**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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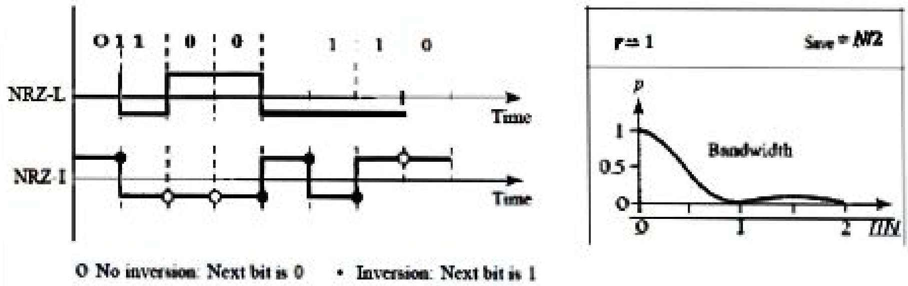
**Q1. (a)** (Marks 20, CLO 1)

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.




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)** (Marks 16, CLO 1)

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

**Q3. (a)** (Marks 12, CLO 1)

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?

**(b)** (Marks 02, CLO 1)

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

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paper : computer communication Network

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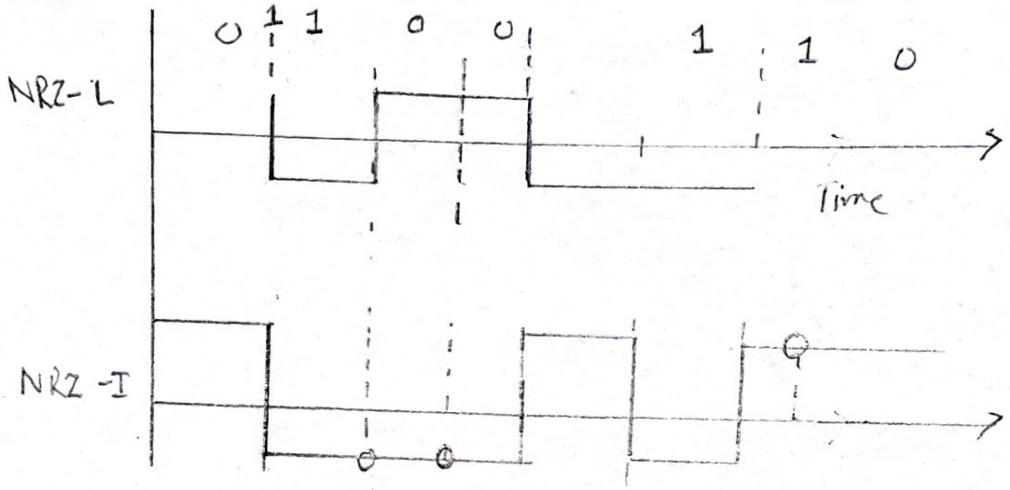
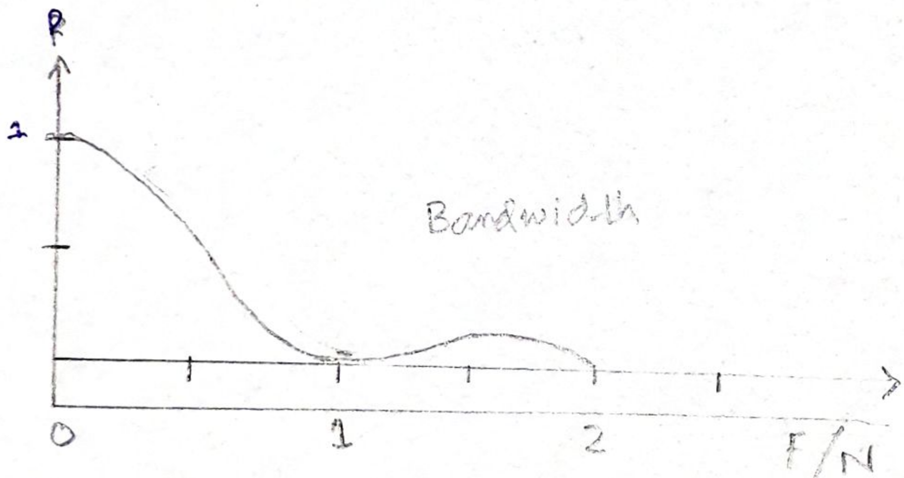
Q 1 (a)(i): An NRZ-I signal has a data rate of 100 Kbps. Using the following Figure calculate the value of the normalised energy (P) for frequency at 0 HZ, 50 KHz, and 100 KHz.




