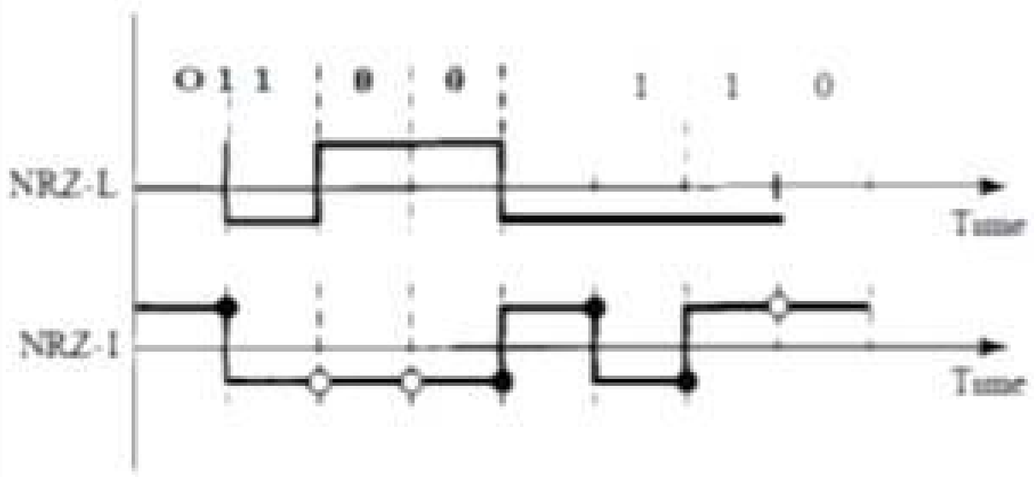
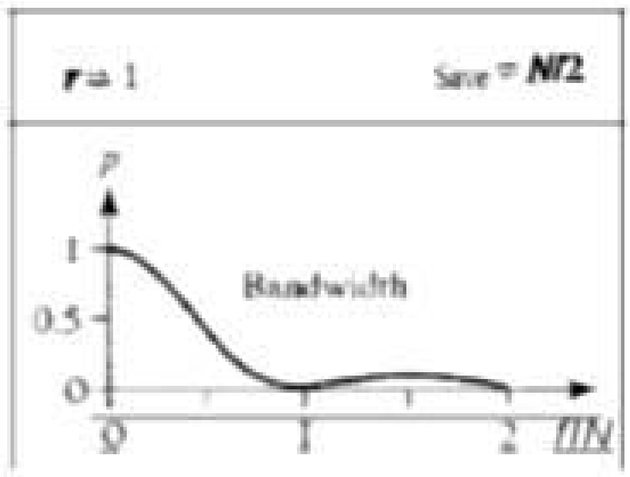
Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

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

Student Details

Name: Shehriyar khan **Student ID:** 13738

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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Q No (1) (a)

Sol:- Data Rate = 100 Kbps

a.) Frequency = 0 KHZ ⇒ P = 1

for NRZ-I, when f/N = 0

~~to~~ power is taken as 1.

P = Frequency ÷ Data Rate.

b. Frequency = 50 KHZ

= 50 ÷ 100 = 0.5

c) ⇒ Frequency = 100 KHZ

= 100 KHZ ÷ 100 KHZ = 1

Q No (1) (a)

Nyquist Sampling Rate = 2 x fmax.

