CE

2020

2(a) $\frac{\text{propagation speed}}{\text{bandwidth (s)}} = \text{bit length (m)}$

$\text{bit } \cancel{\text{length}} \text{ duration} = \frac{1}{\text{bandwidth (Mbps)}}$

$\therefore \text{bit length} = \text{propagation speed} \times \text{bit duration (m)}$

(b)

(c) $1^\circ = \frac{\pi}{180}$ radian

(d) Signal to noise ratio, $SNR = \frac{\text{Signal Power}}{\text{noise Power}}$

Shannon's theorem, data Rate $= B \log_2 (1 + SNR)$ (kbps).

2019

2(b) No of bits = bandwidth × propagation delay

no. of bits = 1 Mbps × 2 ms = $10^6 \times 2 \times 10^{-3}$ bit

= 2000 bit

(d) Throughput = $\frac{(\text{frames} \times \text{bit}) = \text{file size}}{\text{time}}$ (bps).

2018

2(a) bit rate = $\frac{\text{bit}}{\text{time}}$

bit rate = $\frac{10}{20 \times 10^{-6}}$ = 500 Kbps.

2 (b) Power of Signal $= 200 \times 10^{-3}$ W

Power of Noise $= 20 \times 2 \times 10^{-6} = 4 \times 10^{-5}$ W

$$SNR = \frac{\text{Signal Power}}{\text{Noise Power}} = \frac{200 \times 10^{-3}}{4 \times 10^{-5}} = 5000$$

$$* \boxed{SNR_{db} = 10 \log_{10} (SNR)} = 10 \log_{10} (5000) = 36 \text{ db}$$

6

2. (c) $B = 1 \times 10^{6}$ Hz, $SNR = 63$

bit rate, $C = B \log_2 (1 + SNR)$

$= 1 \times 10^{6} \log_2 (1 + 63)$

$= 6000000$ bps

$= 6$ Mbps

$L = 2^n$

signal level, $C = 2 B \log_2 (L)$

$6 \times \cancel{10^6} = 2 \times 1 \times \cancel{10^6} \log_2 (L)$ $\quad L =$

$3 = \log_2 (L)$

$2^3 = L$

$8 = L$

$\therefore L = 8$

$2^n = 8$

$2^n = 2^3$

$n = 3$

$s = vt$

2017

2ⓐ attenuation $= 10\log_{10}\frac{P_2}{P_1}$

$t = \frac{d}{v}$

$t.d. = \frac{m.s.}{bandwidth}$

~~bit rate $C = 2B\log_2 L$~~

Noiseless medium ; bit rate $= 2B\log_2 L$

bit Rate: no. of bit interval per second

bit interval : time taken to transport one single bit

Lab

ICE 3262 : CEL

Submit date: 07-02-23

Lab-1 :

1) Unipolar - NRZ

2) Polar NRZ-L

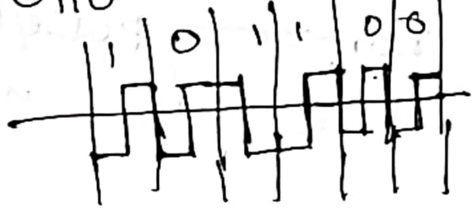
3) Polar NRZ-R

Matlab Code

Differential Manchester:-

0 ⇒ (transition).
1 ⇒ (no transition)

101100



1st এর টা একটা choose করতে হবে। এটা উপর depend করে পরের গুলা set করতে হবে।

ধরলাম 1 এর জন্য neg to pos নিলাম

2020

3 (a) Draw graph of AMI & MLT-3 shcheme for each of the following data streams, assuming that the last signal level is positive.

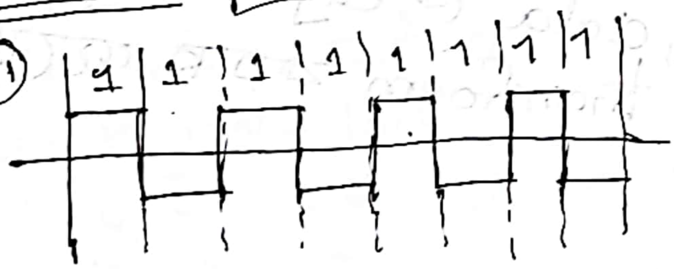
i) 11111111 (ii) 01010101 (iii) 00011000

AMI

0 → zero voltage level

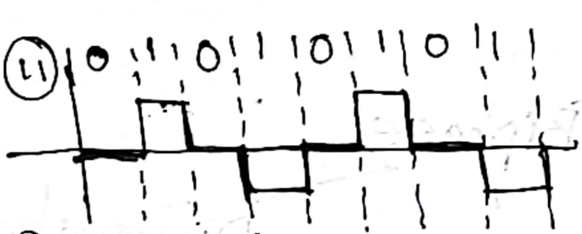
1 → Alternate Vol. level

(i)