Solution:

(a) for frequency = 0 HZ

$$f/N = 0/100 = 0$$

(b) for frequency = 50 HZ

$$f/N = 50/100 = 1/2$$

(c) for frequency = 100 Hz

$f/N = 100/100 = 1$

**Normalised Energy:**

according to graph:

for $f/N = 0$

$P = 1.0$

for $f/N = 1/2$

$P = 0.5$

for $f/N = 1$

$P = 0.0$

(2) What is Nyquist sampling rate for each of the following signals?

(a) A low-pass signal with bandwidth of 200 Khz ?

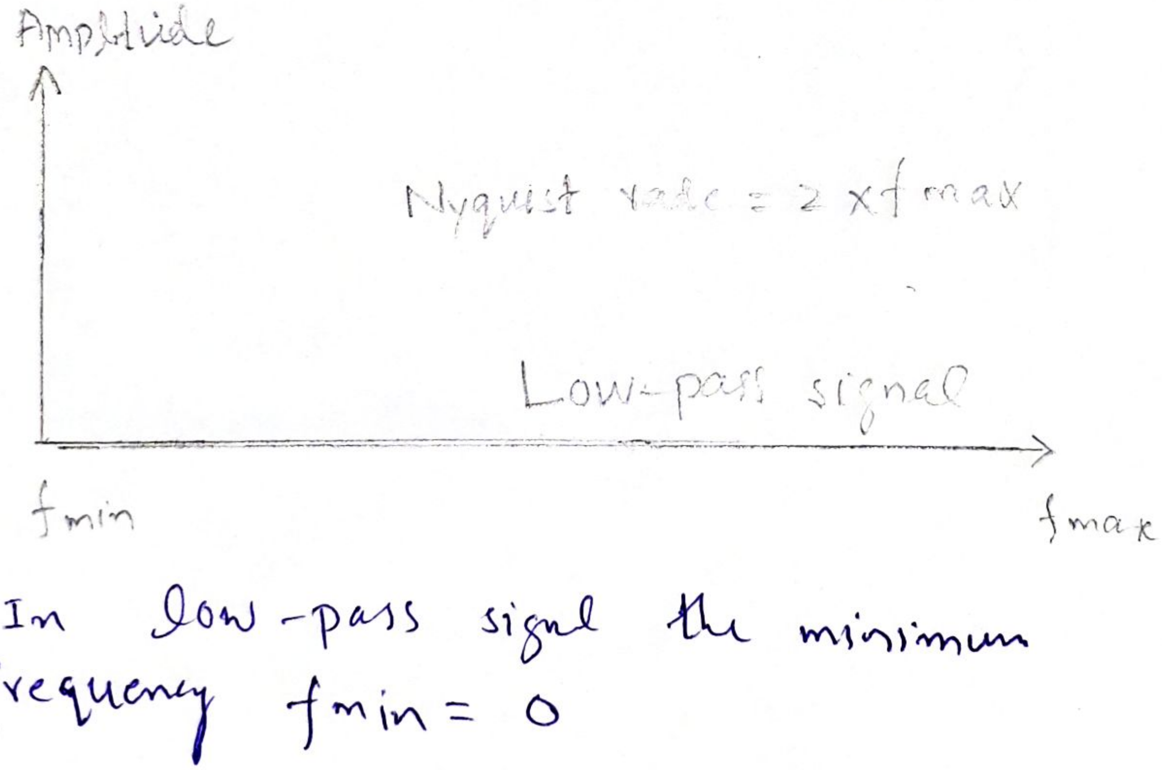
Given data:

A low pass signal with bandwidth = 200 Khz

$= 200 \times 10^3$ Hz

$= 200,000$ Hz

Nyquist sampling rate for low pass signal.




