CSE320

Assignment No. 2

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Section : 16

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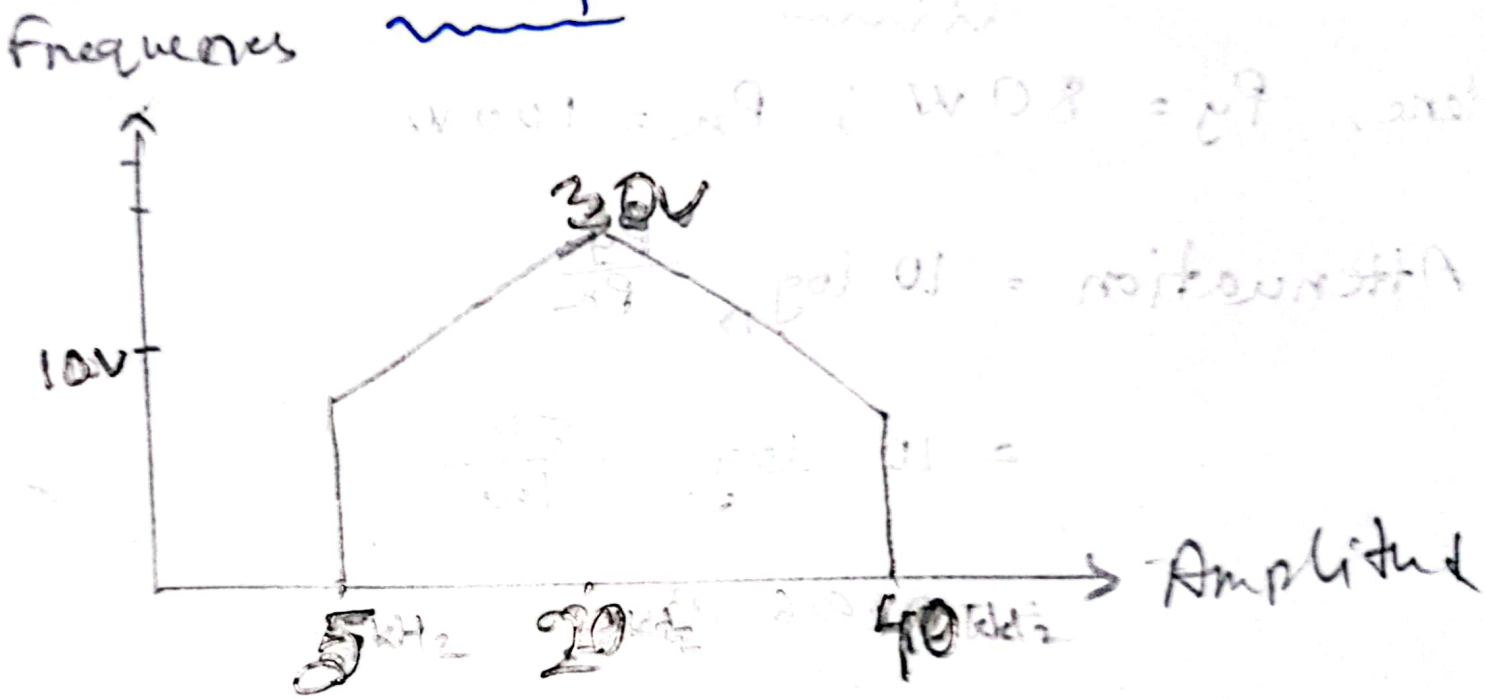
Ans. 1



Lowest freq = 5kHz
Highest = 40kHz
} Connesponds to 10v

Ans.2

Here, $P_y = 80\,W$; $P_x = 100\,W$

$$\text{Attenuation} = 10 \log_{10} \frac{P_y}{P_x}$$

$$= 10 \log_{10} \frac{80}{100}$$

$$= -0.096\ dB$$ (Ans.)

Ans.3

Here $SNR = 2000$; $B = 12000\,KHz$
$= 12 \times 10^6\,Hz$

$$C = B \log_2 (1 + SNR)$$

$$= 12 \times 10^6 \times \log_2 (1 + 2000)$$

$$= 1.316 \times 10^8\ bps$$ (Ans.)