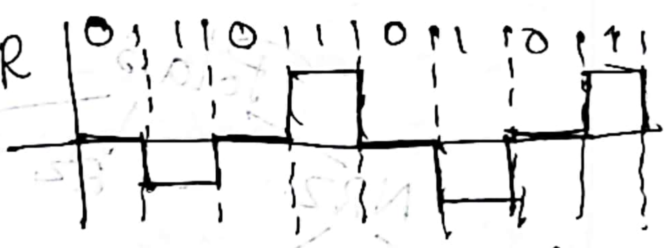


OR

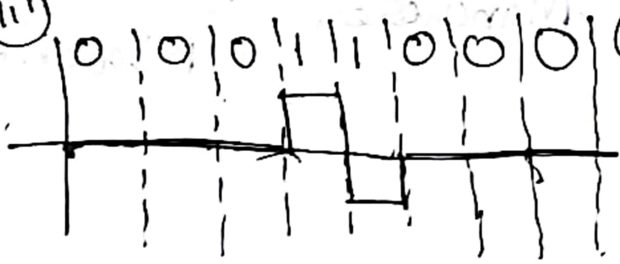
(ii)



OR



(iii)



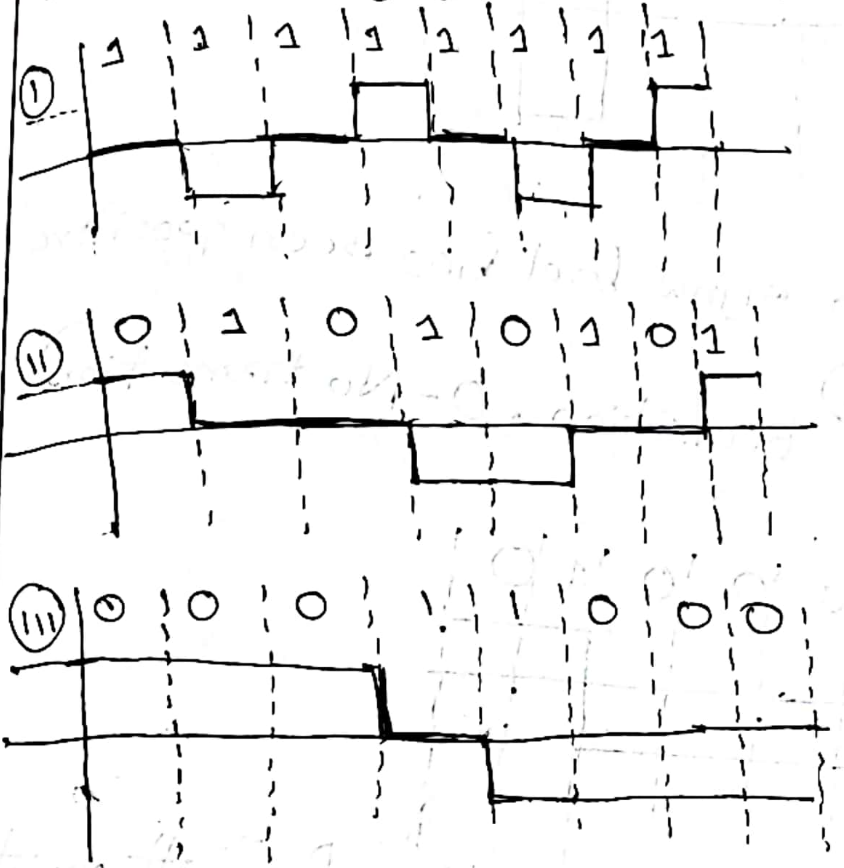
OR

MLT-3 : last signal level is positive +

Bit 0 → no transition

Bit 1 $\xrightarrow[\text{Not } 0]{\text{Current level}}$ 0

Bit 1 $\xrightarrow[0]{\text{Current level}}$ opposite of last non-zero level

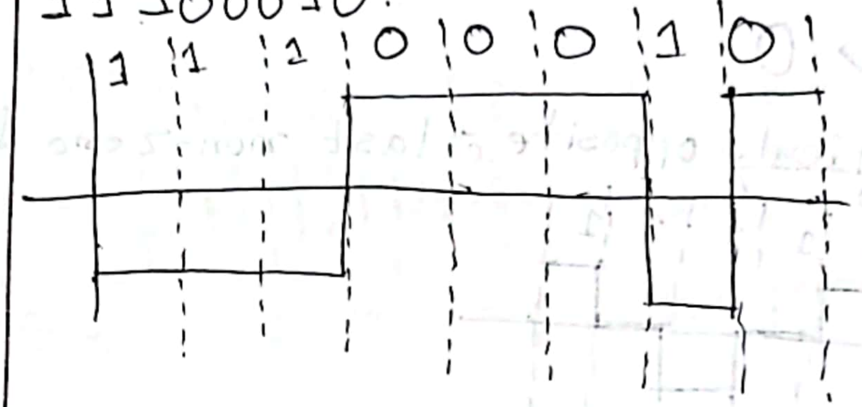


2019 3(a) Draw the digital signals encoded using NRZ-L and NRZ-I for the bit stream 11100010. Mention the problems occurred for this bit combination with each technique (last non-zero signal level has been positive).

(Level)

① NRZ-L (1-Negative, 0-positive).

11100010.



Last non-zero signal level has been positive.

(inverse)

② NRZ-I (1-transition, 0-No transition).

11100010

① Basline wandering is a problem for both variation but is twice as severe in NRZ-L. If there is a long sequence of 0s or 1s in NRZ-L, the average signal power becomes skewed. ② The receiver might have difficulty discerning (differentiate) the bit value. In NRZ-I this problem occurs only for a long sequence of 0s. ~~If~~ ③ The synchronization problem (sender and receiver