In low-pass signal the minimum frequency $f_{min} = 0$

Therefore, the Nyquist rate = 2 × $f_{max}$

= 2 × 2,00,000

= 4,00,000 samples

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

Therefor we have.

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

$f_s$ = = 2 × 300,000

= 600,000 samples/s

(3.) we have sampald a low pass signal with a bandwidth of 200Khz using 1024 levels of quantization

(a) calculate the bit rate of the digitized signal.

Solution:

Low pass signal: frequency between 0-200Khz

BW = 200Khz

sampling rate >= 2 X fmax

>= 2 X 200Khz

>= 400,000 samples/s

$n_b$ = $\log_2 1024$ = 10 bits/sample

Quantization 10 bits/samples :

Bit rate = 400,000 X 10 = 4Mbps

(b) calculate the SNRdB for this signal.

The value of $n_b$ = 10

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

= $6.02 \times 10 + 1.76$

= 61.96

(c) calculate the PCM bandwidth of this signal.

The value of $n_b$ = 10

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

= $10 \times 200$ KHz

= 2 MHz

Q # 4: What is the maximum data rate of a channal with a bandwidth of 200Khz if we use four levels of digital signaling.

Solution:

Bandwidth = 200 Khz

levels = 4

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

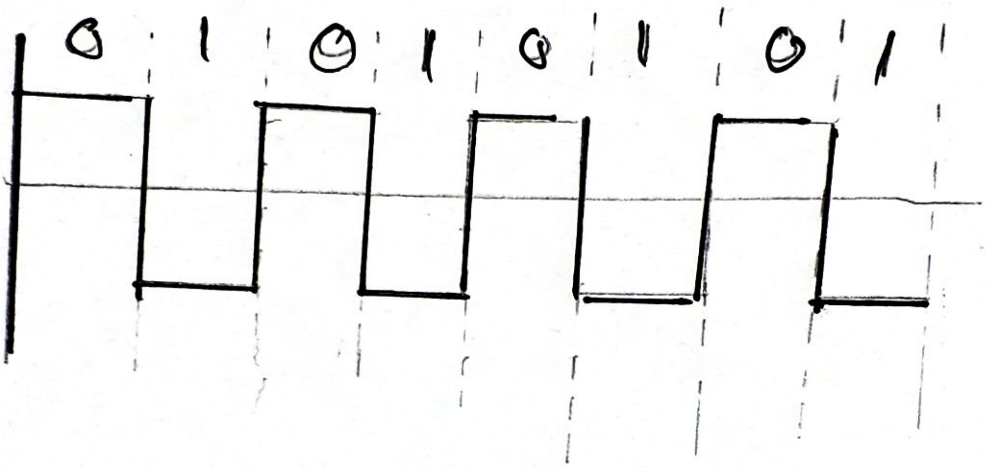
$= 2 \times 200\,Khz \times \log_2 4$

$= \boxed{800\ Kbps}$

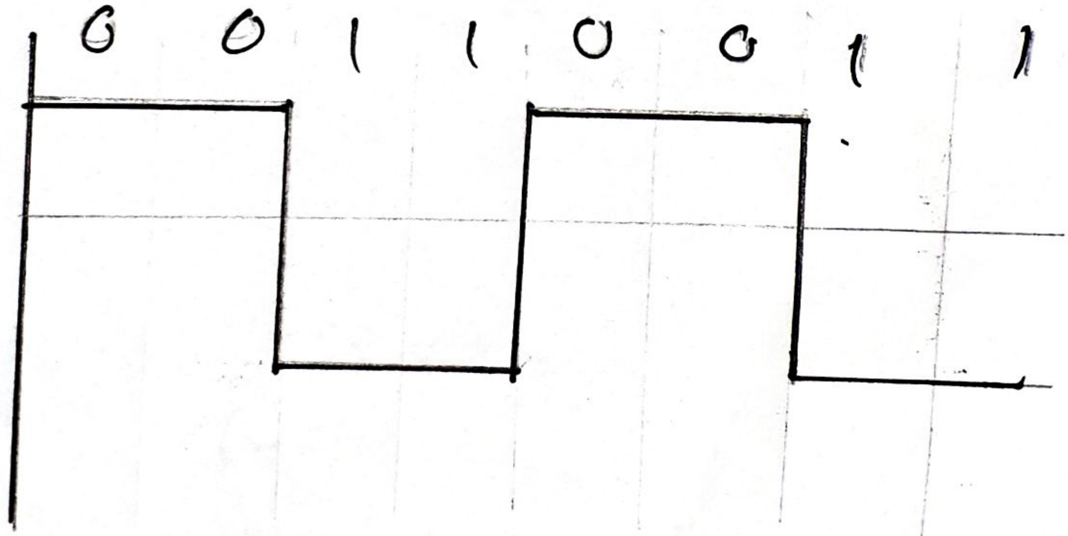
Q# 2) Draw the graph of the NRZ-L, NRZ-I Menchestar scheme using each of the following data streams.

