Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

Course Title: Computer Communication Network   **Module:** 06
Instructor: Sir waqas   **Total Marks:** 50

Student Details

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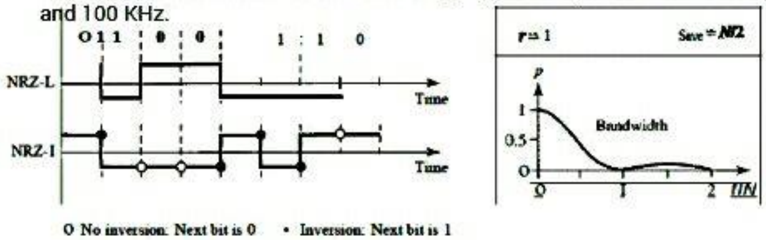
Q1.	(a)	1. An NRZ-I signal has a data rate of 100 Kbps. Using the following Figure, calculate the value of the normalized energy (P) for frequencies at 0 Hz, 50 KHz, and 100 KHz.  2. What is the Nyquist sampling rate for each of the following signals? a. A low-pass signal with bandwidth of 200 KHz? b. A band-pass signal with bandwidth of 200 KHz if the lowest frequency is 100 KHz? 3. We have sampled a low-pass signal with a bandwidth of 200 KHz using 1024 levels of quantization. a. Calculate the bit rate of the digitized signal. b. Calculate the SNRdB for this signal. c. Calculate the PCM bandwidth of this signal. 4. What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling.	Marks 20 CLO 1
Q2.	(a)	Draw the graph of the NRZ-L, NRZ-I, Manchester and differential Manchester scheme using each of the following data streams a. 01010101 b. 00110011	Marks 16 CLO 1
Q3.	(a)	1. A TV channel has a bandwidth of 6 MHz. If we send a digital signal using one channel, what are the data rates if we use one harmonic, three harmonics, and five harmonics? 2. A signal travels from point A to point B. At point A, the signal power is 100 W. At point B, the power is 90 W. What is the attenuation in decibels? 3. The attenuation of a signal is -10 dB. What is the final signal power if it was originally 5 W? 4. A signal has passed through three cascaded amplifiers, each with a 4 dB gain. What is the total gain? How much is the signal amplified? 5. If the bandwidth of the channel is 5 Kbps, how long does it take to send a frame of 100,000 bits out of this device?	Marks 12 CLO 1
		6. The light of the sun takes approximately eight minutes to reach the earth. What is the distance between the sun and the earth?	
	(b)	A signal has eight data levels with a pulse duration of 2 ms. Calculate the pulse rate and bit rate.	Marks 02 CLO 1

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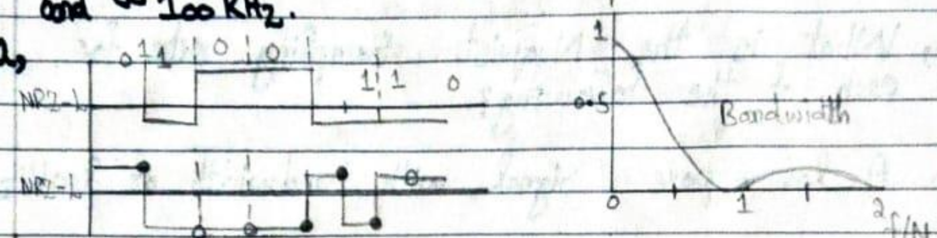
SUBJECT :- CCN   SUBMITTED To :- SIR WAQAS

QUESTION 1 :-

An NRZ-I signal has a data rate of 100 Kbps. Using figure calculate value of normalized energy (P) for frequencies of 0Hz, 50KHz and 100KHz.

a,



Given data :-

$N = 100$ KbPS

$F = 0Hz$, $50KHz$, $100KHz$.

$P = ?$

So,

first we find F/N :-

$F/N = 0/100$

$= \boxed{0}$

For 50KHz,

$F/N = 50/100$

$= \boxed{\frac{1}{2}}$

For 100KHz,

$F/N = 100/100$

$= \boxed{1}$

Finding energy P :-

By graph it has clear that

At point 0,

$\boxed{P = 1.0}$

At $\frac{1}{2}$:-

$P = 0.5$

At 1 :-

$P = 0.0$

b) What is the Nyquist Sampling rate for each of the following?

(i) A low-pass signal with bandwidth of 200 KHz?

Sol:- Low pass signal with bandwidth = 200 KHz

$200\,KHz \Rightarrow 200 \times 10^3\ Hz$
$= 200,000\ Hz$.

