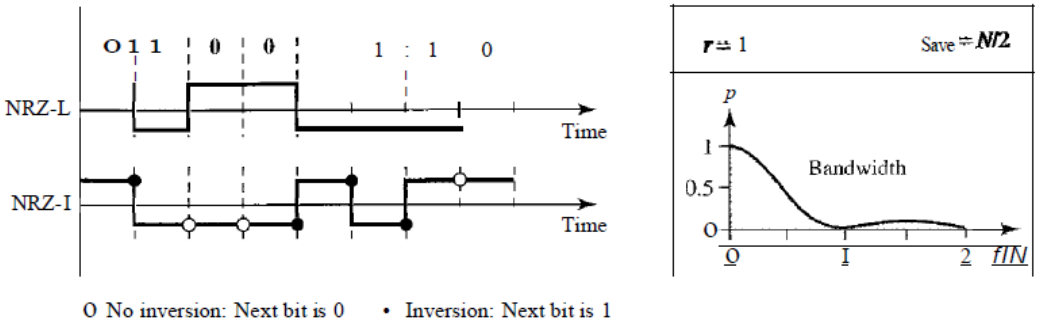
Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

Course Title: Computer Communication Network **Module:** 06
Instructor: Engr Waqas sb **Total Marks:** 50

Student Details

Name: Muhammad Waqar Hameed **Student ID:** 6939

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.  0 No inversion: Next bit is 0 • Inversion: Next bit is 1 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? 6. The light of the sun takes approximately eight minutes to reach the earth. What is the distance between the sun and the earth?	Marks 12 CLO 1
	(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

Q 1 (a)

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 0Hz, 50 KHz and 100 KHz

Ans:

Given data

Data rate N = 100 Kbps

Now first Calculate

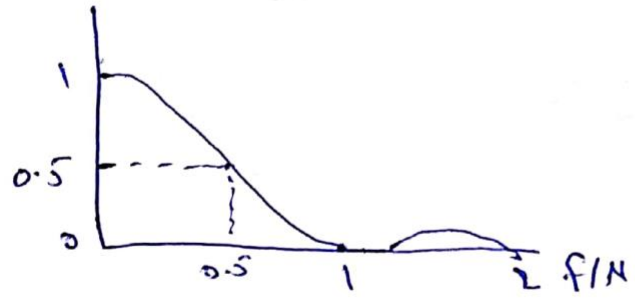
f/N value then after find energy P Value by using the given figure

f = frequency

N = data rate

P = energy per Hz

The given figure is



Case 1 : f = 0Hz then $f/N = \frac{0}{100} = 0$

$f/N = 0$, So $P = 1$

Scanned with CamScanner

Case 2: $f = 50$ KHz then $f_N = \frac{50}{100} = 0.5$

$\frac{f}{N} = 0.5$ So

$P = 2$

Case 3: $f = 100$ KHz

then $\frac{f}{N} = \frac{100}{100} = 1$

$\frac{f}{N} = 1$ So $P = 0$

B Part:

Given data:

In a band Pass Signal the minimum frequency is equal to ~~the~~ bandwidth Plus minimum frequency

$f_{max} = 200 + 100$

$= 300$ KHz

$= 300 \times 10^3$ Hz

$= 300,000$ Hz

Therefore

Nyquiest rate $2 \times f_{max}$

$= 2 \times 300,000$

$= 600,000$ sample/s

Scanned with CamScanner

Q1 Part 2:

Given data:

A low Pass signal with bandwidth = 200KHz

$= 200 \times 10^3$ Hz

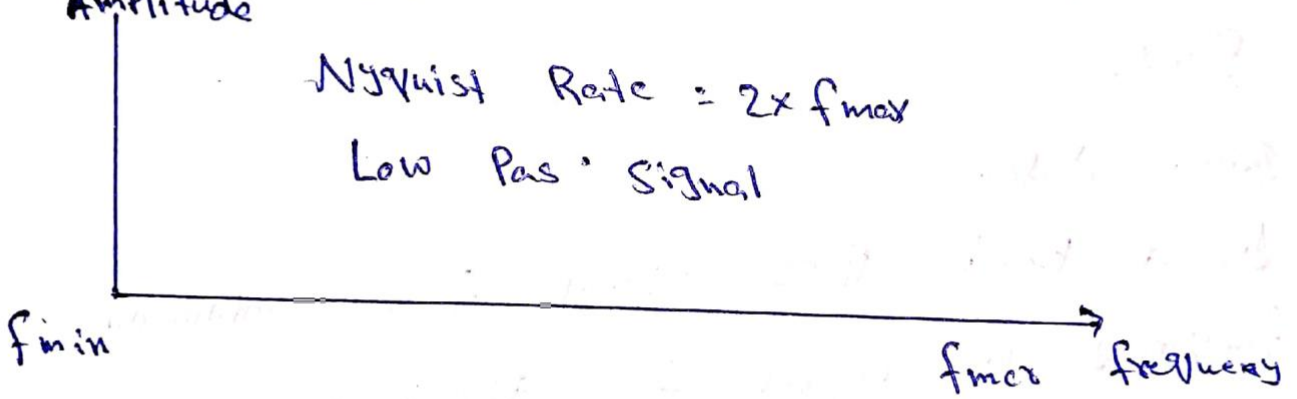
$= 200,000$ Hz

Nyquist Rate

Amplitude

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

Low Pass Signal



In a low Pass signal, the minimum frequency $f_{min} = 0$

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

$= 2 \times 200,000$

$= 400,000$ Sample/s

Scanned with CamScanner

Q1 Part (3)

(a) Bit rate = Sampling rate × number of bit per sample

$f_s \times n_b$

$n_b = \log_2 1024 = 10$ bit

$f_s = 2 \times 200\,KHz = 400\,KHz$

Bit rate $= f_s \times n_b$

$= 400 \times 10$

$= 4\,Mbps$

b) $SNR_{db} = 6.02 n_b + 1.76\,dB$

$= (6.02 \times 10) + 1.76$

$= 60.2 + 1.76$

$SNR = 61.96$

c) $B_{min} = n_b \times B_{analog}$

B_{analog} represent the Bandwidth of analog Signal

$B_{min} = 10 \times 200\,KHz$

$= 2000\,KHz$

Scanned with CamScanner

Q1 Part 4):

What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four level of digital signaling

Ans:

Bandwidth = 200 KHz

level of signaling (L) = 4

The maximum data rate of a channel

$$N_{max} = 2 \times B \times \log_2 L$$

$$= 2 \times 200 \times \log_2 4$$

$$= 400 \times 2$$

$$= 800 \text{ Kbps}$$

Scanned with CamScanner

Draw the graph of the NRZ-I NRZ-L Manchester and differential Manchester Sheme using each of the following data Stream

