

Assignment No. - 2

- Q1 Write a Short Note on NRZ and RZ in point-to-point scheme.

→ Encoding Schemas

In digital communication, encoding schemes play a crucial role in transmitting data across networks. Such encoding methods are as follows- ↳ 1. NRZ ↳ 2.

- ① NRZ (Non-Return-to-Zero)

- In this scheme, a positive voltage defines bit 1, and zero voltage defines bit 0.

- 2) The signal does not return to zero at the middle of the bit.

- 3) In Polar NRZ encoding we use two levels of voltage amplitude.

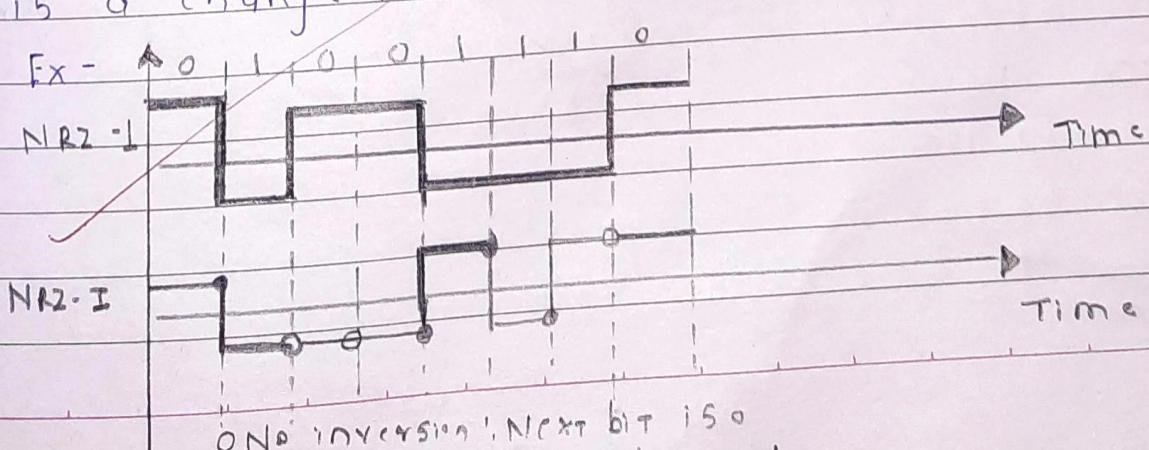
- 4) NRZ-1

- ① In NRZ-L, the value of the bit (0 or 1) is determined by the level of the voltage.

- 38 NRZ-I

- 3) NRZ-I

 - ① In NRZ-I, the value of the bit is determined by changes or lack of changes in the voltage level.
 - ② If there is no change, the bit is 0; if there is a change, the bit is 1.

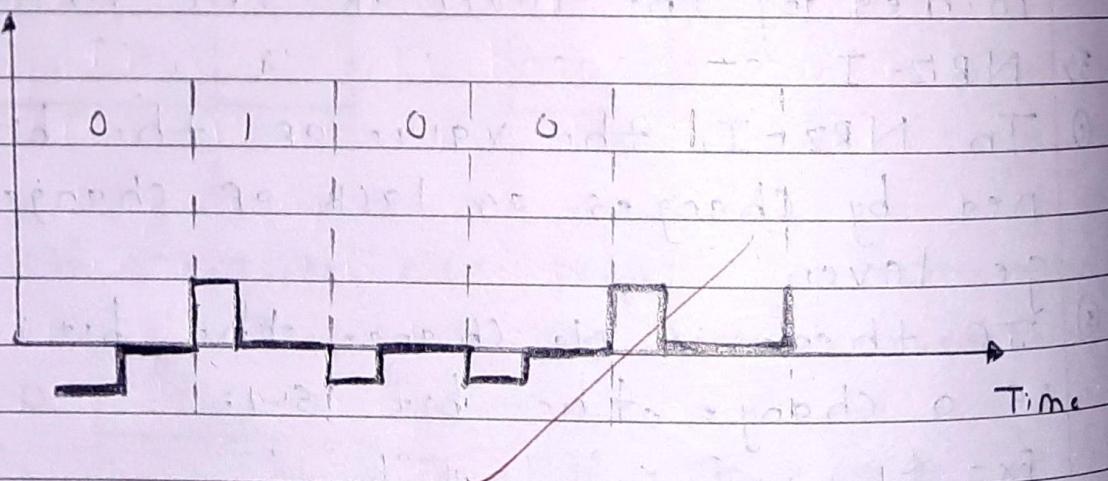


- Inversion : Next bit is

⇒ Return-to-Zero (RZ)