Nyquist rate formula :-

Nyquist rate = $2 \times f_{max}$

So,

in low-pass signal $f_{min} = 0$

So,

Nyquist rate = $2 \times f_{max}$
$= 2 \times 200,000$
$= 4,00,000$ Samples

(ii) A band-pass signal with bandwith of 200 kz. Lowest frequency is 100 Hz.

As we know that

Nyquist rate = $2 \times f_{max}$

we have $f_{min} = 100\,Hz$ and $f_{max} = 200$

So $f_{max} = 100 + 200 = 300\ KHz$

$f_s = 2 \times 300,000$
$= 600,000$ Samples

c, We have sampled a low pass-signal with bandwidth of 200KHz using 1024 levels of quantization?

i, **Calculate the bit rate :-**

As we find that

$$\text{Nyquist rate} = 2 \times f_{max}$$
$$= 200,000 \times 2$$
$$= 400,000 \text{ samples}$$

So,

$$\text{Bit rate} \Rightarrow n_b = \log_2 1024$$
$$= 10 \text{ bits / sample}$$

So,

Quantization 10 bits / Sample.

So,

$$\text{Bit rate} = 400,000 \times 10$$
$$= 4\text{Mbps}$$

ii, **Calculate SNRdB of this signal.**

We have $n_b = 10$ bits

So,

$$SNR_{dB} = 6.02 \times n_b + 1.76$$
$$= 6.02 \times (10) + 1.76$$
$$= 60.2 + 1.76$$
$$= 61.96$$

iii, **Calculate the PCM :-**

$n_b = 10$ bits $\quad B = 200\text{KHz}$

$$B_{PCM} = n_b \times B_{analog}$$
$$= 10 \times 200 \times 10^3$$
$$= 10 \times 200,000$$
$$= 2\text{MHz}$$

4, What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling?

$B = 200\,KHz \qquad n_b = \log_2 4$

So,

$N_{max} = 2 \times B \times n_b$
$= 2 \times 200{,}000 \times \log_2 4$
$= 800\ Kbps$

Q2 Draw the graph of NRZ-L, NRZ-I, Manchester and different Manchester using following data streams?

a, 01010101

b, 00110011

Solution:-

First we have to find bandwidth.

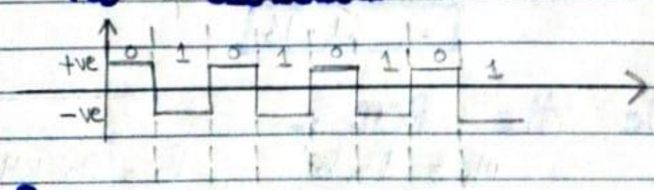
NRZ-L:-

In NRZ the voltage level are both sides of the time axis.

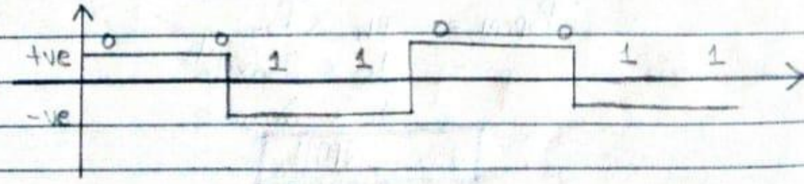
Voltage level +ve = 0
Voltage level −ve = 1

Graph:-

For 01010101



For 0011 0011



NRZ-L has a avexage signal xate is N/2 means avexage no of changes in the signal level.

The minimum bandwidth of avexage band xate is

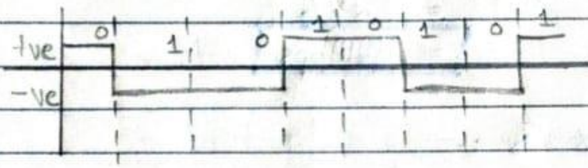
$$B_{min} = S = \frac{N}{2}$$

$$\boxed{B_{min} = \frac{N}{2}}$$

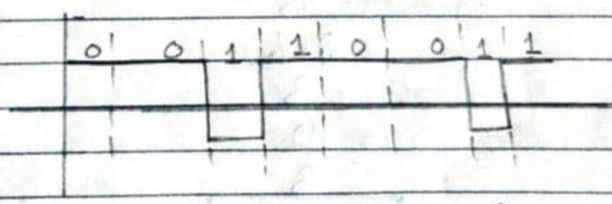
NRZ -I :-

In this case invention occus when next bit -is 1 othes with no invexsion.