a) 01010101

b) 00110011

NRZ-L , NRZ-I , Manchester & Aui and We need to find bandwidth

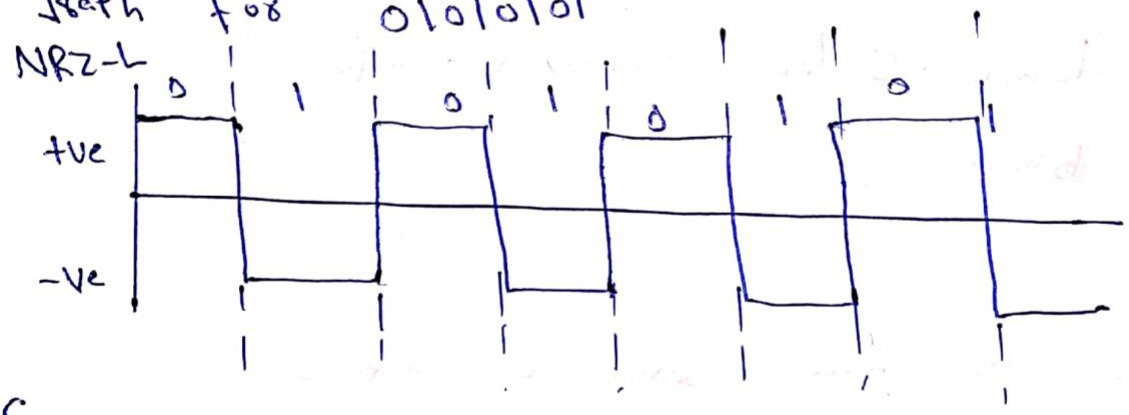
NRZ-L

In NRZ-L The voltage level are both sides of the time axis

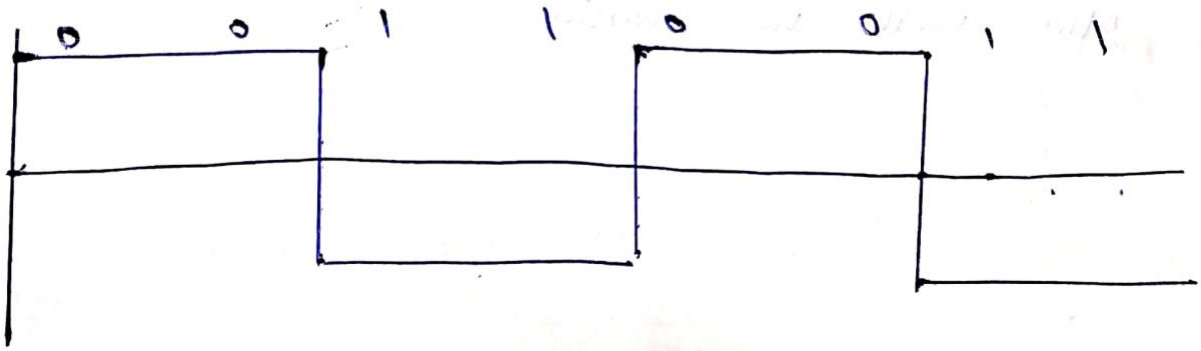
Voltage level +ve = 0

Voltage level -ve = 1

Graph for 01010101



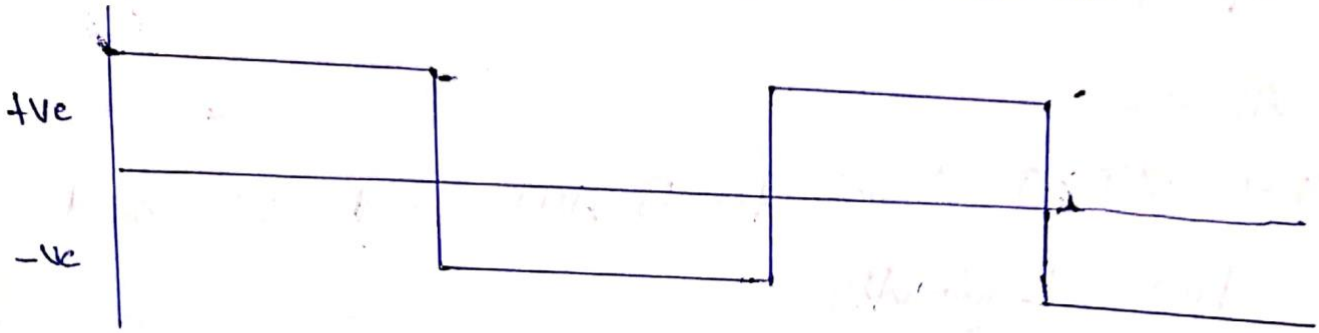
for



Scanned with CamScanner

NRZ-L has a average signal rate is N/2 means average no of Changes in the signal level

The minimum bandwidth for average bar



NRZ-L has a average signal rate is = N/2 means average no of Changes in the signal level

