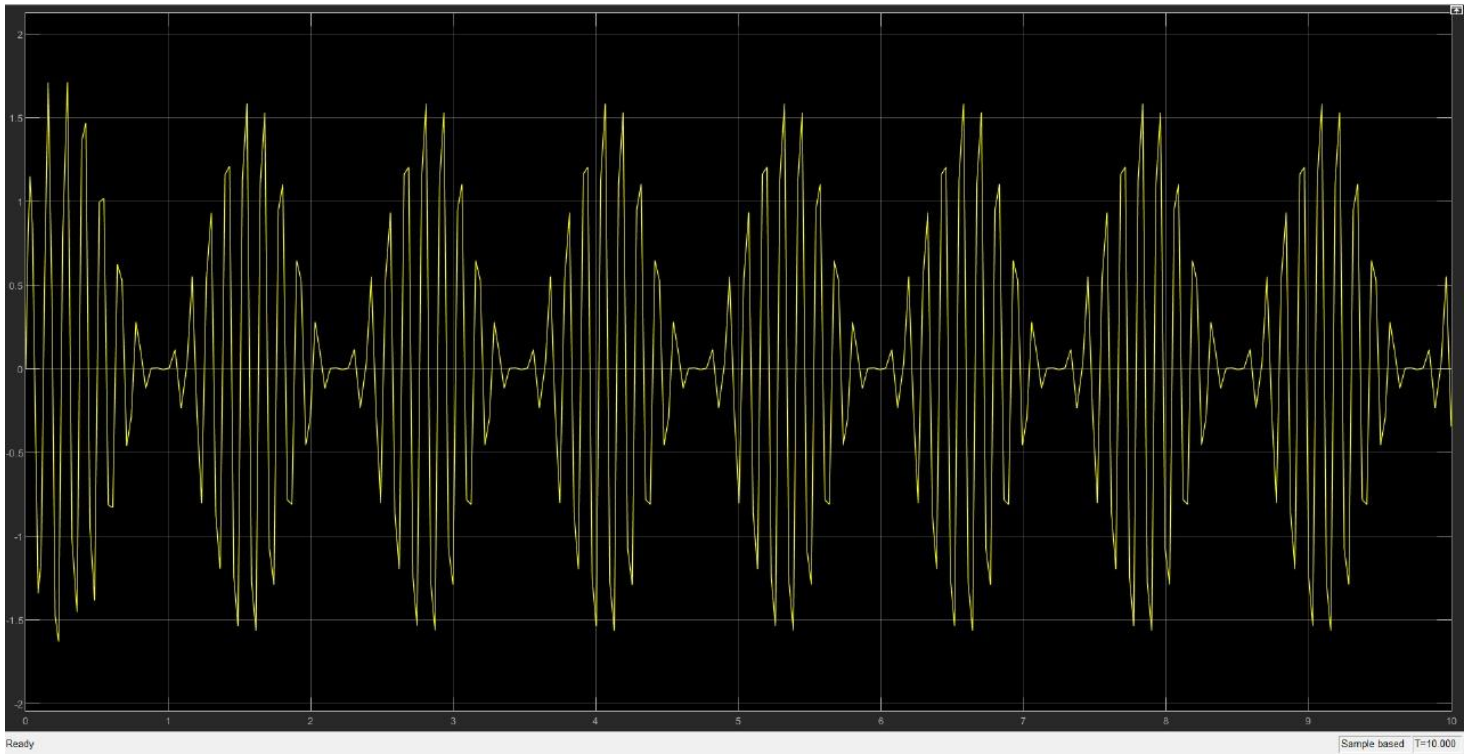
Modulator:-



Modulated Signal:-

- **Parameter:** Amplitude levels of the pulses.
- **Effect:** Increasing the number of amplitude levels increases the resolution of the signal but also increases the bandwidth required for transmission due to higher complexity.
- **Conclusion:** Higher resolution provides better fidelity but at the cost of increased bandwidth requirements.