Fox 01010101



Fox 00110011

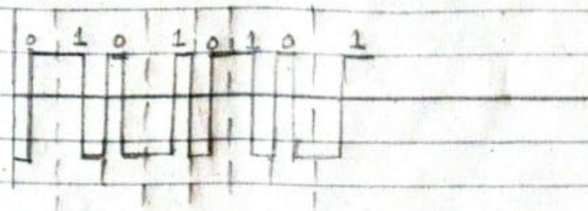


avexage signal xate of NRZ-I is = N/2

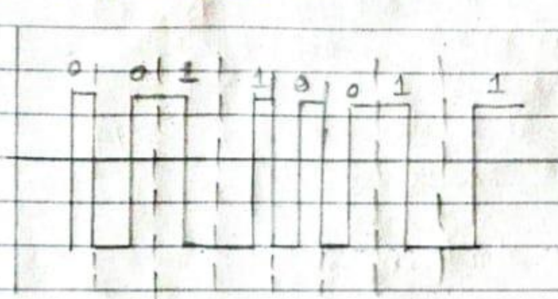
$$\boxed{B_{min} = \frac{N}{2}}$$

Manchester Sheme :-

For 01010101



For 00110011



Q3 Question 3 :-
(a xi) A TV channel has bandwith of 6MHz. If we send digital signal using one channel. What are the data rates if we use one harmonic, 3 and 5?

Given data:-

TV channel bandwidth $B = 6MHz$

So,
For 1 channel.

$$\text{Bandwidth}(B) = \frac{\text{datarate (bit rate)}}{2}$$

$$\text{Data rate} = 2 \times B = 2 \times 6 = \boxed{12\text{Mbps}}$$

Similarly, For 3 :-

$$\text{Data rate} = \frac{2 \times B}{3} = \frac{2 \times 6}{3} = \frac{12}{3} = \boxed{4\text{Mbps}}$$

Now for 5 :-

$$\text{Data rate} = \frac{2 \times B}{5} = \frac{2 \times 6}{5} = \frac{12}{5} = \boxed{2.4\text{Mbps}}$$

(ii) A signal travel from point A to B. At point A signal power is 100 watt. At point B power is 90 W. What is the attenuation in decibels?

Solution :-

At point A :- $P = 100\,W$
At point B :- $P = 90\,W$
Attenuation = ?

So,

$$\text{attenuation in (dB)} = 10\log_{10}\frac{B}{A}$$

putting values

$$= 10\log_{10}\left(\frac{90}{100}\right)$$

$$= 10\log_{10}(0.9)$$

$$= 10(-0.046)$$

So,

$$\log_{10}(0.9) = -0.046$$

Attenuation (dB) = −0.46dB

(iii) The attenuation of a signal is −10dB. What is the final signal power if it was orginally 5.

Attenuation is the reduction of strength in the power of a signal due to external factors.

$P = 5W$
attenuation = −10dB

Formula:-

$$-10 = 10\log_{(10)}\cdot(Pd/5)$$

$$Pd = 10^{-1} \times 5$$

$$\boxed{Pd = 0.5\ W}$$

(iv) **A signal has passed through 3 cascade amplifiers each with a 4dB gain. What is the total gain? How much the signal is amplified?**

First we find total gain.

Amplifiers = 3

Each gain = 4dB

So, total gain = 3x4dB

$$\boxed{P_{dB} = 12dB}$$

Now,

Signal amplified

$$P_{dB} = 10 \log_{10}^{P}$$

$$P = 10^{\frac{PdB}{10}}$$

$$P = 10^{\frac{12}{10}}$$

$$\boxed{P = 15.85}$$

(v) **If the bandwidth of channel is 5Kbps, how long does it take to send a frame of 100,000 bits out of this device?**

Solution:-

Bandwidth = 5Kbps

Convert it in to bps.

(1Kbps = 1000 bps)

So (5Kbps = 5000 bps)

B = 5000 bps

Frame = 100,000 bits

Time T = ?

$$T = \frac{100,000}{5000}$$

T = 20 Sec

vi) The light of sun takes approximately 8 minutes to reach the earth. What is the distance between the sun and the earth?

Solution :-

Time to reach earth = 8 minutes

Convert minutes in to seconds.

8min = 8 x 60 sec (1 hour = 60sec)

= 480 sec

Now convert m/s to km/s.

$$= \frac{18600 \text{ miles}}{\text{Sec}} \times \frac{1 \text{ Km}}{0.621 \text{ miles}}$$

= 300,000 km/s

Now,

Multiply sec with Km/s

= 480 x 300,000

~~Time~~ Distance => **= 144,000,000 Km/s**

b) A signal has 8 data levels with a pulse duration of 2ms. Calculate the pulse rate and bit rate?

Solution :-

data levels = 8

T = 2ms

Pulse rate = ?

Bit rate = ?

For Pulse :-

$$\text{Pulse rate} = \frac{1}{2\text{ms}}$$ = **500 pulse/sec**

Bit rate = Pulse rate × $\log_2 L$

$= 500 \times \log_2 8$

$= 1500$

THE END