The minimum bandwidth for average band rate is

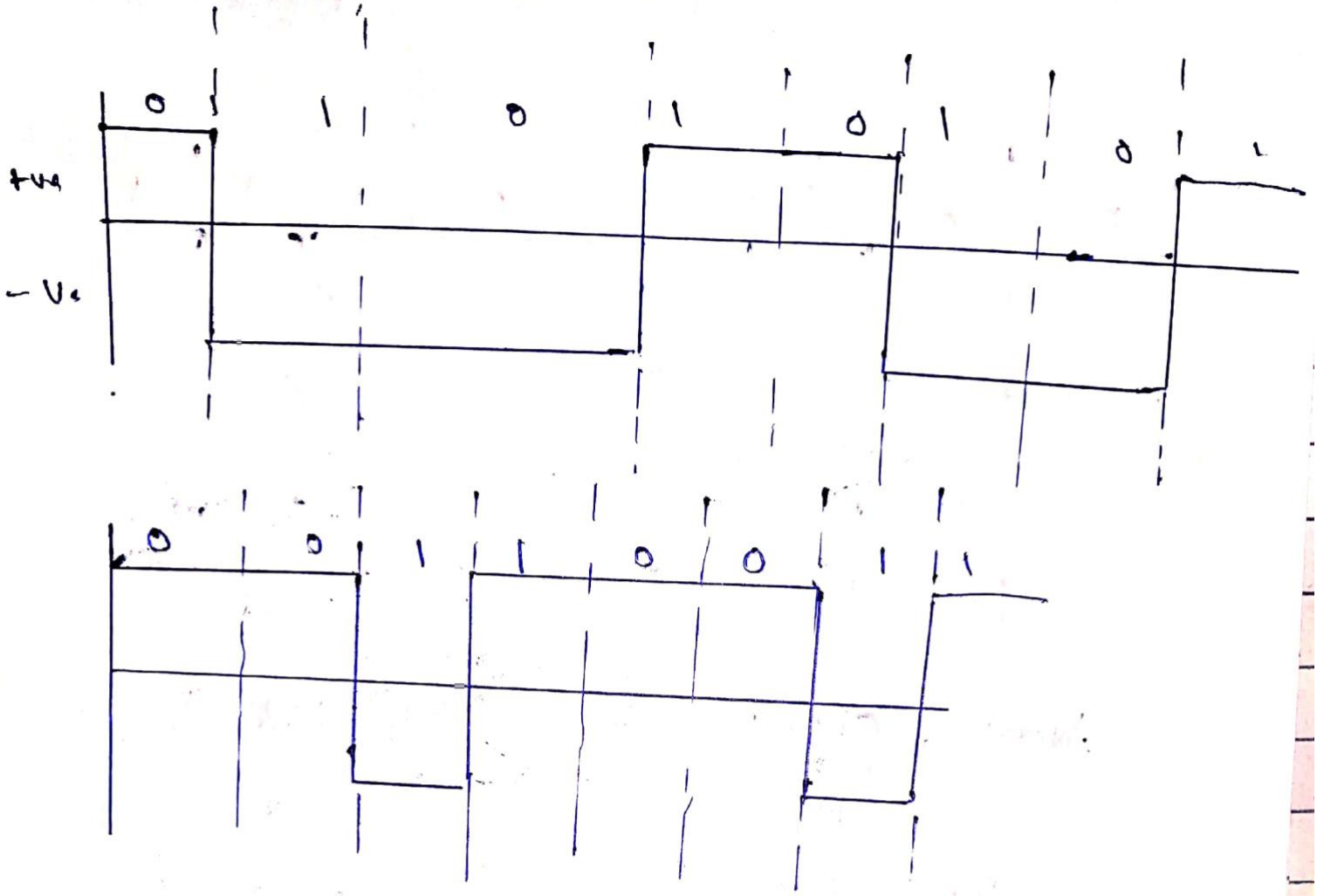
$B_{min} = S = N/2$ N → bit rate

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

NRZ-I

This is the same as NRZ-L But inversion occurs when next bit is other with no inversion