Ans. 4

We know,

Total delay (latency) = Propagation time + Transmission time + Queuing time + Processing delay.

$$\text{Propagation time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{3000\ km}{2\times10^{8}\ ms^{-1}} = \frac{3000\times10^{3}\ m}{2\times10^{8}\ ms^{-1}}$$

$$= 0.015\ s = 15\ ms$$

$$\text{Transmission time} = \frac{\text{Size}}{\text{Bandwith}}$$

$$= \frac{6\ \text{million bits}}{10\ \text{mbps}} \quad \left[\text{size} = \frac{6000000}{1\times10^{6}}\right]$$

$$= \frac{6}{10} = 0.6\ s$$

$$\text{Queuing time} = 5\times5\ \mu s = 25\ \mu s = 0.025\ ms$$
$$= 25\times10^{-6}\ s$$

$$\text{Processing delay} = 2\ \mu s\times5 = 10\ \mu s = 10\times10^{-6}\ s$$
$$= 0.01\ ms$$

$\therefore$ Latency $= (\cancel{0.015 + 0.6 + 0.025 + 0.01})$ s

$= (0.015 + 0.6 + 25\times10^{-6} + 10\times10^{-6})$ s

$= \cancel{16.635 \text{ ms}}$

$= 0.615$ s transmission delay

Here, the ~~Propagation delay~~ component is the dominant component of the total delay which is 0.63 and the negligible component is processing delay which is 10×10^{-6} s.

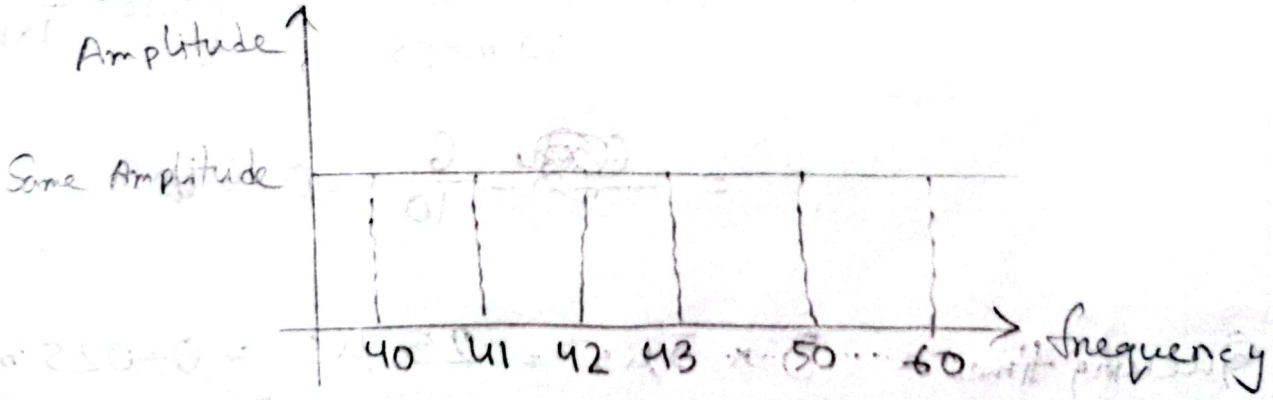
(Ans)

Ans. 5

Here; $f_H = 60$ Hz ; $B = 20$ Hz ; $f_L = ?$

$B = f_H - f_L$

$\therefore f_L = f_h - B = 60 - 20 = 40$ Hz



(Ans.)

Ans. 6

Attenuation	Distortion
(i) Loss of energy in signal	(i) Changes the form or shape of signal
(ii) shape of waveform doesn't change	(ii) Shape of wave form changes
(iii) Decreases the magnitude of a signal	(iii) Alters the shape, phase, or frequency content of the signal

Ans. 7

$P_{signal} = 200\,mW = 200 \times 10^{-3}\,W = 0.2\,W$

$P_{Noise} = 10 \times 2\,\mu W = 10 \times 2 \times 10^{-6}\,W$

$= 2 \times 10^{-5}\,W$

$\therefore SNR = \dfrac{P_{signal}}{P_{Noise}} = \dfrac{0.2}{2 \times 10^{-5}}$

$= 10000$

$\therefore SNR_{dB} = 10 \log_{10}(10000)$

$= 40$

Ans. 8

(a). The bit rate is the number of bits sent in 1s.

So, for 0.001 s ; Bit rate $= \frac{1}{0.001}$

$= 1000$ bps

(b) for, 2ms or 2×10^{-3} s; Bit rate $= \frac{1}{2\times10^{-3}}$

$= 500$ bps

(c) for 20μs or 20×10^{-6} s; Bit rate $= \frac{10}{20\times10^{-6}}$

$= 500\times10^{3}$ bps

Ans. 9

High SNR is more desirable. Because the higher the ratio, the better the signal quality. A high SNR means that the signal is clear and easy to detect or interpret and low SNR means that the signal is corrupted or obscured by noise and maybe difficult to distinguish or recover.