- ① Clock Synchronization Issue - RZ helps the problem of clock synchronization b/w Sender and Receiver in digital communication.
- ② RZ Schemes uses three values, Positive, Negative and Zero.
- ③ Signal variation within bits - In RZ, the signal transition to zero in the middle of each byte, 1 bit.
- ④ Polarity Changes Impact - Similar to NRZ, sudden polarity changes can lead to misinterpretation of bits in RZ encoding.
- ⑤ RZ encoding does not suffer from a DC component problem.
- ⑥ RZ encoding involves three levels of voltage, making it more complex to implement and interpret.

Amplitude



Q.2 Write a Short Note on Manchester and Differential Manchester.

→ 1) Manchester :-

- ① The Idea of RZ and the idea of NRZ-I are combined in the Manchester Scheme.
- ② Encoding Principle - Divides each bit into two halves.
- ③ Synchronization - Uses the transition at the middle of the bit for synchronization.
- ④ No baseline wandering - Eliminates baseline wandering by having both +ve & -ve voltage contributions for each bit.
- ⑤ It requires twice the bandwidth of NRZ, bcz it has more transitions within each bit, leading to a higher signal rate.

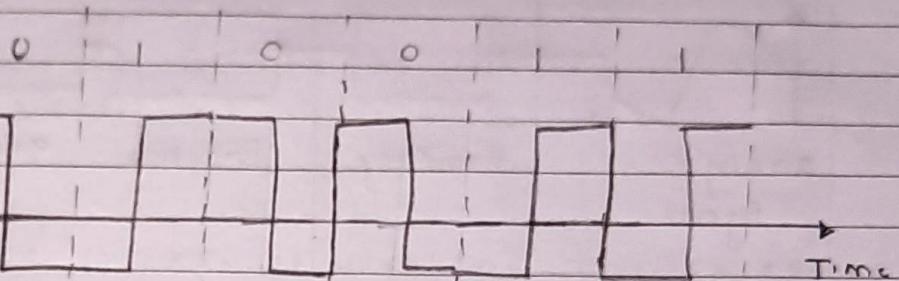
2) Ex-Differential Manchester.

- ① It combines the Idea of RZ and NRZ-I.
- ② Encoding Principle - It has a transition in the middle of the bit by + determines bit value at the beginning.
- ③ Synchronization - Utilizes the transition at the middle of the bit for synchronization.
- ④ No baseline wandering - Similar to Manchester, it eliminates baseline wandering with +ve and -ve voltage.
- ⑤ Bandwidth requirement - Requires a Minimum bandwidth twice the bandwidth of NRZ bcz they have more transitions per bit, in order to maintain the signal level.

Sing the signal rate.

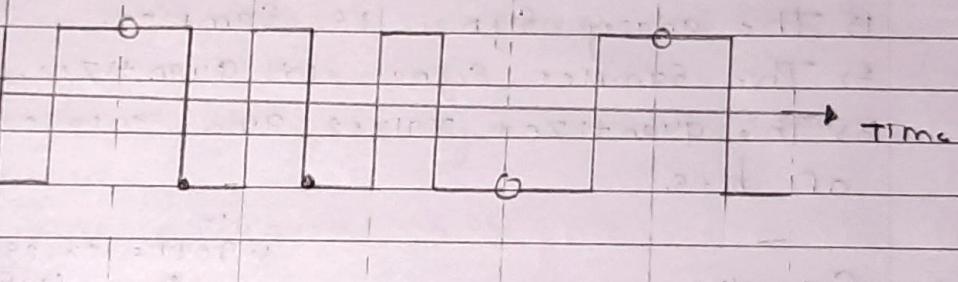
Ex -

Manchester



Differential

Manchester



0 : No Inversion → 1. Inversion in next bit is 0.

