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

Course Details

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

Student Details

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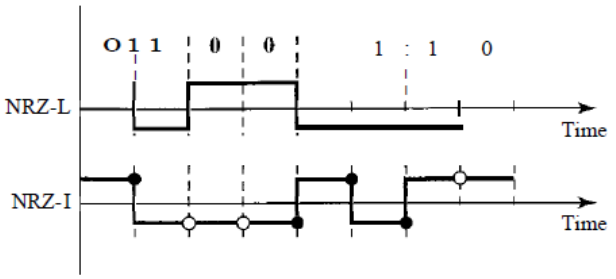
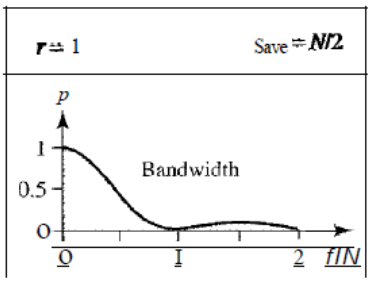
13684

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

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Q1(a)

(1) Given data:-

NRZ-I signal = 100Kbps

Frequencis = 0Hz, 50KHz and 100KHz.

Required

Normalized energy (P) = ?

Sol

(a) $P = \frac{f}{N}$

$= \frac{0}{100}$

$P = 1.0$

(b) $P = \frac{f}{N} = \frac{50}{100} = 1/2 \Rightarrow P = 0.5$

(c) $P = f/N$

$= 100/100$

$= 1$

$P = 0.0.$

0 will change in to 1

1 will change into 0.

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(2) Given

$F_m = 200KHz$

(a) $F_s = 2F_m$

$= 2 \times 200KHz$

$= 400$ K samples/sec

$= 400,000.$

(b) A band-pass signal with bandwidth of 200KHz if the lowest frequency is 100 KH

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

$f_s = 2 \times 300,000$

$= 600,000$

(3)

Solution

(a) In a lowpass signal, the minimum frequency is 0. Therefore, we can say

$f_{max} = 0 + 200 = 200\text{kHz}$

$f_s = 2 \times 200{,}000 = 400{,}000$ samples/s.