Sol:- a) In low pass filter B = fmax = 200 KHZ

Nyquist sampling Rate = 2 x 200 KHZ

= 400,000 Samples/sec

b) $f_{max} = 200 + 100 = 300\ KHZ$

Nyquist Sampling Rate $= 2 \times 300\ KHZ$

$= 600{,}000$ samples/sec

Q No(1)(3)(a)

Sol:- $B = f_{max} = 200 \times 10^3\ Hz$

$L = 1024$

a) Bit rate $= f_s \times n_b$ $\because n_b = \log_2 1024$

$= \log_2 2^{10}$

$= 10$

$= 2 \times 200 \times 10^3 \times 10$

$= 4\ Mbps$

b) $= 6.02 \times n_b + 1.76\ dB$

$= 6.02 \times 10 + 1.76\ dB$

$= 61.96\ dB. = 61.96\ dB$

c) The value of $n_b = 10$

$B_{PCM} = n_b \times B_{analog} = 10 \times 200\ KHZ$

$= 2MHZ.$

Q # 1(4)

Sol:- $B = 200 \times 10^3$ Hz

$L = 4$

$N_{max} = ?$

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

$= 2 \times 200 \times 10^3 \times \log_2 4$

$= 2 \times 200 \times 10^3 \times \log_2 2^2$

$= 400 \times 10^3 \times \log_2 2^2$

$= 400 \times 10^3 \times \log_2 2^2$

$= 8 \times 10^5$

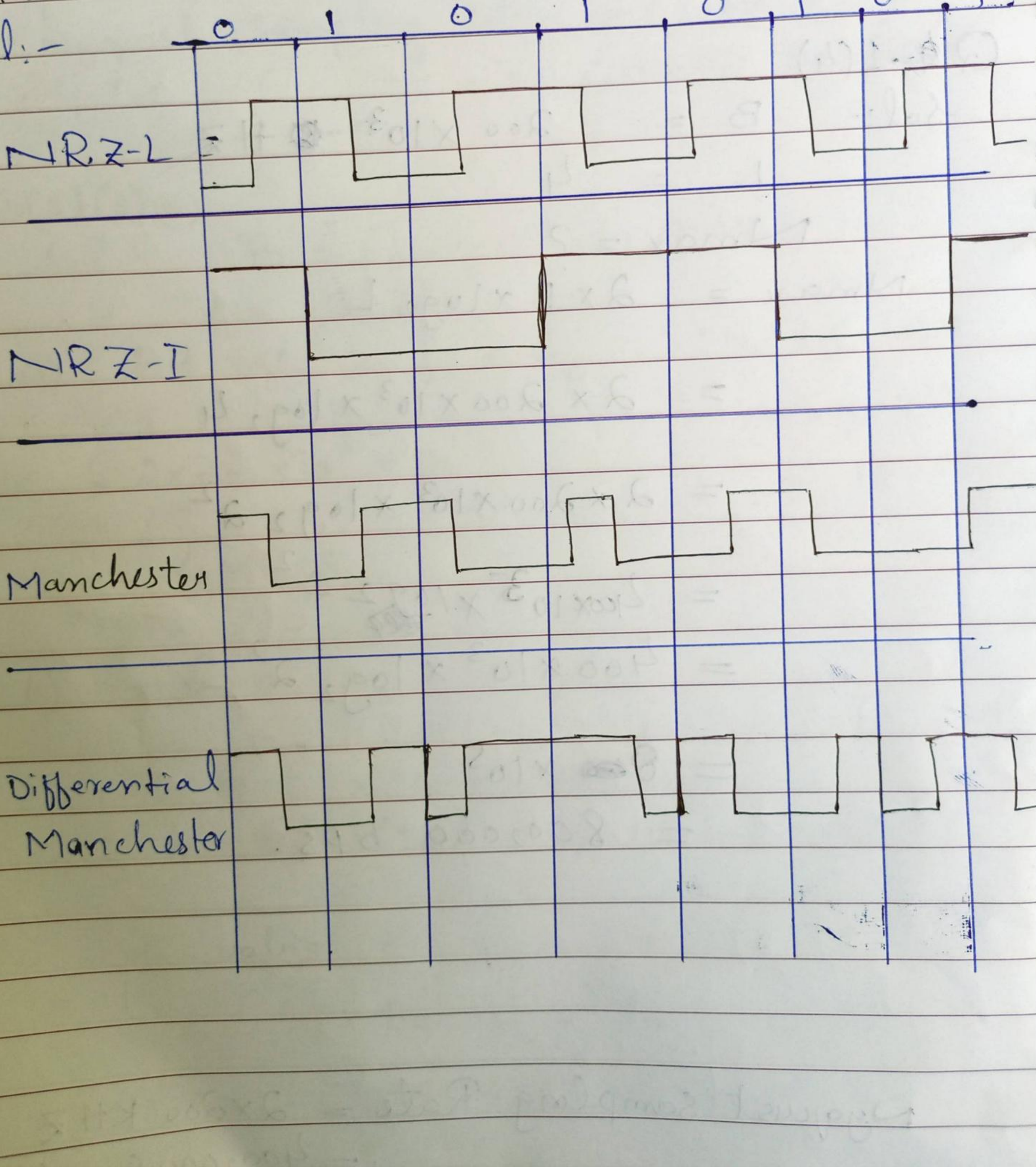
$= 800,000$ bps.

