SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade(III Cycle)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB301-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

UNIT 1 – ANALOG COMMUNICATION

TOPIC – Pulse Communication-PAM

PULSE COMMUNICATION

•Pulse communication refers to a category of modulation techniques where information is transmitted using a series of pulses, which can vary in different properties such as amplitude, width, position, or code.

• These techniques are fundamental in digital communication systems and are essential for converting analog signals into digital form.

Key types of pulse communication include:

- Pulse Amplitude Modulation (PAM)
- Pulse Width Modulation (PWM)
- Pulse Position Modulation (PPM)

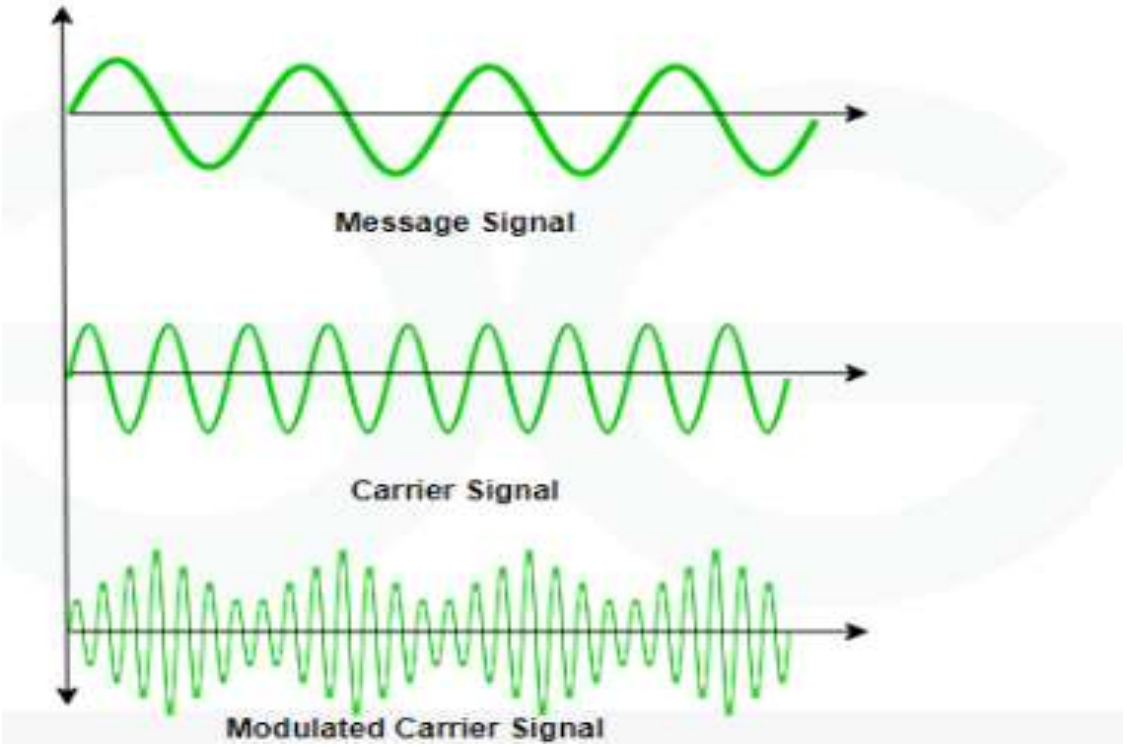
PULSE AMPLITUDE MODULATION (PAM)

•Pulse Amplitude Modulation (PAM) is a key modulation technique used in digital communication for transmitting analog data and is one of the most widely used types of analog-to-digital conversion.

•Its process is simple where the amplitude of a sequence of pulses changes with the instantaneous amplitude of the analog message signal.

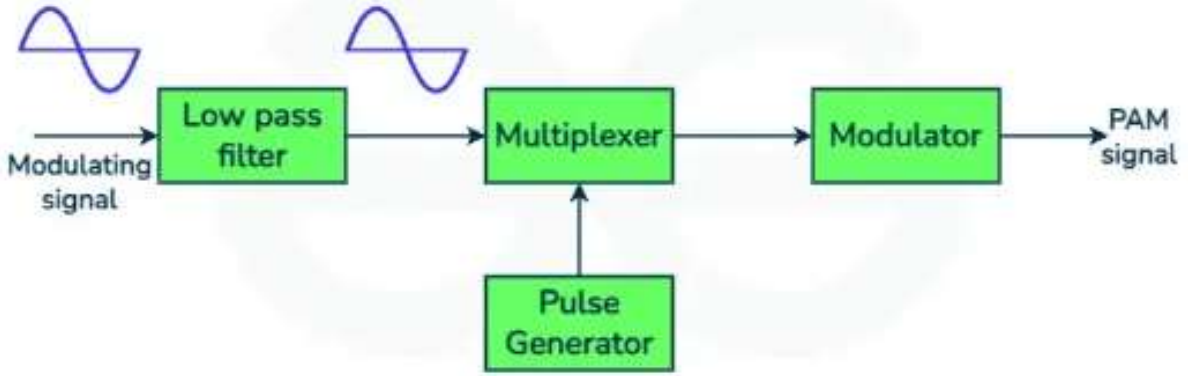
•The analog signal that is to be modulated is sampled by a sequence of pulses that are amplitude-modulated on the carrier to produce the amplitude-modulated pulses.

PULSE AMPLITUDE MODULATION (PAM)



PAM-BLOCK DIAGRAM

•Pulse Amplitude Modulation (PAM) is a modulation technique where the amplitude of a series of pulses is varied according to the amplitude of the analog signal being transmitted.