The number of bit's per sample and the bit rate are

$n_b = \log_2 1024 = 10$ bits/sample $N = 400\text{kHz} \times 10$

$= 4\text{Mbps}.$

(b) The value of $n_b = 10$. We can easily calculate the value of SNR_{db}

$SNR_{db} = 6.02 \times n_b + 1.76 = 61.96$

(c) The value of $n_b = 10$. The minimum bandwidth

Can be calculated as

$$B_{PCM} = n_b \times B_{analog}$$

$$= 10 \times 200\,KHz$$

$$= 2\,MHz.$$

4

Answer:-

Here, bandwidth = 200KHz = 200000 Hz

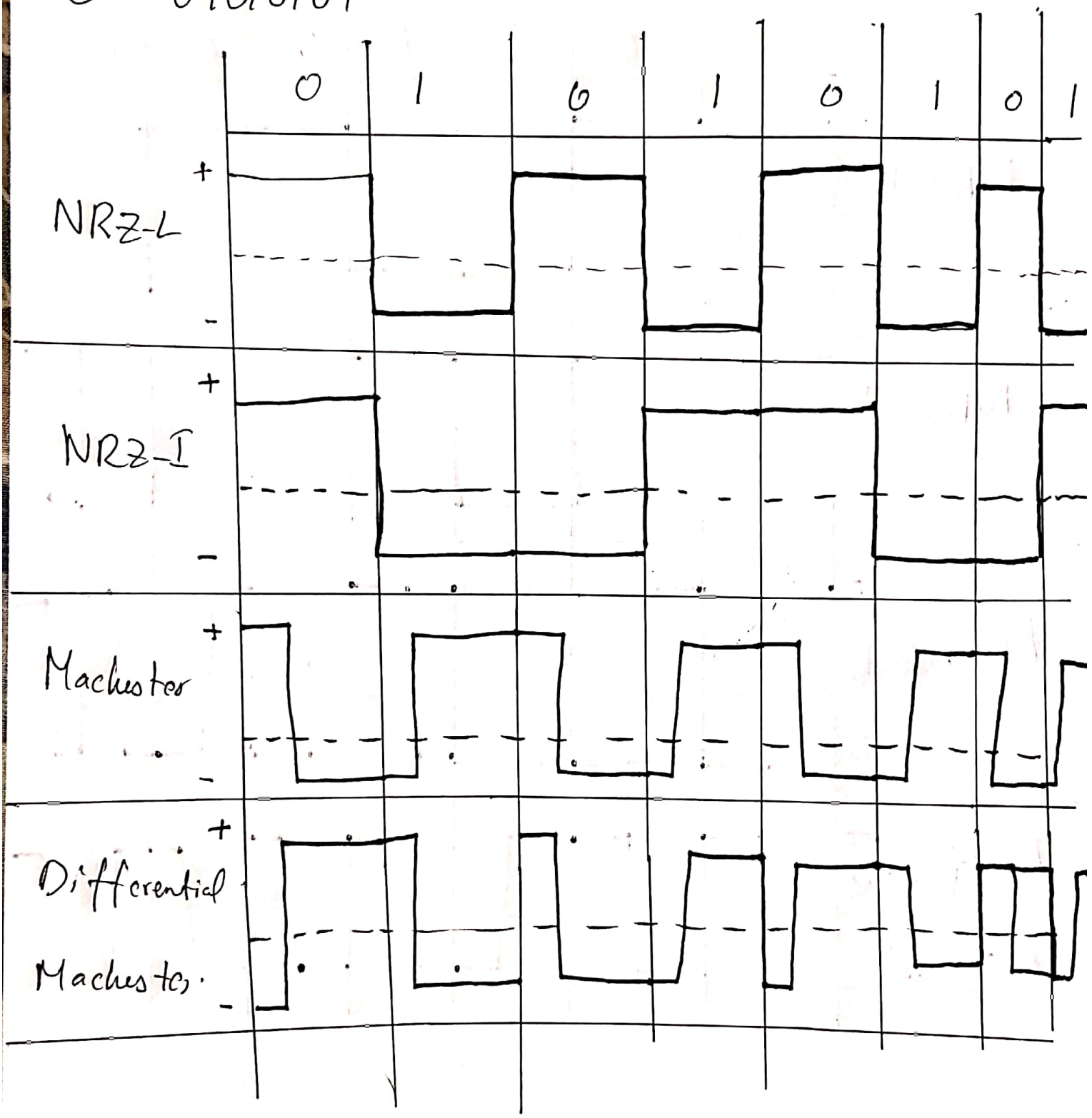
The maximum data rate can be calculated as.

$$N_{max} = 2 \times B \times n_b = 2 \times 200000 \times \log_2 4 = 8 \times 10^8 bps$$