10. Ans.

We know,

number of bits per level = $\log_2$ (Level)

(i) 67 levels ; $= \log_2(67)$

$= 6.07 \approx 7$

(ii) 128 levels ; $= \log_2(128)$

$= 7$

(iii) 198 levels ; $= \log_2(198)$

$= 7.63 \approx 8$ (Ans.)

11. Ans

Baseline Wandering	DC Component
(i) A long strings of 0's and 1's can cause a drift in the baseline making it difficult for the receiver to decode properly	(i) When the voltage level in the digital signal is constant for a while, the spectrum creates very low frequencies.
(ii) Shifts baseline up or down	(ii) shifts entire waveform
(iii) Reduces accuracy of amplitude amplitude measurements	(iii) Causes amplitude distortion in the signal

~~Due to the presence of~~

Both Baseline wandering and DC component effects on digital transmission : They can cause errors during the conversion process and lead to inaccurate representation of the original signal

(i) They can cause amplitude distortion is the transmitted signal, affecting the accuracy of a amplitude measurements and signal interpretation

(ii) Baseline wandering can complicate signal processing and analysis because the shifting baseline obscures or distorts the underlying signal properties.

(iii) The presence of a DC component, the entire signal may be displaced towards the upper or lower limits of the transmission range, resulting in a loss of dynamic range.

Ans. 12

Scrambling is a binary bit-level processing applied to the transmission rate signal in order to make the resulting binary sequence appear more random.

The purpose of scrambling is to introduce controlled randomness or to achieve certain desirable properties in the transmitted signal. Scrambling is commonly employed in digital communication systems, such as wired and wireless transmission, to achieve → enhancing signal security, enhancing channel capacity. etc.

Ans. ~~Q~~ 13

The data stream refers to the sequence of binary data that needs to be transmitted or encoded using a specific coding scheme.

~~Differential~~ D. Manchester encoding is a self-clocking scheme, that doesn't require block coding. It represents data by transition and the lack of transition within each bit period. A transition in first half indicates a "0" or '1', while the transition or non-transition in the second half represents the ~~inve~~ inversion of the previous bit. This

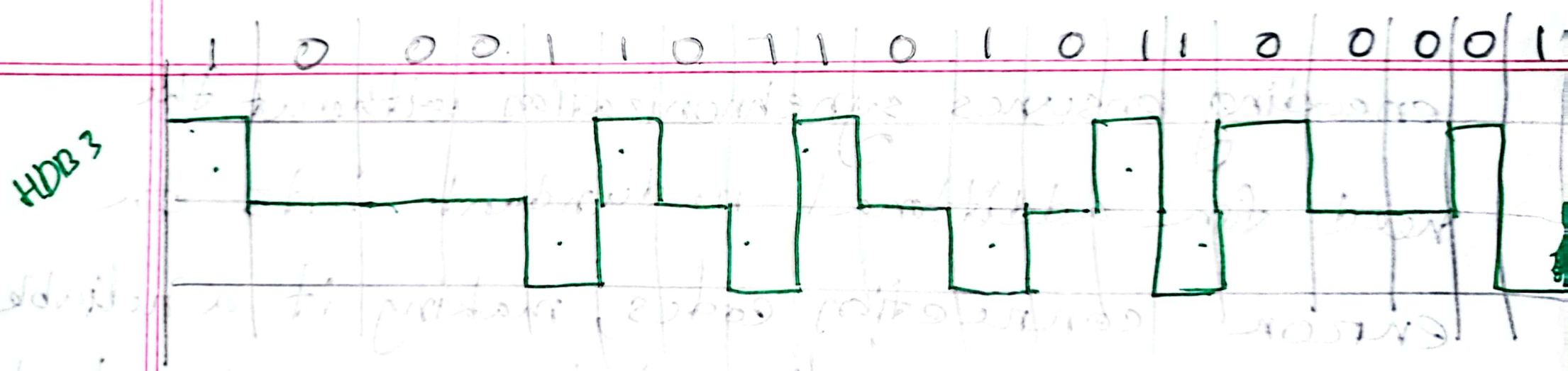
encoding ensures synchronization without the need for additional redundant bits on error connection codes, making it a reliable and efficient encoding technique. ~~D. Manchester~~

Ans. 14

(i) NRZ-L ; 1000110110110000001

(ii) Manchester Encoding

(iii) HDB3 Encoding..