NRZ-L Scheme :-

(1) 01010101

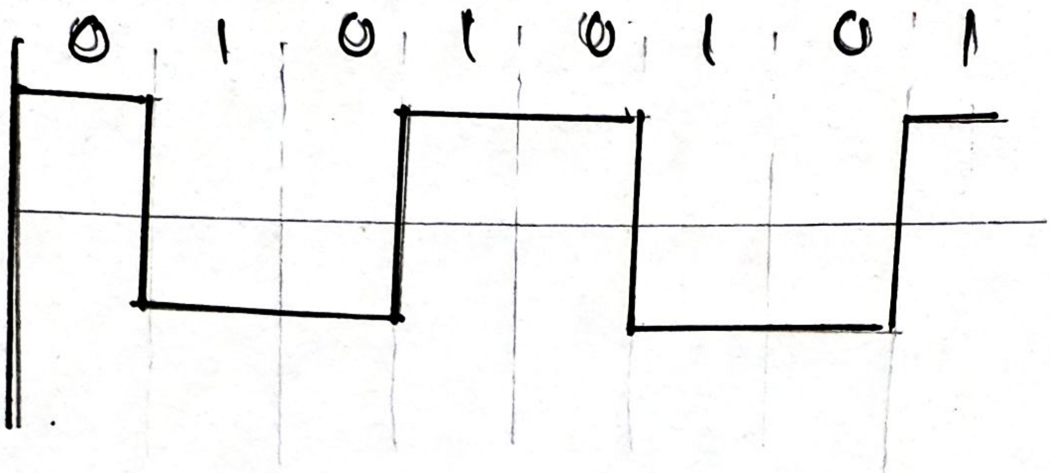



(2) 00110011

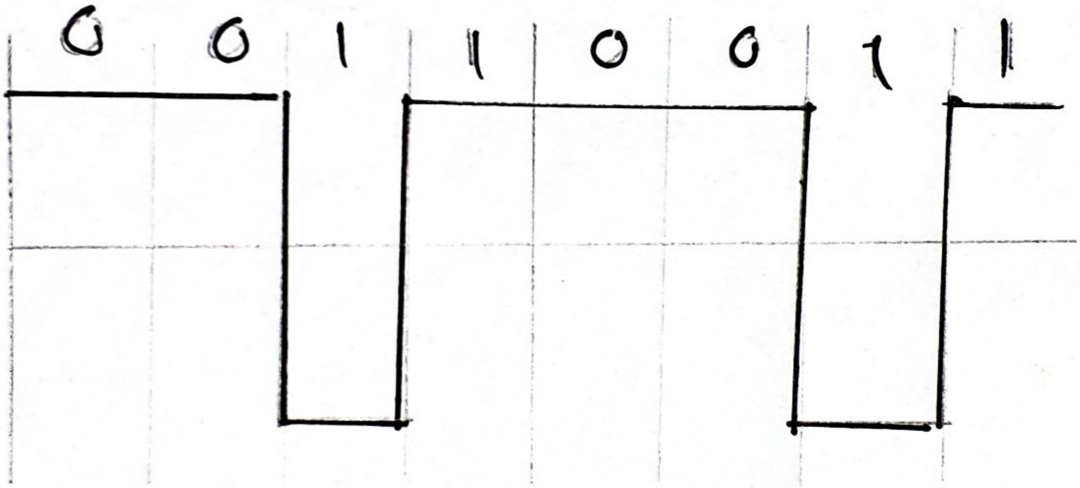


NRZ-I scheme:

(1) 01010101

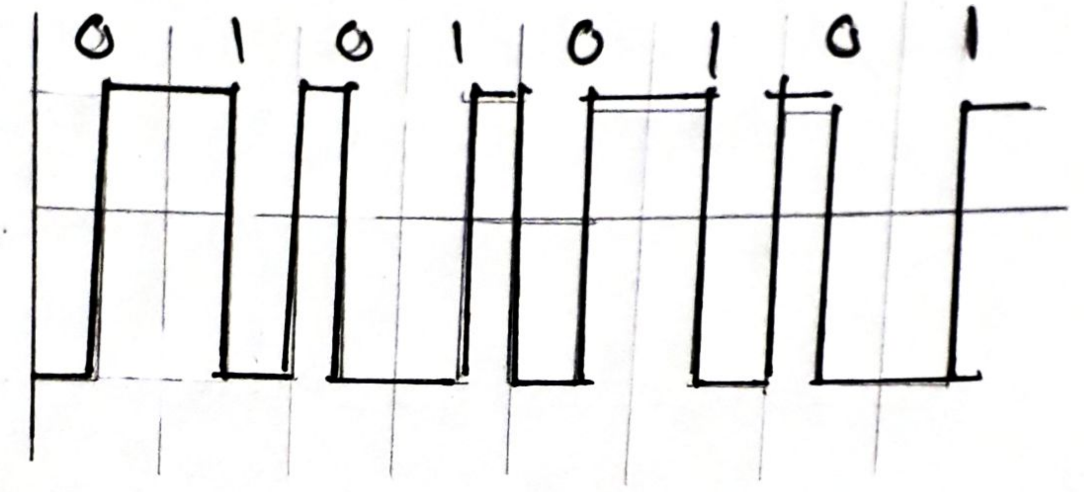



(2) 00110011

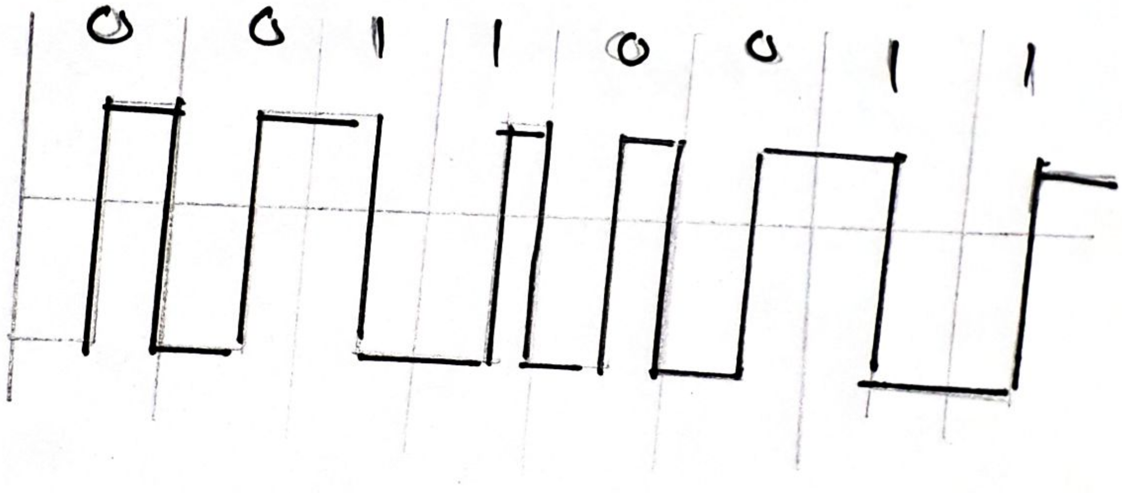


Manchester sheme:

(1) 01010101




(2) 00110011



Q#3 (a)

(1) A TV channal has a bandwidth of 6 MHZ if we send digital signal using one channal what are the data rates if we use one hormonic. three hormonic and five hormonic?

Solution:

Given data:

TV channal bandwidth $(B) = 6\,MHz$

using the 1st hormonic:

$$\text{Bandwidth} = \frac{\text{data rate (bit rate)}}{2}$$

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

$$= 2 \times 6$$

$$= 12\ \text{Mbps}$$

using a 1st and three hormonic

A bitter resuet can be achived by using the 1st and thirel hormonic with the requird bandwith

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

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

$= 4$ Mbps

Using the 1st and 5th hormonic.

Bandwidth $= \frac{5 \times \text{data rate}}{2}$

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

$= \frac{2 \times 6}{5}$

data rate $= 2.4$ Mbps

Q3 (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 attinuation in decibell..?

Solution

$$\text{the attinuation (dB)} = 10\log_{10}\frac{B}{A}$$

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

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

$$= 10(-0.046) \quad \text{since}$$

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

$$\text{Attinuation (dB)} = -0.46\,dB$$

Q3(3) the attenuation of signal is -10dB what is the final signal power if it was originally 5 W?

Attinuation is the reduction of strength in the power of a signal due to external factor.

the extent of reduction is measured in decibles.