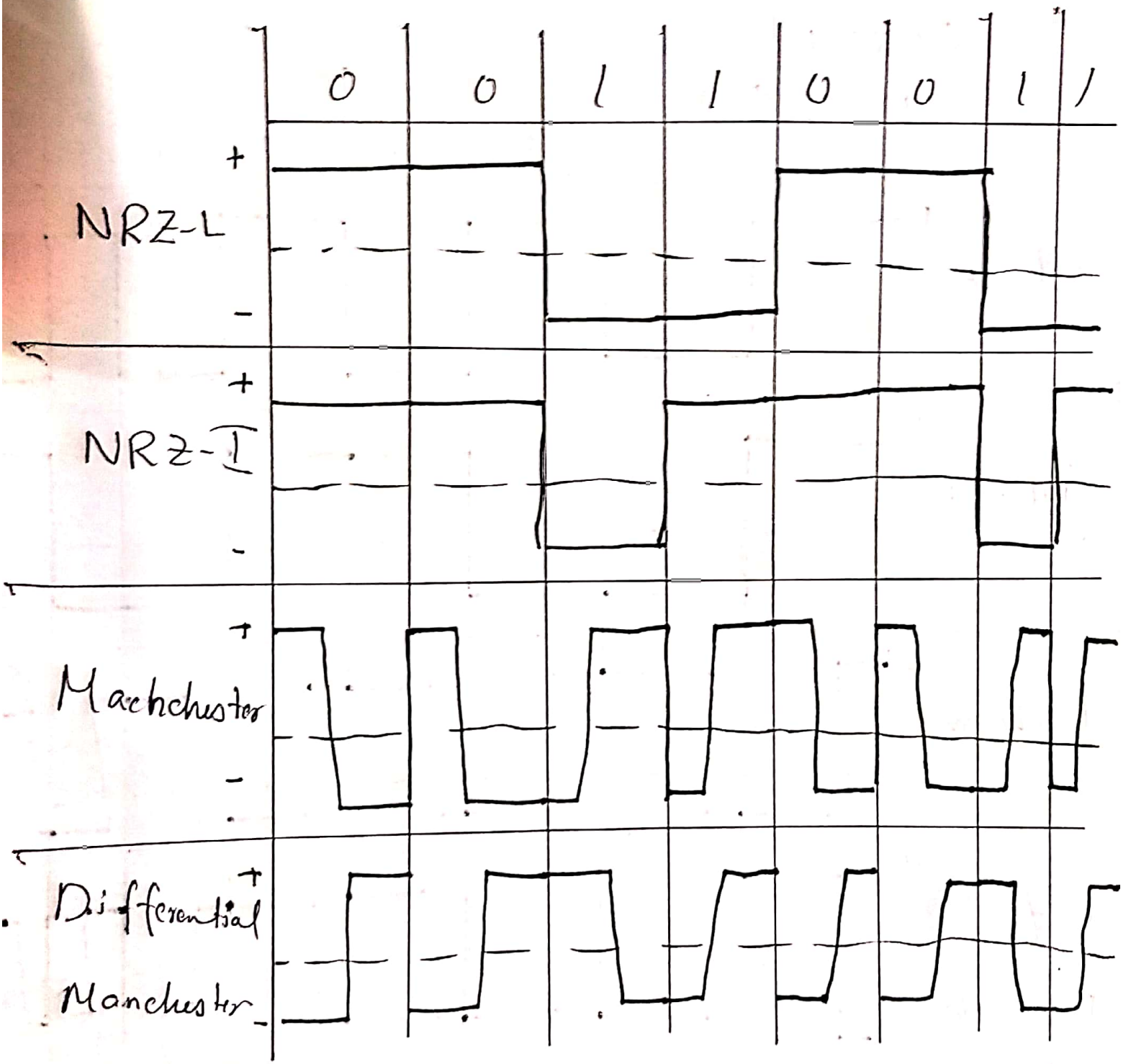
$$= 800\,Kbps$$

Q2(a)

(a) 0 1 0 1 0 1 0 1



(b) 00110011



Q3 (a)

(I) Answers:-

$BW = 6MHz$

(1) BW from 0Hz to $f_{1st\ harmonic} = 6MHz$.

Bit rate = $2 * f_{1st\ harmonic} = 2 * 6 = 12Mbps$.

(2) BW from 0Hz to $f_{3rd\ harmonic} = 6MHz$

$f_{3rd\ harmonic} = 3 * f_{1st\ harmonic}$

$f_{1st\ harmonic} = 6MHz/3 = 2MHz$.

Bit rate $= 2 * f_{1st\ harmonic} = 2 * 2 = 4Mbps$.

(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.

Answer: (2)

Attenuation of a signal = 10 * log (input power / output power)

Note- Logarithm is the base 10.

Here, Power at point A is the input Power

Power at point B is the out power

Therefore Attenuation in dB = $10 * \log(100/90)$

$= 0.457575$ db.

Answer (3)

$db = 10 \log_{10} \frac{P_2}{P_1} \Rightarrow 10 = 10 \log_{10} \frac{P_2}{5}$.

$\log_{10} \frac{P_2}{5} = -1$

$\frac{P_2}{5} = 10^{-1}$

$\Rightarrow P_2 = 0.5 W$.

(10)

Answer 4

Total gain = 4+4+4 = 12 db

For power gain of the first stage

$4dB = 10 * \log_{10} \frac{P_2}{P_1}$

$\frac{P_2}{P_1} = (10^{(\frac{4}{10})} = 2.512$

For power gain of three stages.

$2.512 * 2.512 * 2.512 = 15.851$

An amplifier is used to improve the power of a signal moving from one point to another. Given that the signal is passed through three amplifiers.

Answer 5

Given :.

Bandwidth 5000 bps

Frame 100,000 bit.

Sol

$$\frac{100000}{5000} = 20 \text{ sec.}$$

Answer 6

This is fairly simple you just have to remember a simple equation

$Z = C * t$

if you know the time that light take to reach us then you can calculate the distance to that object and vice versa.

Z = distance of the object

c = speed of light 300,000 km/sec

$\Rightarrow 3 \times 10^8$ km/sec

t = time light take.

$Z = c * t$

$= 3 \times 10^8 \times 8$

$\Rightarrow$ Now that the speed of light in unit of km/sec convert it in to minutes.

1 minute = 60 sec

8 minutes = 8×60

$= 480$

$Z = 480 \times 3 \times 10^8$

$Z = 144000000$ km.

Q3 (b)

Sol

Pulse duration = 2ms.

level = eight = 8.

Sol

$$\text{Pulse rate} = \frac{1}{2\times10^{-3}} = 500 \text{ pulse/sec.}$$

Bit rate = Pulse rate $\times \log_2 L$

So

Bit rate = $500 \times \log_2 8$

$= 500 \times 3.$

$= 1500$ bps.