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

Course Details

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

Student Details

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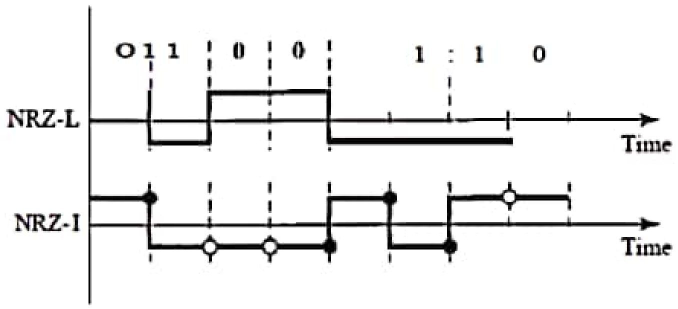
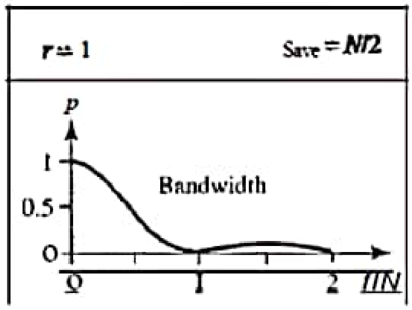
Q1.	(a)	1. An NRZ-I signal has a data rate of 100 Kbps. Using the following Figure, calculate the value of the normalized energy (P) for frequencies at 0 Hz, 50 KHz, and 100 KHz.	Marks 20 CLO 1





O 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.

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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Ans ①

(i) Data rate 100 Kbps.

Find energy (P) for frequencies

0 HZ, 50 KHZ, 100 KHZ.

Solution:-

First we will calculate f/N value then we will find energy (P).

For 0 HZ

$f = 0$

$$f/N = \frac{0}{100K} = 0$$

For NRZ-I when ~~power~~ $f/N = 0$, power is taken as 1

So here $P = 1$

For 50 KHZ.

$$f/N = \frac{50K}{100K} = 0.5$$

So $P = 0.5$

For 100 KHZ

$$f/N = \frac{100K}{100K} = 1$$

For NRZ-I when $f/N = 1$, P will be $P = 0$

So $P = 0$

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Ans) (i)
(ii) (a)

Bandwidth = 200 KHZ

Solution:-

Nyquist rate = 2 × fmax

In low pass signal the fmin = 0

= 2 × fmax
= 2 × 200 K
= 400K samples per second.

(b) In Band Pass Signal the minimum frequency (fmin) is equal to bandwidth and minimum frequency.

fmax = B + f(min)
= 200 K HZ + 100KHZ

fmax = 300KHZ

So the Nyquist rate will be;
= 2 × fmax
= 2 × 300K
= 600KHZ Samples per second

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Ans ① ③ ⓐ Bandwidth = 200 KHZ

L = 1024

Solutions

Bit rate = Sampling rate × Number of bits/sample

$= f_s \times N_{bits}$ — ①

$N_b = \log_2(1024)$

$N_b =$ 10 bits — put in equ ①

$f_{max} = 2 \times f_s$

$= 2 \times 200K$

$= 400$ KHZ — put in equ ①

Bit rate = 400K × 10 bits

$= 400000 \times 10$

$= 4000000 \quad \div 10^6$

Bit rate = 4 Mbps

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Ans ① ③ ⓑ The SNR (signal to noise ratio) for this signal will be;

$= 6.02\, N_b + 1.76\,dB$

$= (6.02 \times 10) + 1.76$

$= 60.2 + 1.76$

$SNR = 61.96\,dB$

ⓒ $B_{min} = n_b \times B$

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

$PCM_{(B)} = 2000\,KHZ$

④ Bandwidth = 200KHZ

So the maximum data rate =

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

$= 2 \times 200K \times \log_2(4)$

$= 400K \times 2$

$= 800\,Kbps$

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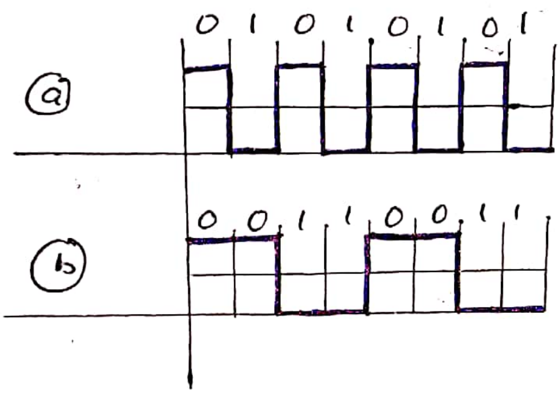
Ans (2)