PAM-BLOCK DIAGRAM

A detailed breakdown of how PAM functions:

1.Sampled:

•Periodically the analog signals are sampled.

•These are called sampling intervals, and an aliasing of these has no chance if we put a condition for the sampling rate, “Nyquist theorem” states that the sampling frequency must at least be twice the highest frequency component of the signal.

2.Quantization: Each sample is provided with quantized amplitude.

3.**Modulation:**

•Since each sample’s quantization level constitutes the amplitude of the generated pulses, only single pulses are produced if every sample level is integer.

•Often, the pulse doesn’t change its width, but its amplitude can adopt any of the quantified sample values.

PAM-BLOCK DIAGRAM

4.Transmission through the medium of transmission:

•The carrier, for example, is a visual analog signal or digital one is represented as the pulse train that is modulated.

•It can be transmitted through wireless or wired pathway depending on the framework of purpose that lies behind it.

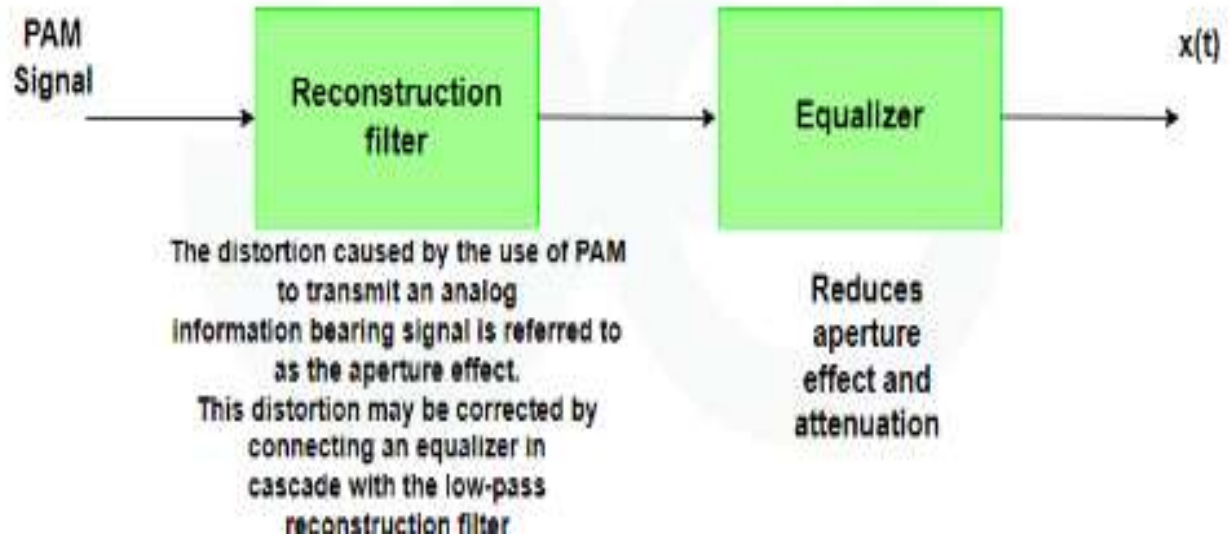
5.Reception: The reception results in amplitudes modulation which then undergoes a process of demodulation.

6.Reconstruction: By the summation of different orders of the magnitudes outlined in a given position, the low frequencies are under modulated and the final rebuild into a continuous signal. This also means that it is used for the interpolation.

7.Pass-through filtering: A low-pass filter is generally employed to take out the high-frequency components from the smooth recovered analog signal, which meanwhile preserves the original analog signal component

PULSE AMPLITUDE DEMODULATION

•Extracting the original data from the modulated signal is the demodulation process of pulse amplitude modulation, or PAM.



PAM-APPLICATIONS

- To send digital data over phone lines, digital subscriber line (DSL) modems use PAM.
- Pulse code modulation is used in audio CDs to encode analog audio signals into digital form.
- Digital data is sent across optical fibers using PAM in fiber optic communications.
- Physiological signals are sent over PAM in biomedical signal processing, including electrocardiography (ECG).
- Pulse width modulation (PWM) techniques are used in PAM-based industrial automation systems to control motor speed and position.

ACTIVITY

3. Analog information is converted to digital data using

a) Sampling

b) Quantization

c) Coding

d) All of the mentioned

PAM-ADVANTAGES

- PAM is inexpensive and simple to integrate into a variety of systems because it only requires simple analog circuitry.
- It facilitates the transfer of analog information via digital communication channels without compromising quality by encoding analog signals with discrete amplitude levels.
- PAM transmits analog signals over digital communication networks with ease, making it compatible with contemporary digital communication protocols. This is made possible by its integration with digital systems.
- PAM is simple, it has strong noise immunity and can withstand noise interference both during signal transmission and reception.
- Simple signal processing methods like filtering and demodulation are made possible by PAM, which makes it possible to efficiently extract information from modulated signals for a variety of applications, such as audio transmission and telecommunications.

PAM-DRAWBACKS

- AM is susceptible to amplitude changes, which can reduce signal quality and causes information loss during transmission, particularly when noise or channel distortion is present.
- Compared to other modulation techniques, PAM demands a large bandwidth, which results in lower efficiency in accordance with limited bandwidth and lowers the total capacity for data transmission.
- PAM has a reduced SNR, especially in high-noise settings where background noise can obstruct the signal and reduces the accuracy and dependability of the data being sent.

ASSESSMENT

1.What are all the types of pulse communication ?

2.What does the term PAM stands for?

THANK YOU