Scanned with CamScanner

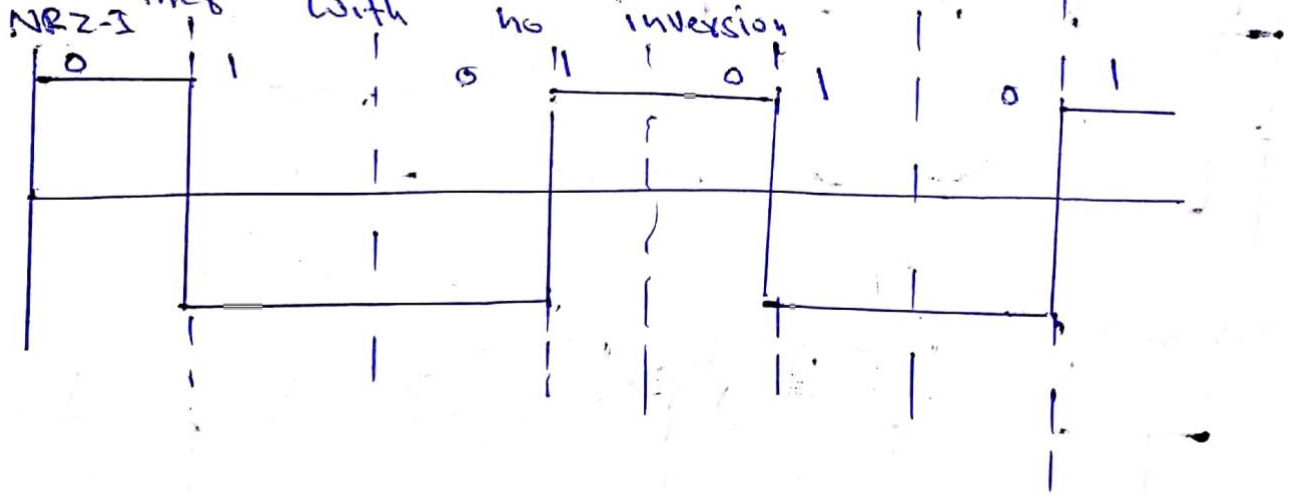


Average Signal rate of NRZ-I is

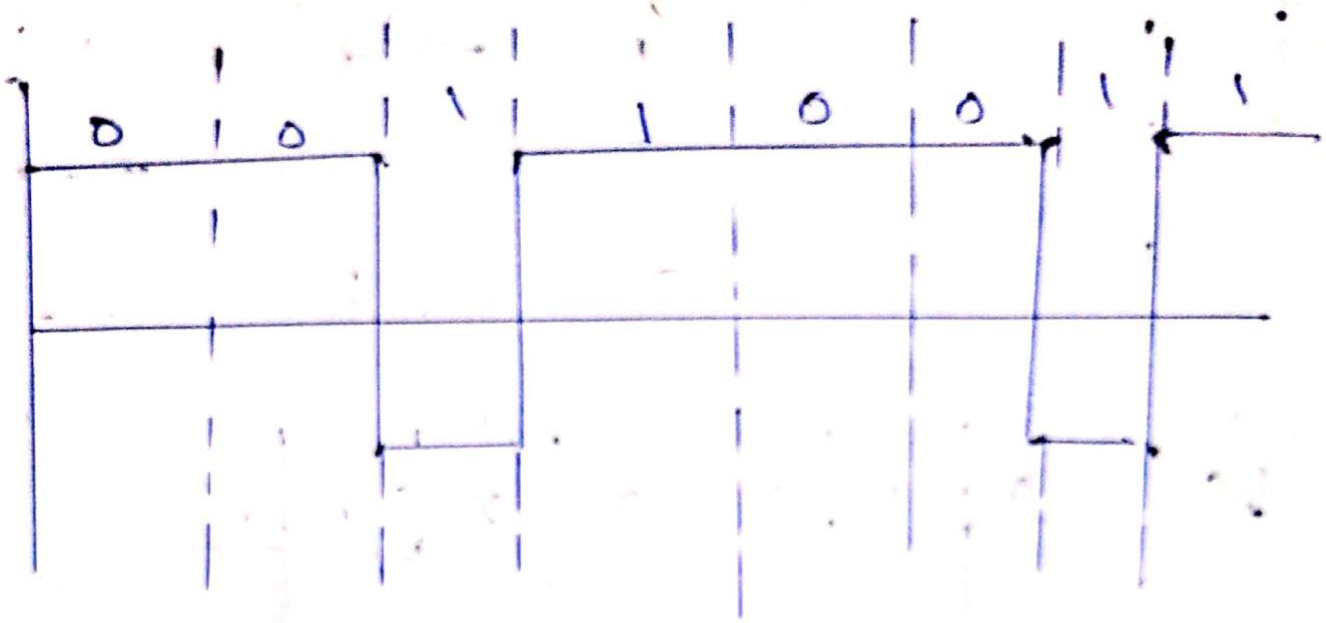
This is the same as NRZ-L

But inversion occurs when next bit is 1

Other with no inversion



Scanned with CamScanner



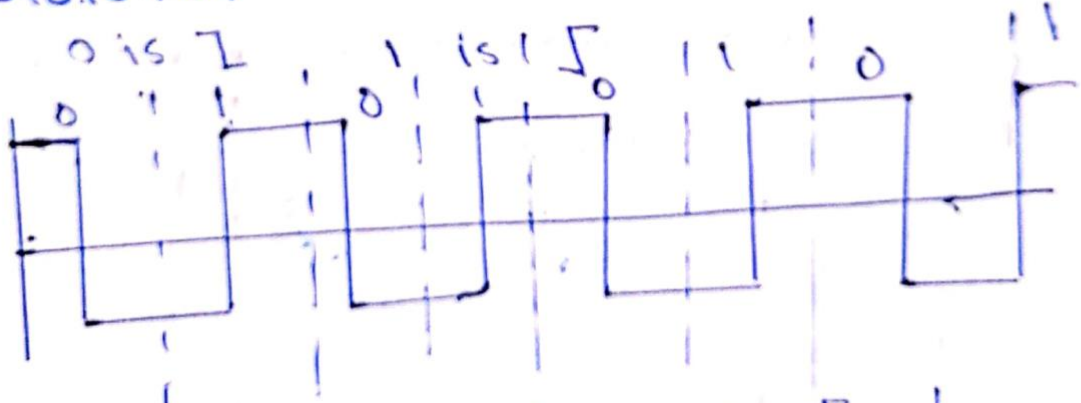
Average signal rate of NRZ-I is

$= N/2$

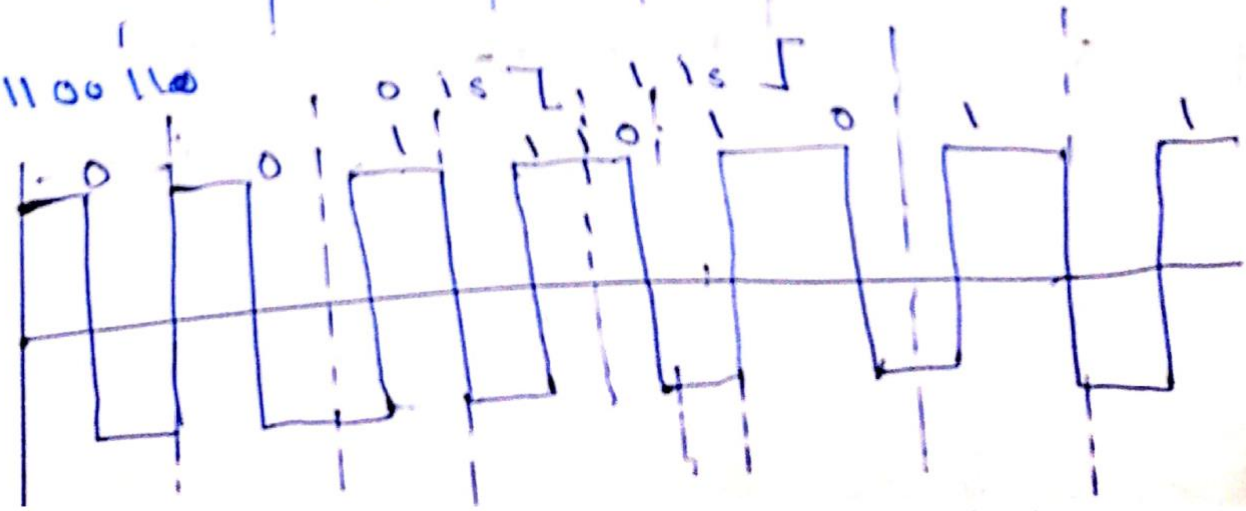
$B_{min} = N/2$

Manchester

a) 0 1 0 1 0 1 0 1



b) 0 0 1 1 0 0 1 1



Scanned with CamScanner

Q3: a) A TV Channd has a bandwidth of 6MHz If we send a digital signal using one Channel What are the data rate if we use one harmonic, three harmonic and five harmonic

Ans: BW = 6MHz

1) BW from 0Hz to f 1st harmonic = 6MHz

Bit rate = 2* f 1st harmonic = 2* 6 = 12 MbPs

2) BW from 0Hz to f 3rd Harmonic = 6MHz

f 3rd harmonic = 3* f 1st harmonic

f 1st harmonic = 6MHz/3 = 2MHz

Bit rate = 2* f 1st harmonic = 2*2 = 4 MbPs

3) BW from 0Hz to f 5th harmonic = 6MHz

f 1st harmonic = 6MHz/5 = 1.2MHz

Bit rate = 2* f 1st harmonic = 2* 1.2 = 2.4 MbPs

(b) Part

Ans: The attention (dB) $= 10 \log_{10} \frac{B}{A}$