(a) 01010101

(b) 00110011

Solution:-

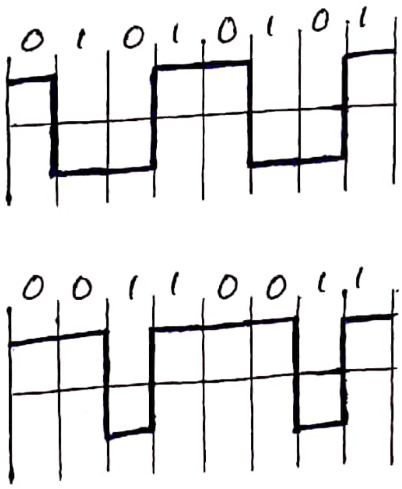
NRZ-L :



Average number of changes $= \frac{8+4}{2} = \frac{12}{2} = 6$ $(N=8)$

Bandwidth $= \left(\frac{6}{8}\right) N$

NRZ-I :



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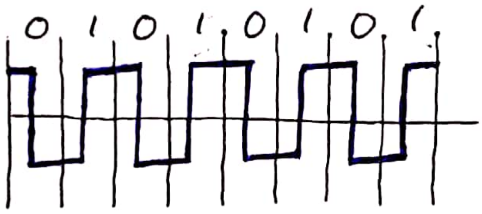
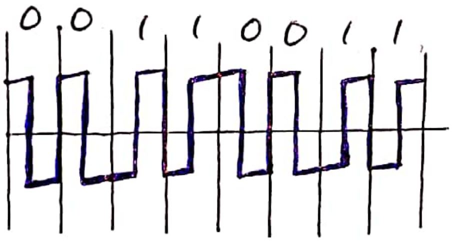
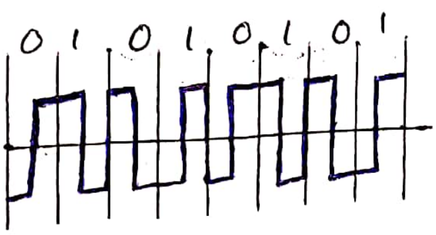
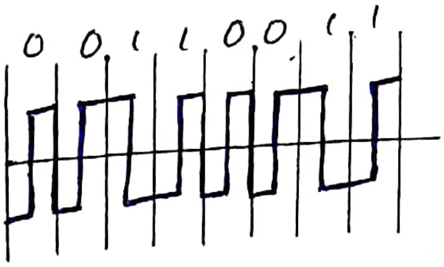
Manchester Scheme:





Differential Manchester Scheme:





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Ans) (3) (a) (1) Bandwidth = 6 MHz

Solution:

$$\text{Bandwidth} = \frac{\text{data rate}}{2}$$

ReArrange the formula =

data rate = Bandwidth × 2

= 6 × 2

data rate = 12 Mbps

$$\text{Data rate} = \frac{2 \times B}{3}$$

$$= \frac{2 \times 6}{3}$$

~~1st~~ 3rd = 4 Mbps

$$\text{5th} = \frac{2 \times B}{5}$$

$$= \frac{2 \times 6}{5} = 2.4 \text{ Mbps}$$

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(3) (2) The Attenuation in dB;

$= 10 \log_{10} \left(\frac{B}{A}\right)$

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

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

$= 10 (-0.046)$

Attenuation $- 0.46 \, dB$

(3) Attenuation is the reduction of Signal (Strength in Power) due to external factors.

Attenuation $= -10 \, dB$

$P = 5W$

$-10 = 10 \log_{10} \left(\frac{P_2}{5}\right)$

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

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

$(P_2 = 0.5W)$

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(4) Total gain = 4dB + 4dB + 4dB + 4dB

= 12 dB

For gain of first stage:

$4dB = 10 \times \log_{10}\left(\frac{P_2}{P_1}\right)$

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

$= 2.512$

For Power gain of three stages

$2.512 * 2.512 * 2.512$

$= 15.851$

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(5) Solution:

Bandwidth = 5 Kbs
Frame = 100 000 bits

$$\frac{100\ 000\ b}{5000\ bps}$$

$= 20s$

(6) The time taken by light to reach earth from Sun is 8 minutes (480s)

$$speed = \frac{distance}{time}$$

we need distance;

distance = speed × time

$= 3 \times 10^8 \times 480$ ∵ speed of light

$= 144\,000\,000\,000$ m

$= 144\ 000.000$ km

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(3) (b) Pulse rate = $\frac{1}{2ms}$

= 500 pulse/sec

Bit rate = Pulse rate x $\log_2 L$

= 500 x $\log_2(8)$

Bit rate = 1500

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