Given

$P_s = 5W$

Attenuation = -10db

therefore

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

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

$= \boxed{0.5W}$

Q3(4) A signal has passed through three cascade amplifier each with a 4 dp gain what is the total gain How much is the signal amplified.

Solution:

A signal has passed through 3 cascade amplifier each with 4 db gain.

total gain = 3 x 4 dB

$P_{db}$ = 12 dp

the signal is amplified then

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

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

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

$P =$ 15.85

Q#3 (5) if the bandwidth of the channel is 5 Kbps. How long does it take to send the frame of 100,000 bits out of this device?

Solution:

Bandwidth = 5 Kbps

= 5000 bps

(1 Kbps = 1000 bps)

It taken time to send a frame of 100,000 bits out of this device.

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

$$T = \boxed{20s}$$

Q#3 (6) The light of sun takes aproximatly eight minut to reach the earth what is the distance between sun and earth.?

Solution:

Time = 8 minuts

$= 8 \times 60\,s$

$= 480\,s$

Convert mile per second to Km/s

$= \frac{186000}{sec} \times \frac{1\,Km}{0.621\,miles}$

$= \boxed{300000\,Km/s}$

therefor the distance between the sun and earth is

$48 \cdot \times 300000$

distance $= \boxed{144000{,}000\,Km/s}$

Q#3 (b)

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

Solution:

$$\text{pulse rate} = \frac{1}{2ms}$$

$$= \boxed{500 \text{ puls}/\text{se.}}$$

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

$$= 500 \times \log_2 8$$

$$\text{Bit rate} = 1500$$