Ans. 13

The data stream refers to the sequence of

Ans. 15

Differential Manchester solves a number of common problem that occur in signal encoding process.

1. Baseline Wandering : By having transition for both '0' and '1' bits, this coding avoids a constant voltage level during consecutive bits of the same value.

2. DC Component : By ensuring that there is always a transition during each bit period. This eliminates the constant voltage level and prevents the accumulations of DC component in the signal

~~3. Synchronizing~~

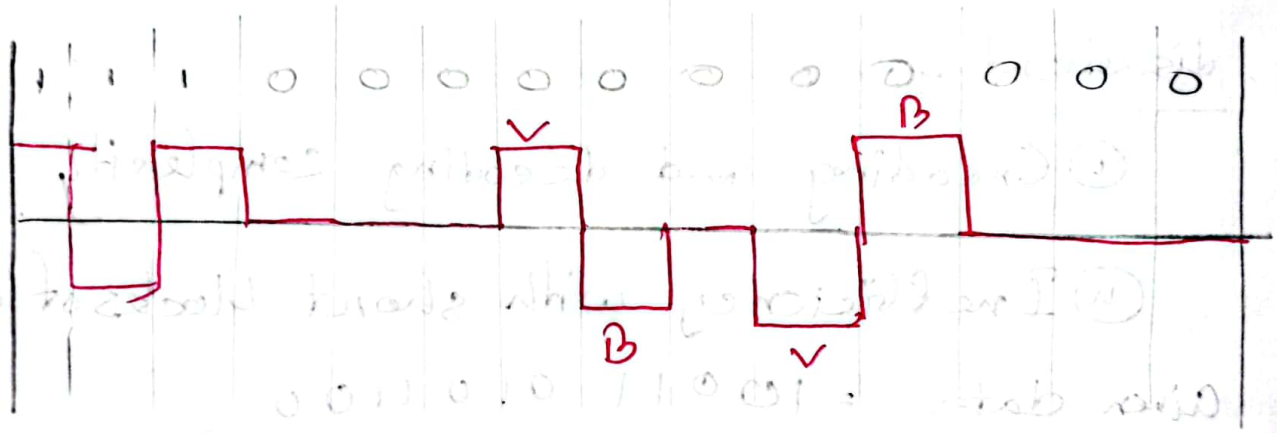
3. Self Synchronization : By introducing additional transitions within each bit period, regardless of the bit value. ~~A transition is introduced at the begining of a bit value~~. Guarantees a transition during each bit period, allowing

the receiver to synchronize its clock with the incoming signal.

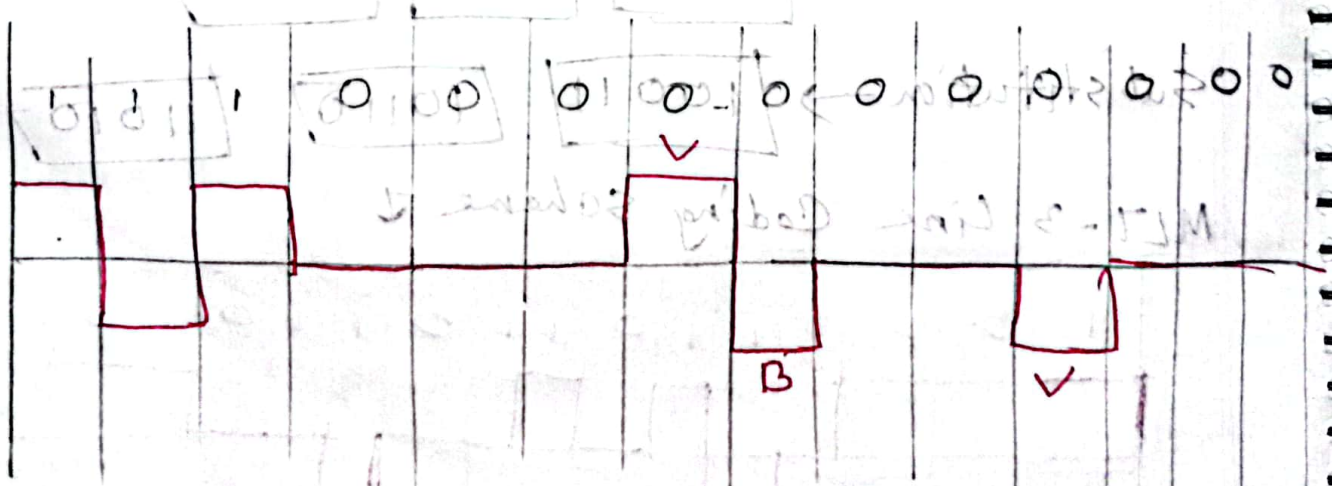
Ans. 16

1110000000000000

(a) B8ZS



(b) HDB3



Ans. 17

Advantages

(i) Error detection and correction capabilities.