Nyquist sampling Rate $= 2 \times 200$ KHz

$= 400,000$ Samples/sec

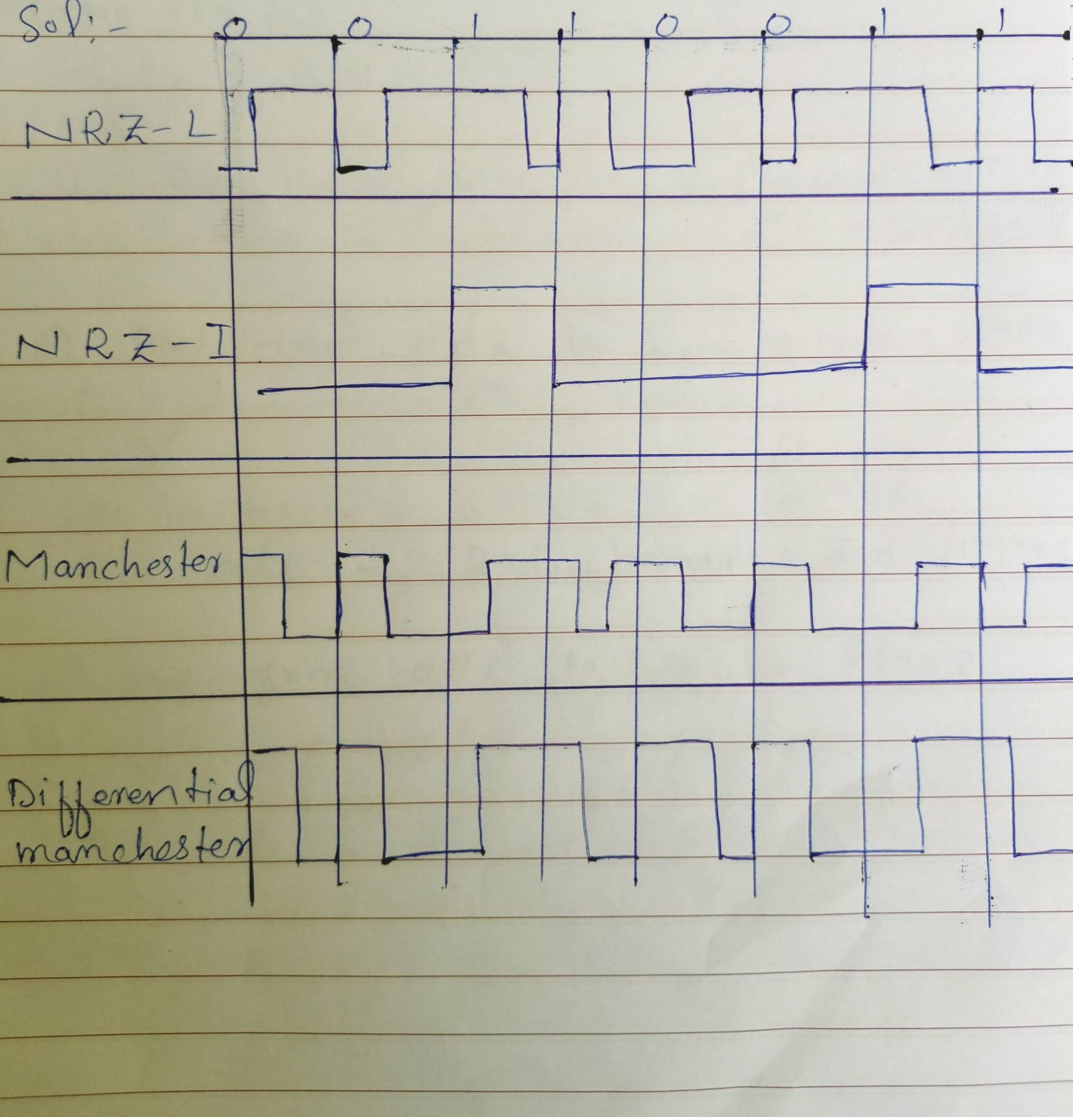
Q No 2 (a)