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

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

$= 10 (-0.046)$

Scanned with CamScanner

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

Attention (dB) $= -0.046$ dB

Q (3) 3 Part

Ans:- Attention is the reduction of the Stregth in the Power of a Signal due to external factors.
the extent of reduction is measured in decibels

Given

$P_s = 5w$

Attenuation $= -10db$

Therefore

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

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

$Pd = 0.5w$

Scanned with CamScanner

Q3 Part 4:

A Signal has passed through three cascaded amplifier each with a 4dB gain. What is the total gain How much is the signal amplified.

Ans:

A signal has passed through 3 cascaded amplifiers each with a 4dB gain,

Total gain (PdB) 3×4 dB

$P_{dB} = 12$ dB

The signal is amplified then

$P_{db} = 10 \log_{10} P$

$P = 10^{\frac{P_{db}}{10}}$

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

$P = 15.85$

Scanned with CamScanner

Q3 Part 5:

If the bandwidth of the channel is 5Kbps how long does it take to send a frame of 100,000 bit out of this device

Ans:

Bandwidth = 5Kbps

= 5000bps

1Kbps = 1000 Kbps

its takes time to send a frame of 1000,000 bit out of this device

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

$$T = 20\ s$$

Q3 Part 6:

The light of the Sun takes approximatly eight minutes to reach the earth

What is the distance b/w the Sun and the earth

Ans: The light of Sun takes time to reach earth = 8min

that is

8 min = 8 x 60s

= 480 s

Convert miles Pes Second to Km/s

Scanned with CamScanner

(14)

$$\frac{186000 \text{ miles}}{\text{Sec}} \times \frac{1 \text{ Km}}{0.62 \text{ / miles}}$$

$$= 300{,}000 \text{ Km/s}$$

Therefore the distance b/w Sun and earth is $4800 \times 300{,}000$

$$= 144{,}000{,}000 \text{ Km/s}$$

Q 3 (B) Part

A signal has eight data levels with a pulse duration of 2ms. calculate the pulse rate and bit rate.

Ans:

$$\text{Pulse rate} = \frac{1}{2\text{ms}} = 500 \text{ Pulse/Sec}$$

$$\text{Bit rate} = \text{Pulse rate} \times \log_2 L$$

$$= 500 \times \log_2 8$$

$$= 1500$$

Scanned with CamScanner