.

clocks are not synchronized) also exists in both schemes. This problem is more serious in NRZ-L than in NRZ-I.

(4) NRZ-L & NRZ-I both have a DC component problem. ~~most of~~ As the average signal rate is N/2, the energy is not distributed evenly between the two halves.

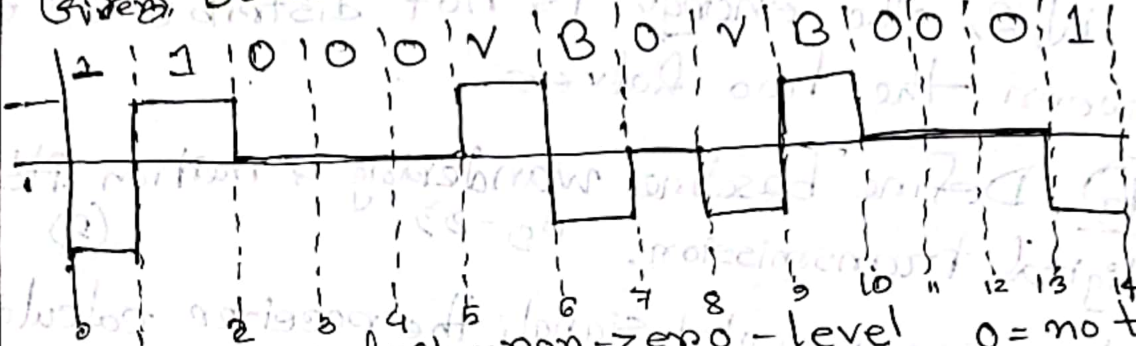
3(b) Define baseline wandering & mention its effect on digital transmission. Pg-99. (2)

→ In decoding a digital signal, the receiver calculates a running average of the received signal power. This average is called the baseline. The incoming signal power is evaluated against this baseline to determine the value of the data element. A long string of 0s or 1s can cause a drift in the baseline wandering & make it difficult for the receiver to decode correctly. A good line coding scheme needs to prevent ~~word~~ baseline wandering.

2018

3 (c) Draw the resulted signal of scrambing the sequence 1100000000000001 using B8ZS and HDB3 scrambling technique. (last non-zero signal level has been positive)