Sol:-



Q No 2(b) (b) 00110011

Sol:-



Q NO 3 (a) (1)

Sol:- BW = 6 MHz

i) BW from 0HZ to $f_{1st\ harmonic}$ = 6MHZ

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

ii) BW from 0HZ to f_{3rd} harmonic = 6MHZ

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

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

Bit rate = $2 \times f_{1st\ harmonic}$ = 2x2 = 4Mbps

iii) BW from 0HZ to $f_{5^{th}}$ = 6MHZ

f_{1st} = 6MHZ / 5 = 1.2MHZ

Bit rate = $2^{*} f_{1st}$ = 2x1.2 = 2.4Mbps

(a)(3) $dB = 10 \log_{10} P_2/P_1 = -10 = 10 \log_{10} P_2/5$

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

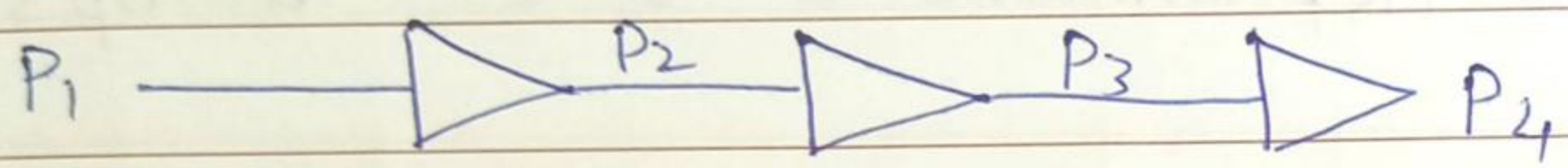
$P_2/5 = 10^{-1}$

$\rightarrow$ $P_2 = 0.5W$.

(a)(4)

Total gain = 4 dB + 4 dB + 4 dB + ~~4 dB~~

= 12 dB



For power gain of the first stage.

$4\,dB = 10 \times \log_{10} P_2/P_1$

$P_2/P_1 \; (_{10} (4/10) = 2.512$

Power gain for Three stages

$2.512 \times 2.512 \times 2.512 = 15.851$

(a)(5) Given band width 5000 bps,

Frame = 100,000 bit

$\rightarrow \dfrac{100{,}000\ b}{5000\ bps} = 20\ sec.$

a)(6) The ~~distance~~ is 93,000,000 miles from earth.

a) (2) $dB = 10 \log_{10}(100/50)$

$= 10 \log_{10}(2)$

$= 3.0102$ db.

Q No (3) (b)

Pulse duration $= 2$ ms

$L = 8$

Pulse rate $= \frac{1}{2 \times 10^{-3}} = 500$ pulse/se

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

$= 500 \times \log_2 8$

$= 500 \times 3$

$= 1500$ bps.