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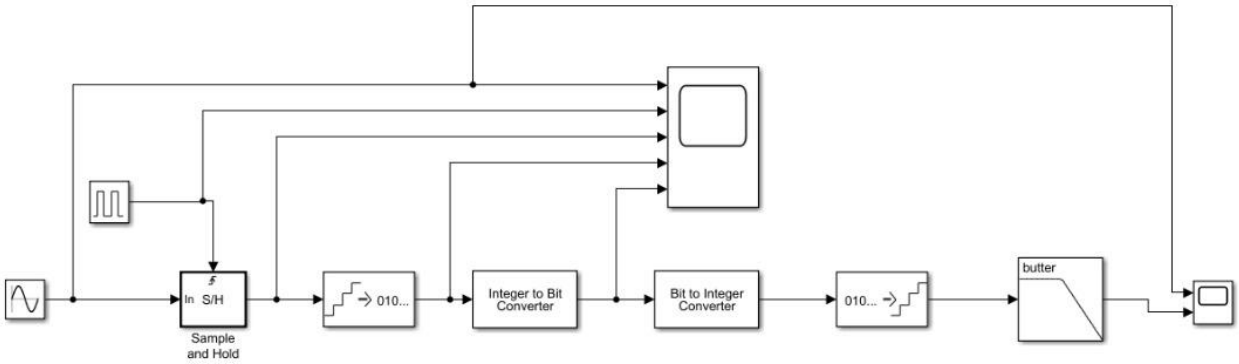
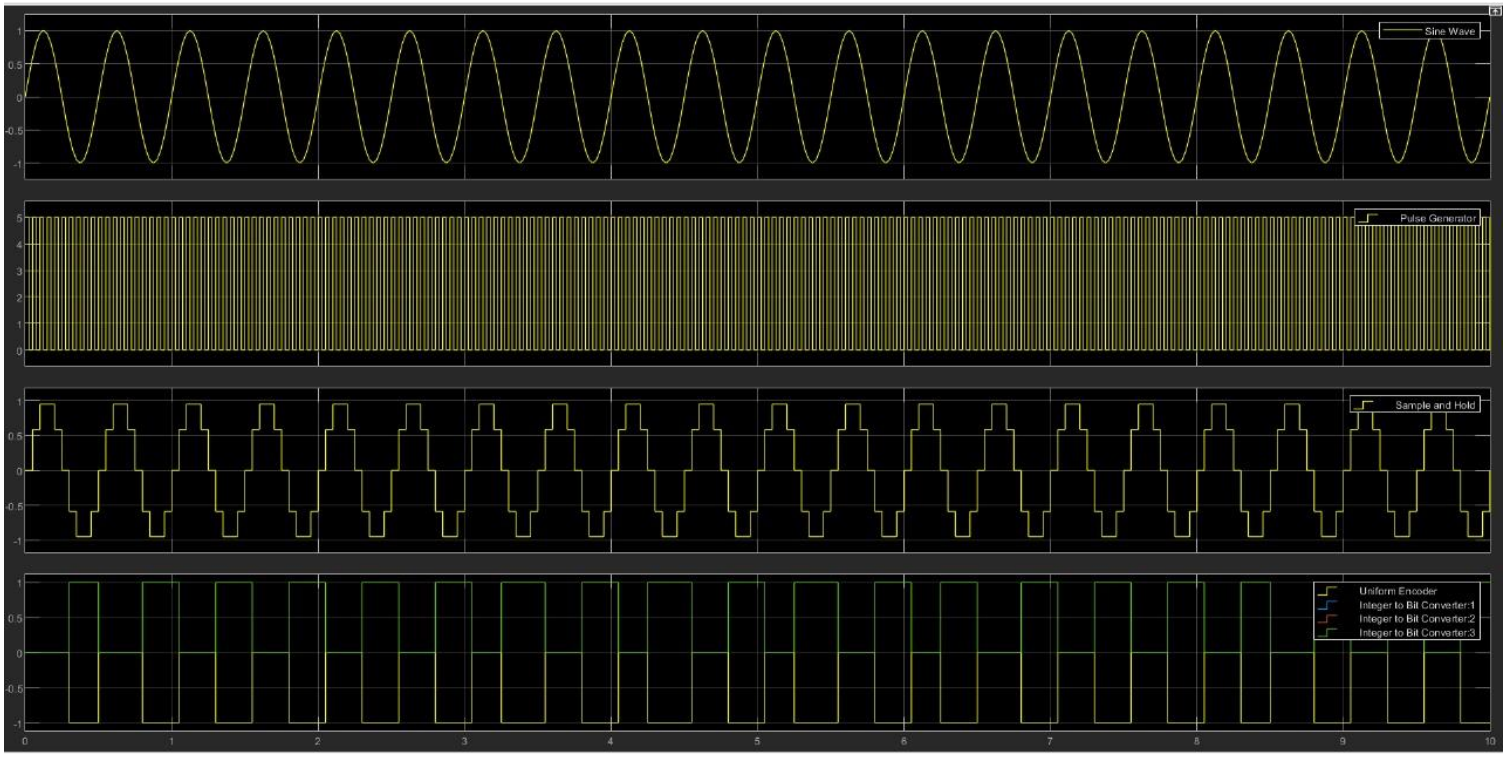
12) Digital Communication System:-

