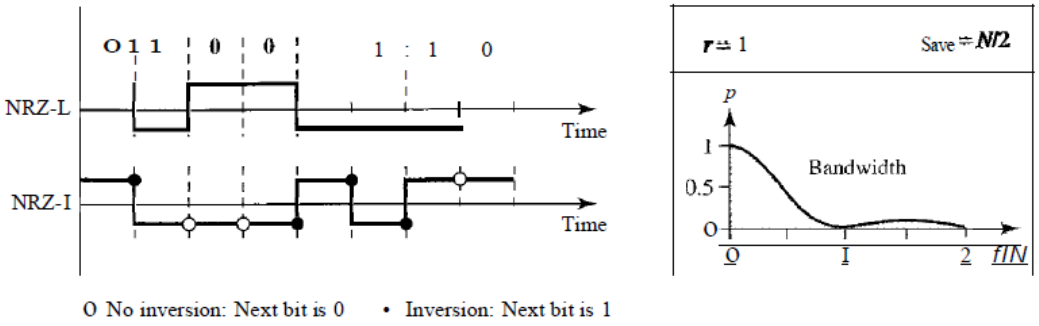
Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

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

Student Details

Name: RAFI UD DIN **Student ID:** 12401

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 No 1 (a)

1) Sol:-

Data Rate = 100 kbps

frequency = 0 kHz = P=1

frequny = 50 kHz = 0.5×10^3

frequny = 100 kHz = 100 kHz ÷ 100 kHz
= 1

2) Solutions:-

a) $Fs = 2 \times Fm = 2 \times 200 = 400$ k samples/s

low pass signal the min. frequy 0
therefore we have

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

$f_s = 2 \times 200,000 = 400,000$

b) A band pass signal with bandwidth of 200 kHz if the lowest freq is 100 kHz.

$F_{max} = 100 + 200 = 300$ kHz

$Fs = 2 \times 300000 = 600,000$ samples/s.

Q No 1 a)

3)

Sol

a) Calculate the bit rate of the digitized signal.