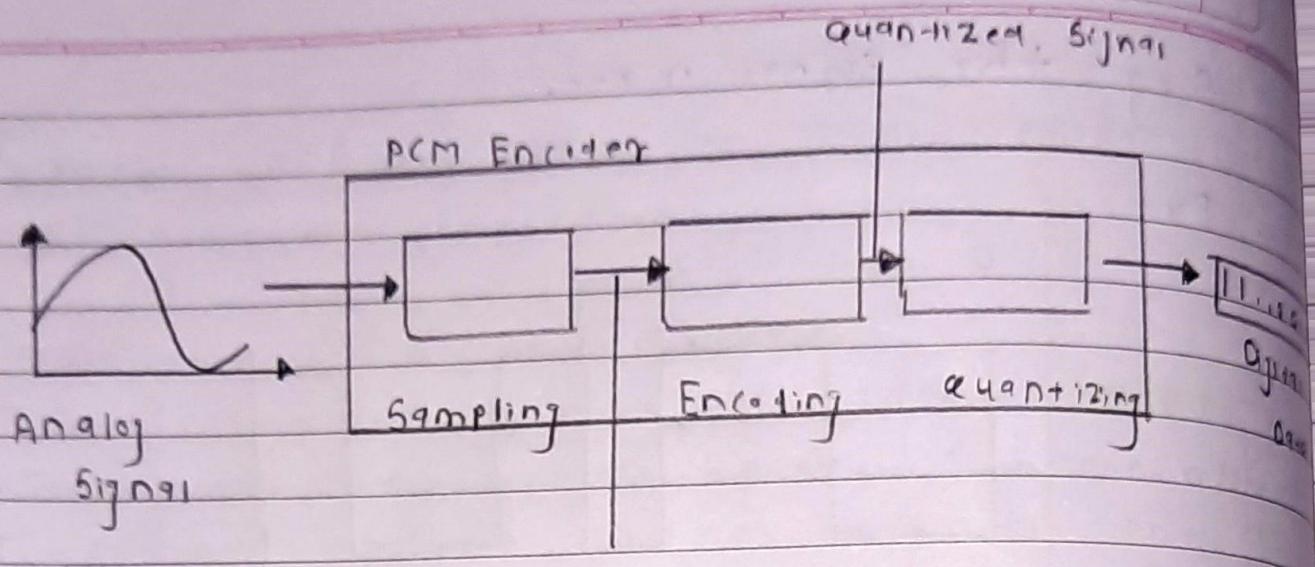
1 : Inversion in next bit is 1.

Q.3 Write a Short Note on Analog to Digital Converter OR Explain Pulse Code Modulation.

→ ① The most common technique to change an analog signal to digital data (digitization) is called Pulse code modulation (PCM).

② A PCM has three processes

- ↳ 1. Sampling
- ↳ 2. Encoding
- ↳ 3. Quantizing



PAM

Signal

- 1) The analog signal is sampled.
- 2) The sampled signal is quantized.
- 3) The quantized values are encoded as strings of bits.

Sampling

No
→ Reduces excessive bits &
↑ Confining the data.

- ① Sampling in PCM - Analog Signal is Sampled regularly.
- ② Sampling Interval (T_s) is the time b/w samples.
- ③ Sampling Rate (F_s) is the Inverse of Sampling Interval.

Sampling Method -

↳ Ideal

↳ Natural

↳ Flat-Top

- ⑤ Result of Sampling - Produces analog Signal with Non-integral values.

Encoding -

- ① The digitizing is a process of digitization of

analog signal is done by the encoder.

- ① It designates each quantizer level by a binary code.
- ② The Sampling done here is the Sample-and-hold process.

3) Quantizing:

- ① It is a process of reducing the excessive bits and confining the digits.
- ② By Calculation - Sampling Rate (f_s) \times Number of bits per sample (nb)
 $= f_s \times nb$

4) Advantage & Disadvantages

Advantage -

- ① Simple Implementation.
- ② Noise Immunity
- ③ Robustness (handle long distance transmission)
- ④ Error detection and correction.

Disadvantages -

- ① Bandwidth Requirement
- ② Sampling Rate Limitation
- ③ Delay.

Q.4 Write a short note on Delta Modulation.

- ① PCM is a very complex technique. Other techniques have been developed to reduce the complexity of PCM.
- ② The simplest is delta modulation. PCM finds the value of the signal amplitude for each sample.
- ③ Whereas DM finds the change from the previous

④ Modulator Functionality:

- 1) It converts analog signal to a stream of bits.
- 2) It records Positive / Negative changes which is denoted by (delta S).
- 3) It provides staircase-like signal for comparison.

⑤ Comparison Process:

- 1) It compares analog signal with staircase signal.
- 2) It determines next bit (1 or 0) based on comparison.

⑥ Staircase Adjustment:

- 1) It updates staircase signal based on Next bit.
- 2) It increases / decreases staircase point based on bit value.

⑦ Demodulator Operation:

- 1) It converts digital data back to the analog signal.
- 2) It uses staircase maker and delay unit.
- 3) Output passes through low-pass filter for Smoothing.