Pulse Coded Modulation :-



Output :-



1)

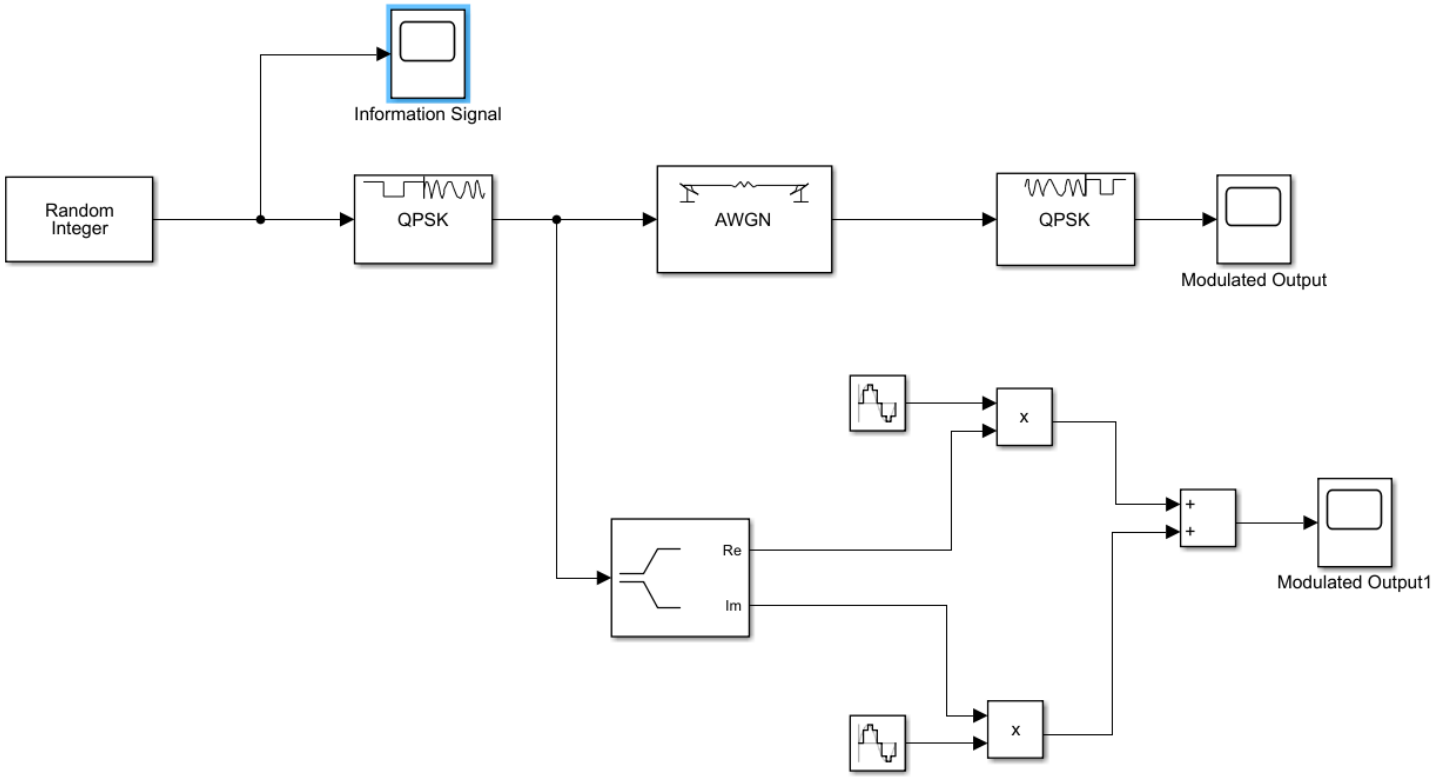
- **Parameter:** Quantization levels.
- **Effect:** Increasing the number of quantization levels improves the fidelity of the signal but also increases the bit rate required for transmission.
- **Conclusion**: Higher quantization levels result in better signal quality but at the expense of increased data rate.