Soln. ~~Given~~ B8ZS. 1100000000000001 = 11000VB0VB0001

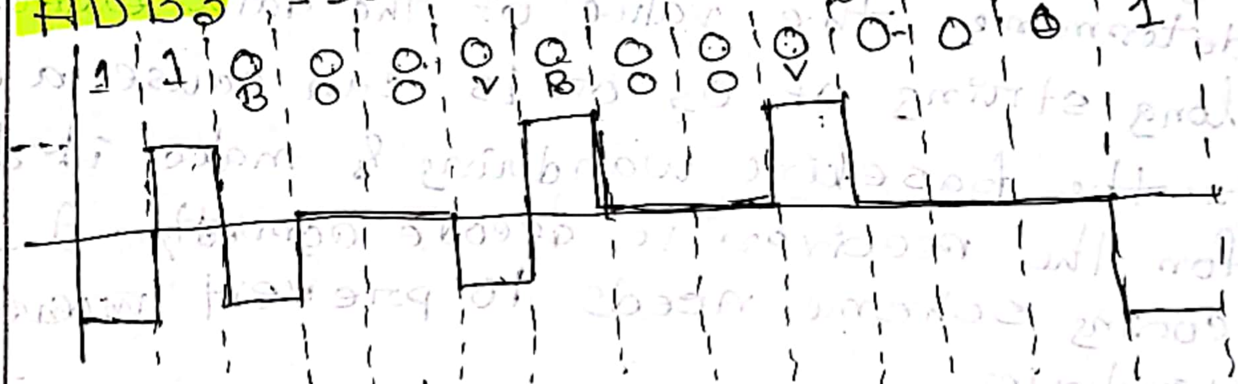


V= Same as last-non-zero-level   0 = no transition

B= opposite of last non-zero-level

1= " " " " "

HDB3 1100000000000001 = 11B00V



V= sam..   total last non-zero pulses → odd - 000V

B= opp.   " " " " " → even → B00V.

1 = "

0= no.

2020 1b

Transmission mode	Half-Duplex	Full-Duplex
Communication	Bi-directional communication, but not simultaneous	Bi-directional communination, simultaneous.
Transmission	Occurs in both direction, but not at the same time	Occurs in both directions at the same time
Signal Flow	Transmission alternate in both direction	transmission flows simultaneously in both direction
example	Walkie-talkie, ~~two~~ two way radio	Telephone conversation, video Conferencing, LANS, WANS.

2020 1 ⓒ Given, effective noise temperature ~~T~~ $= 100°C$
$= 100 + 273 K$
$= 373 K$

$B = 10 MHz$

k = Boltsman Constant
$= 1.38 \times 10^{-23} J/K$

$$N = KTB$$
$$= 1.38 \times 10^{-23} \times 373 \times 10 \times 10^{6}$$
$$= 5.1474 \times 10^{-14} \text{ Watts/Hz}$$

$$\therefore N \text{ dBW} = 10 \log_{10} \left(\frac{N}{1W}\right)$$
$$= 10 \log_{10} \left(\frac{5.1474 \times 10^{-14}}{1W}\right)$$
$$= -132.88 \text{ dBW}$$

2020

6 (a) If bw of an audio signal is 5 KHz, what will be required bandwidth of each AM radio station Find the total number of ~~usable~~ usable AM stations assuming the allocated carrier frequency from 530 KHz to 1700 KHz.

Ans: $BW = 5\ KHz$

Required bandwidth, $B_{AM} = 2 \times B = 2 \times 5 = 10\ KHz$

The allocated carrier frequency range for AM radio station is from 530 KHz to 1700 KHz
The total bandwidth available $= (1700 - 530)\ KH$
$= 1170\ KHz$.

∴ Total number of Usable station =

$$\frac{\text{Total bandwidth}}{\text{Required bw}} = \frac{1170\ KHz}{10\ KHz}$$

$$= 117$$

∴ total 117 usable AM radio station within the allocated carrier frequency range 530 KHz to 1700 KHz, assuming each stati requires 10 KHz.

Burst Error:- 2 or more bits in the data unit have changed from 1 to 0 or 0 to 1. A burst error does not mean that the errors occurs in consecutive bits. The length of burst is measured from the first corrupted bit to the last corrupted bit. Some bits in between may not have been corrupted

sent ← length of burst error (8 bits) →

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

corrupted bits

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

Received

(b) dataword = 101001111, divisor = 10111 (4 3 2 1 0), 5−1 = 4

$x^4 + x^2 + x + 1$

∴ add 4 zeros in last of dataword

XOR

```
10111 ) 1010011110000
        10111
        00011111
           10111
           010001
            10111
            0011000
              10111
              011110
               10111
               010010
                10111
                00101
```

CRC codeword = 1010011110101

2018

4 (b) Bandwidth, $B_W = 300 KHz$. $L = 1024$.

(a) Bit rate $= n \times f_s$ ~~Samp~~.

Low pass signal : frequency betn $0 - 200 KHz$ BW

$f_{max} = 200 KHz$.

Sampling rate, $f_s = 2 \times f_m$

$= 2 \times 200000$

$= 400000$ sample/s

$L = 2^{n_b}$

$\log_{10} L = n \log_{10} 2$

$$n_b = \frac{\log_{10} L}{\log_{10} 2}$$

$= 10$ bits/sample

$\therefore$ Bit rate $= n \times f_s = 10 \times 400000$ bps

$= 4$ Mbps

(b) PCM bandwidth of signal, $B_{min} = n_b \times B_{analog}$

$= 10 \times 200$

$= 2000 Hz$

$= 2 KHz$.