In a low pass signal the min frequency is 0 therefore we can say

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

$$f_s = 2 \times 200000$$

$$= 400000 \text{ Samples/s}$$

the number of bits per samples and the bit rat are

$$n_b = \log_2 1024 = 10 \text{ bits/samples}$$

$$= 400\,kHz \times 10 = 4\,Mbps.$$

b) the value of $n_b = 10$

$$SNR_{dB} = 6.02 \times n_b + 1.76$$

$$61.96$$

c) the value of $n_b = 10$ the min bandwidth can be calculated as

$$B_{Pcm} = n_b \times B_{analag}$$

$$= 10 \times 200\,kHz$$

$$= 2\,MHz$$

4) Solutions-

Bandwidth = 200kHz

= 200000 Hz

The Max data rate can be calculated as

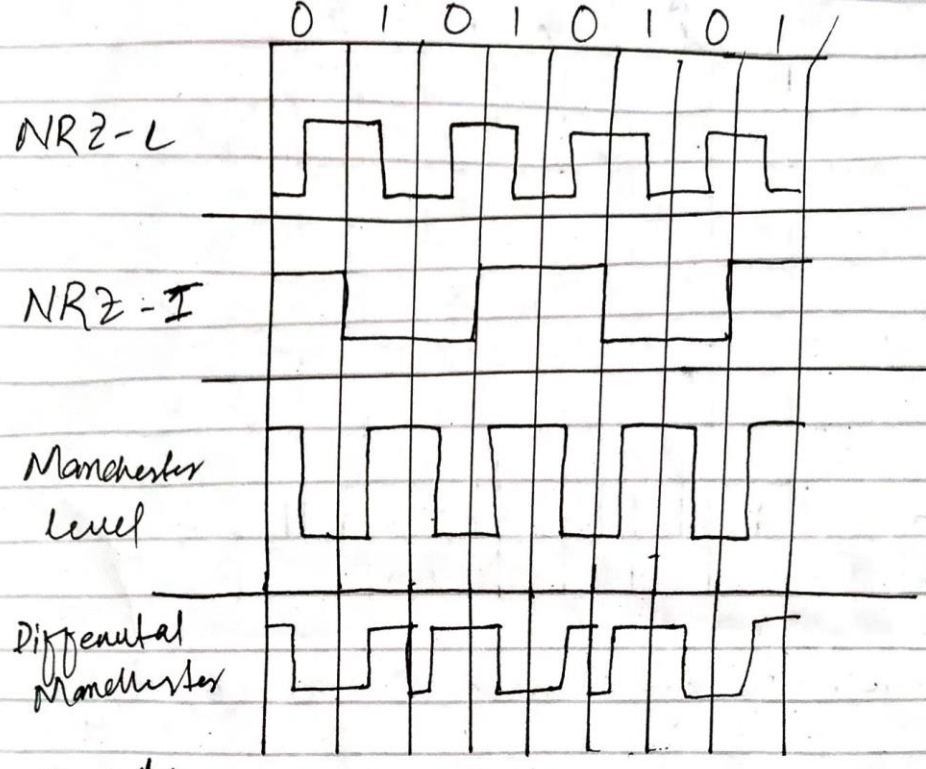
$N_{max} = 2 \times B \times n_b$

$= 2 \times 200000 \times \log_2 4$

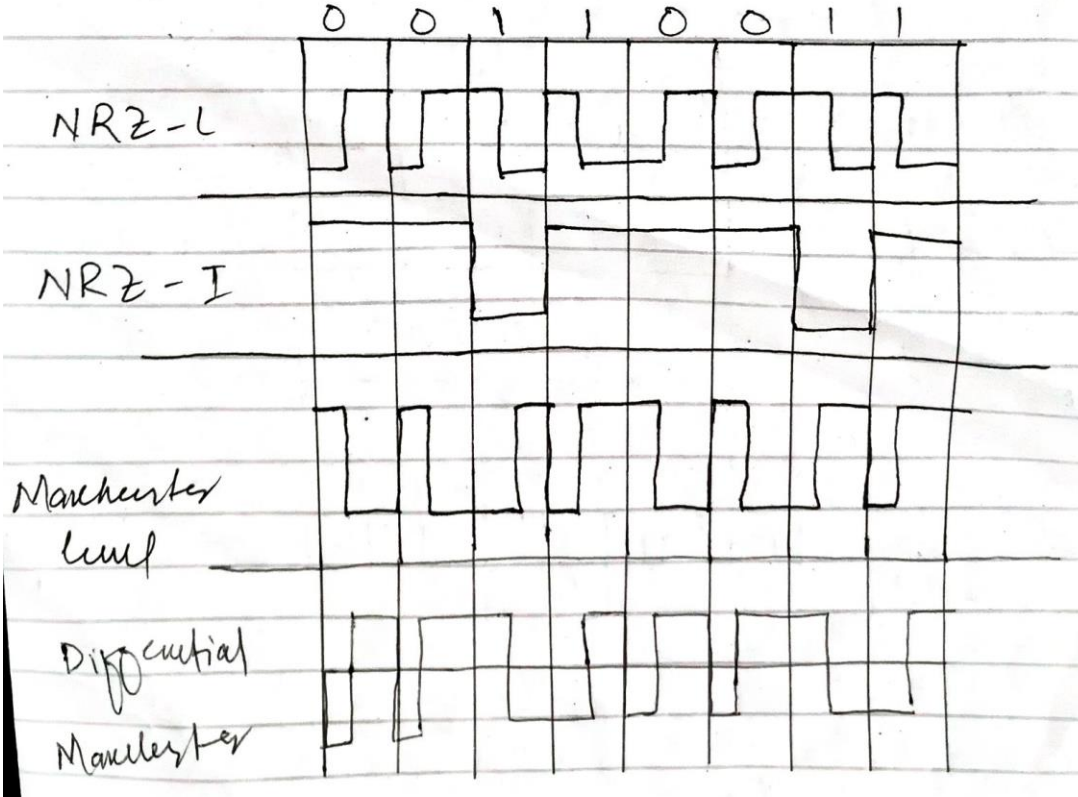
$= 8 \times 10^4$ bps

800 kbps.

Part (a)


0 1 0 1 0 1 0 1
NRZ-L
NRZ-I
Manchester Level
Differential Manchester

Part (b)


0 0 1 1 0 0 1 1
NRZ-L
NRZ-I
Manchester Level
Differential Manchester

Q.No3 part a):- A tv channel has as bandwidth of 6MHz if we send a digital signal using one channel what are the data rates if we use one harmonics, three harmonics and five harmonics?

Sol:- BW = 6MHz

1) BW from 0Hz to first harmonic = 6MHz;
Bit rates = 2* fist harmonics = 2*6 = 12Mbps.

2) BW from 0Hz to f3rd harmonic = 6MHz

F3rd harmonic = 3* fist harmonic
fist harmonic = 6MHz/3 = 2MHz
Bit rate = 2* fist harmonic = 2*2 = 4Mbps.

3) BW from 0Hz to f5th harmonic = 6MHz.

fist harmonic = 6MHz/5 = 1.2MHz
Bit rate = 2* fist harmonic = 2*1.2 = 2.4Mbps.

Q.No3

2) A signal travel from point A to point B At point A the signal power is 100W at point B the power is 90W what is the attenuation in decibels?

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

Here the point A is the input power
power at point B is out put pow

Therefore

Attenuation in dB $= 10 * \log\left(\frac{100}{90}\right)$

$= 0.457575$ dB.

3) The attenuation of the signal is 10 dB what is the final signal power if it was originally 5W?

Sol:

$$dB = 10 \log_{10} \frac{P_2}{P_1} \qquad -10 = 10 \log_{10} \frac{P_2}{5}$$

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

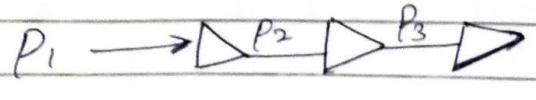
$$\frac{P_2}{5} = 10^{-1}$$

$$P_2 = 0.5\,W$$

4) A signal has passed through three cascaded amplifiers, each with a 4 dB gain. What is the total gain how much the signal Amplified?

Sol:

Total gain $= 4dB + 4dB + 4dB = 12dB$



for power gain of the first stage

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

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

for power gain of three stages

$$2.512 * 2.512 * 2.512 = 15.851.$$

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?

Sol :-

Given

bandwidth 5000 bps, frame 100,000 bit

$$\Rightarrow \frac{100\,000 \text{ b}}{5000 \text{ bps}} = 20 \text{ sec.}$$

6) :- The light of the sun takes approximately eight minutes to reach the earth. What is the distance between the sun and earth.

Sol :- The exact time taken by light to reach the earth from sun is 8 minutes and 20 seconds ie total 500 seconds.

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Speed of Light in vaccume is

$= 3 \times 10^8$ m/s

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

distance = Speed * time

distance = $3 * 10^8 * 500$

$= 150,000,000,000$ meters.

or

150,000,000 Kilometers.

Q No 3 part b)

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

Solution:-

$$\text{Pulse Rate} = \frac{2}{2 \times 10^{-3}} =$$

$2 \times 10^{-3} = 0.002$

$2 / 2 \times 10^{-3} = 1000$ pulses/s.

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

$= 1000 \times \log_2 8 = 1500$