2)

- **Parameter**: Amplitude levels of the pulses.
- **Effect:** Increasing the number of amplitude levels increases the resolution of the signal but also increases the bandwidth required for transmission due to higher complexity.
- **Conclusion:** Higher resolution provides better fidelity but at the cost of increased bandwidth requirements.

13) Quadrature Phase Shift Keying (QPSK) :-

Block Diagram:-



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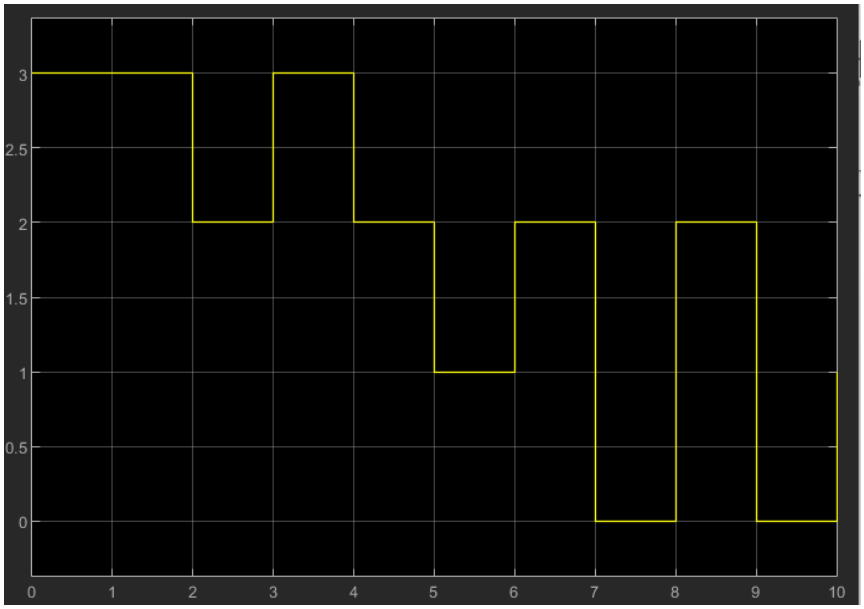
Information Signal :-



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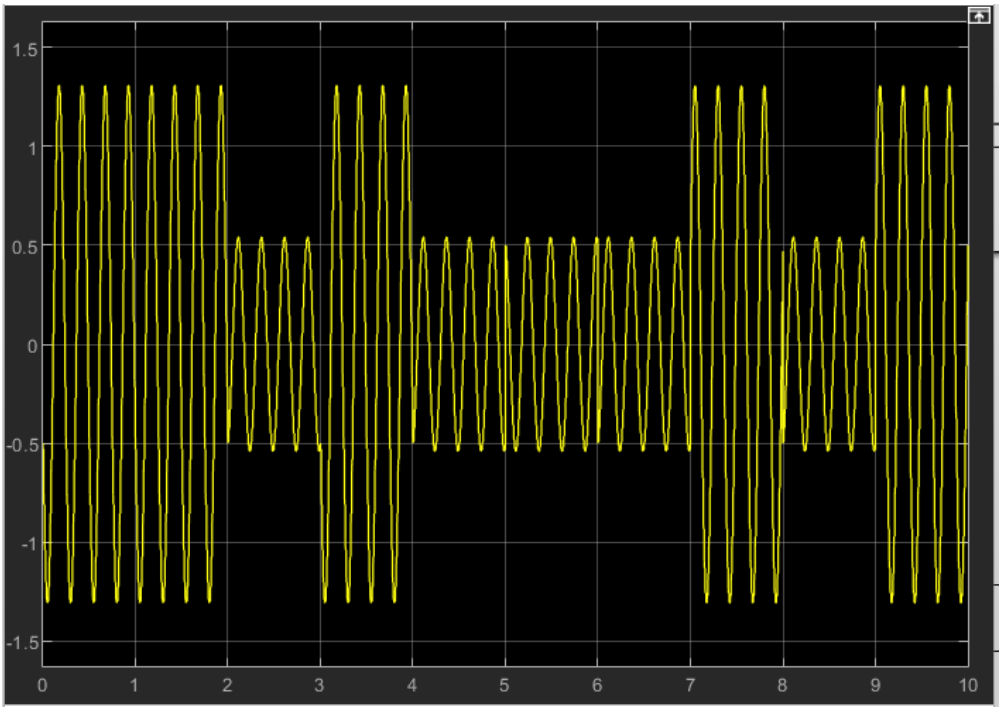
Simulation Project	**Date:-** 18-03-2024	**Enrollment No:-** 92200133030