(ii) Simplified error handling within each block

(iii) Increase robustness against noise and interference

disadvantages

(i) Encoding and decoding complexity

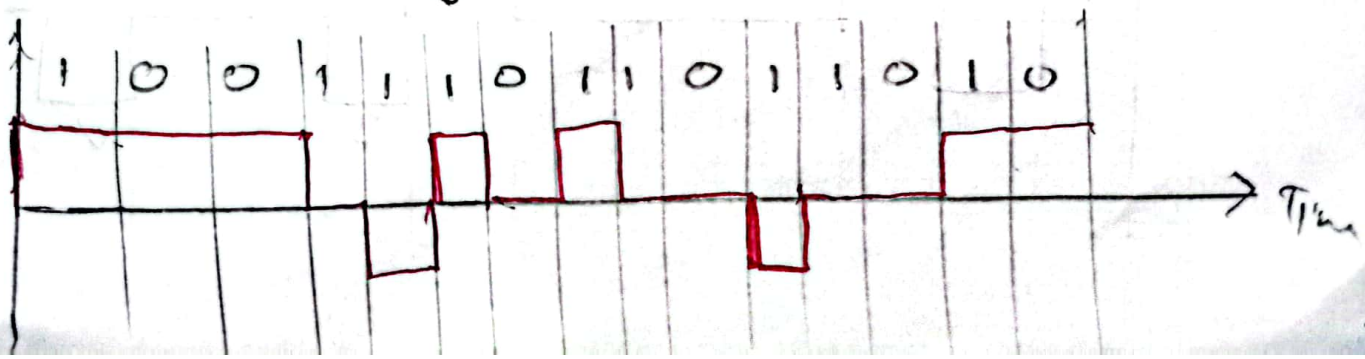
(ii) Inefficiency with short blocks of data

Given data = 10011 0101100

Division → [1001] [1010] [1100]

Substitution → [10011] [10110] [11010]

MLT-3 Line Coding scheme :



Ans. 18

Bipolar-AMI scheme rules are violated in B8ZS scrambling →

~~(i) Bipolar-AMI vi~~

(i) B8ZS scrambling violates the rule of AMI by substituting 8 consecutive 0's with a special pattern, disrupting the normal alternating pattern of positive and negative voltage levels.

(ii) It violates the rule of maintaining signal polarity in Bi-polar AMI by introducing voltage transitions during the substitution of 8 consecutive '0' with 'B' pattern.

(iii) Introduces an imbalance in the number of positive and negative pulses, deviating from the balanced pulse distribution principle of Bipolar-AMI encoding.

Ans. 19

Sometimes, Bipolar encoding are preferred over unipolar encoding schemes due to 2 main issues that can be avoided.

(i) DC Component: Unipolar encoding schemes can suffer from the accumulation of DC component in the transmitted signal. This ~~occur~~ occurs because the scheme uses constant voltage level. On the other hand, Bipolar encoding schemes avoid the accumulation of DC component. In this scheme, both '0' and '1'is represented by alternating positive and negative voltage levels, or be zero voltage levels. This balanced representation ensures that the average voltage level remains around zero, eliminating the DC component problem

(ii) Signal Integrity: Unipolar encoding can be more susceptible to errors caused by noise or interference compared to Bipolar encoding. Since unipolar encoding relies on a single voltage level to represent one binary state,

any noise that affect the signal during transmission can easily distort or corrupt the encoded data.

Ans. 20

NRZ-I encoding is better than NRZ-L encoding for several reasons:

Baseline Wandering is a problem for both NRZ-I and NRZ-L. But it is twice as severe in NRZ-L. If there is a long sequence of 0's or 1's in in NRZ-L, the average signal power becomes skewed. The receiver might have difficulty discerning the bit value. In NRZ-I this problem occurs only for long sequence of 0's

Synchronization Problem is another main reason. This problem also exists in both schemes but this problem is more serious in NRZ-L than in NRZ-I. While long sequence of 0's can

cause a problem in both schemes, a long sequence of 1's affects only NRZ-I

These are the reason why NRZ-I is better than NRZ-L