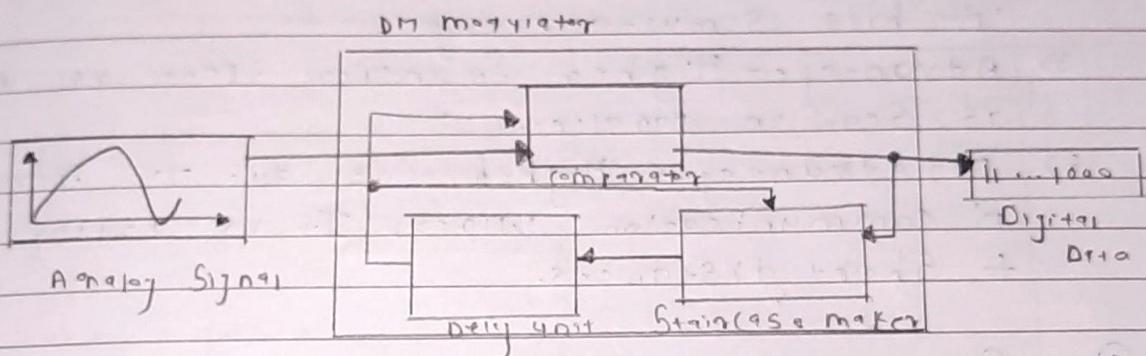
⑧ Adaptive Delta Modulation (DM):

- 1) It adjusts Δ based on analog signal amplitude.
- 2) It improves performance over fixed Δ modulation.

① Quantization error -

↳ Quantization error is always introduced in the process.

↳ It is error much less compared to pulse code modulation (PCM).



Inre

Q.5 Which are the different transmission modes.

→ ① Transmission modes determine how binary data is transferred between devices, considering the organization of data streams and wiring.

② Data transmission modes -

Data Transmission

Parallel

Serial

Asynchronous

Synchronous

Isynchronous

③ Parallel transmission -

- 1) Defn - In Parallel transmission, multiple bits (usually grouped as n bits) are sent simultaneously with each clock tick.
- 2) Mechanism - Utilizes 'n' wires to transmit 'n' bits simultaneously.
- 3) Advantage - Higher transfer speed as data is sent in parallel.
- 4) Disadvantage - Higher cost due to requiring 'n' communication wires, it is usually limited to short distances.

(4) Serial Transmission -

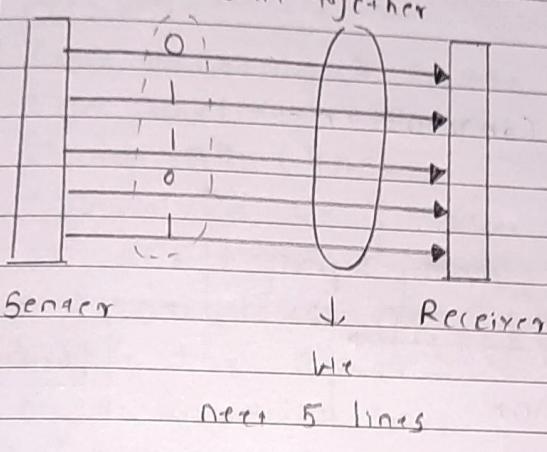
- 1) Defn - In Serial transmission, one bit follows another sequentially over a single communication channel.
- 2) Advantage - Lower cost compared to parallel transmission, as only one communication channel is needed.
- 3) Conversion Requirement - Requires conversion devices (Parallel-to-Serial and Serial-to-parallel) that is the interface between Sender and receiver at interface point.
- 4) Serial communication has three types
 - ↳ Asynchronous
 - ↳ Synchronous
 - ↳ Isynchronous.

Jmp

parallel

transmission

The 5 bits
are sent together



Serial

transmission

The 5 bits are sent one after another

0	1	0	1	1	1	1
0	1	0	1	1	1	1
0	1	0	1	1	1	1
1	0	1	0	1	0	1
1	0	1	0	1	0	1

We need only one line (wire)

Parallel Serial (wire)

converter

Receiver

- (5) Asynchronous - Data is sent as individual bytes with Start and Stop bits for synchronization.
- (6) Synchronous - Data is sent continuously with a synchronized clock signal for timing.
- (7) Isochronous - Data is sent with a constant rate to maintain timing integrity, commonly used in real-time applications.

Q. G. Which are the different Analog to Digital conversion techniques -
[ASK, FSK, PSK.]

and what are the differences
between them?