Modulated Output :-



Demodulated Output :-

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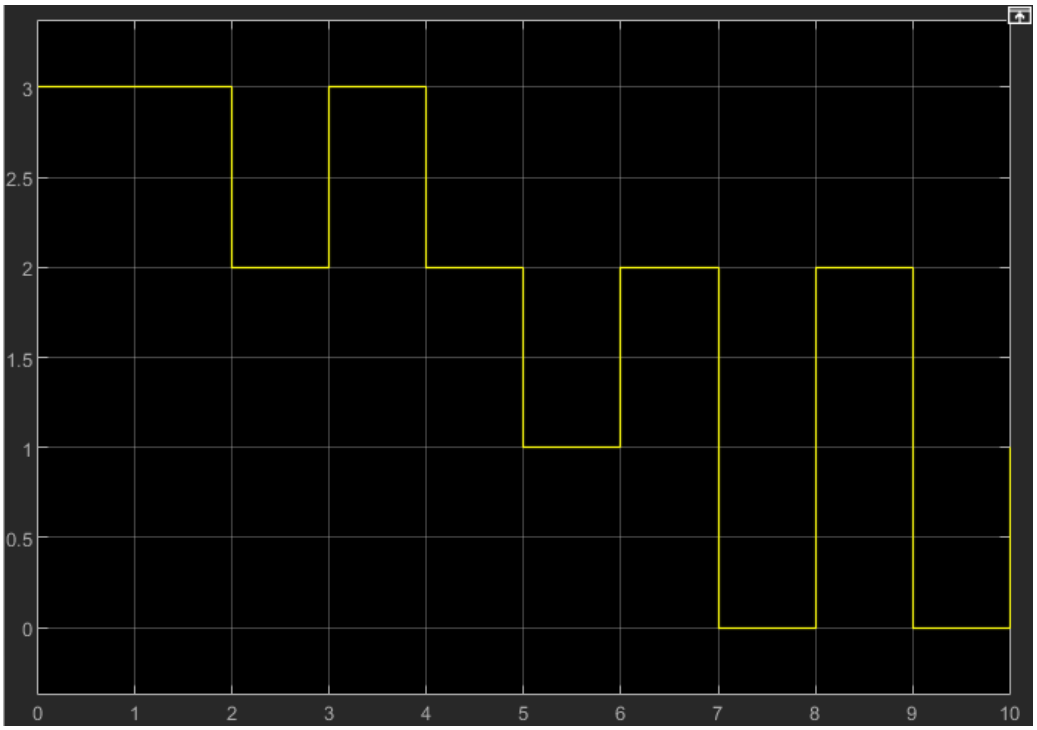

Summary :-

1) Parameter: Amplitude levels of the pulses.

- Effect: Increasing the number of amplitude levels increases the resolution of the signal but also increases the bandwidth required for transmission due to higher complexity.
- Conclusion: Higher resolution provides better fidelity but at the cost of increased bandwidth requirements.

2) Parameter: Symbol rate.

- Effect: Increasing the symbol rate increases the data transmission rate but also increases the susceptibility to noise and inter-symbol interference.
- Conclusion: Higher symbol rates enable faster data transmission, but they also demand more robust error-correction techniques to mitigate the effects of noise and inter-symbol interference.

3) Parameter: Carrier frequency.

- Effect: Changing the carrier frequency alters the spectral characteristics of the signal, affecting its propagation properties and susceptibility to interference.
- Conclusion: Selecting an appropriate carrier frequency is crucial for minimizing interference and maximizing signal strength, especially in environments with competing signals or frequency-dependent attenuation.

4) Parameter: Phase offset between adjacent symbols.

- Effect: Adjusting the phase offset changes the constellation diagram's shape and orientation, impacting the signal's resilience to phase noise and channel impairments.
- Conclusion: Optimal phase offset selection is essential for maintaining signal integrity and minimizing errors caused by phase noise and channel distortions.

5) Parameter: Error correction coding scheme.

- Effect: Implementing more sophisticated error correction codes improves the signal's resilience to noise and channel impairments but also increases computational complexity and overhead.
- Conclusion: Choosing an appropriate error correction coding scheme balances between achieving reliable data transmission and minimizing computational overhead, considering factors such as channel conditions and processing capabilities.