

Name :Danyal Ahmad

Id : 13838

Program : BSSE

Course Title: Data Communication and Networks

Final Term Online Examination(Summer 2020)

Instructor: Engr. Ghassan Husnain

Total Marks: 50

Time Allowed: 4 Hours

Note: Attempt all Questions

Q1) Answer the following short questions briefly. (15 marks)

1)Distinguish between a signal element and a data element.

Answer(1):

A data element is the smallest entity that can represent a piece of information (a bit). A signal element is the shortest unit of a digital signal. Data elements are what we need to send; signal elements are what we can send. Data elements are being carried; signal elements are the carriers.

2) Define baseline wandering and its effect on digital transmission.

Answer(2):

In decoding a digital signal, the incoming signal power is evaluated against the baseline (a running average of the received signal power). A long string of 0s or 1s can cause baseline wandering (a drift in the baseline) and make it difficult for the receiver to decode correctly.

3) List three different techniques in serial transmission and explain the differences.

Answer(3):

The three are synchronous, asynchronous, and isochronous. In both synchronous and asynchronous transmissions, a bit stream is divided into independent frames. In synchronous transmission, the bytes inside each frame are synchronized; in asynchronous transmission, the bytes inside each frame are also independent. In isochronous transmission, there is no independency at all. All bits in the whole stream must be synchronized.

4) An analog signal carries 4 bits per signal element. If 2000 signal elements are sent per second, find the bit rate.

Answer(4):

In This Case $r = 4$, $S=1000$ and N is unknown. We can find the value of N from.

$$S = N \cdot 1/r \text{ or } N = S \cdot r = 1000 \cdot 4 = 4000 \text{ bps}$$

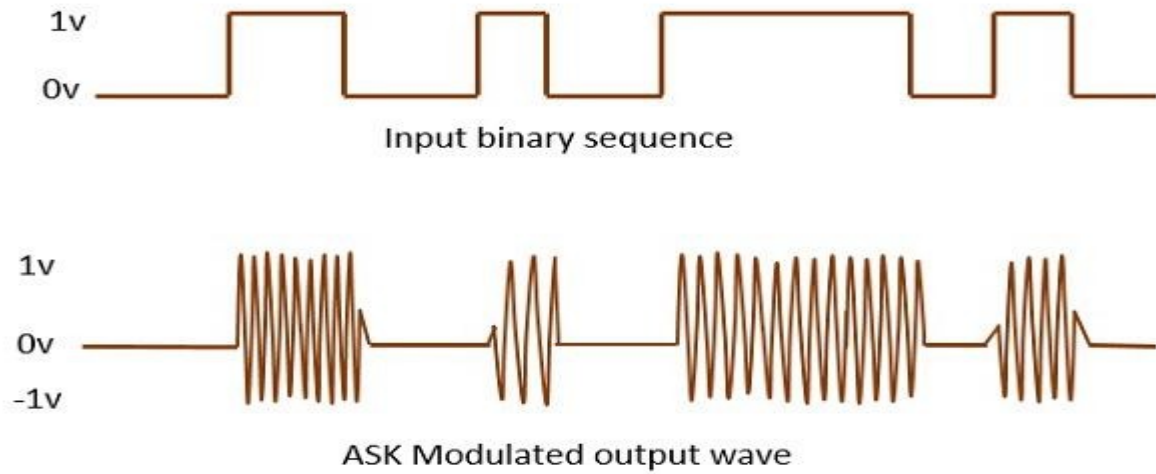
5) Define *constellation diagram*. Give an example each for ASK, BPSK and QPSK.

Answer(5):

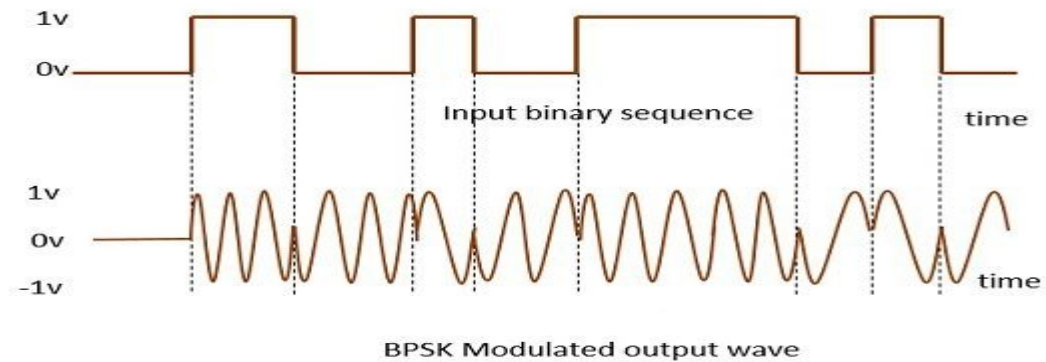
A constellation diagram is a representation of a signal modulated by a digital modulation scheme such as quadrature amplitude modulation or phase-shift keying. It displays the signal as a two-dimensional xy-plane scatter diagram in the complex plane at symbol sampling instants.

Following is the diagram for ASK modulated waveform

along with its input:

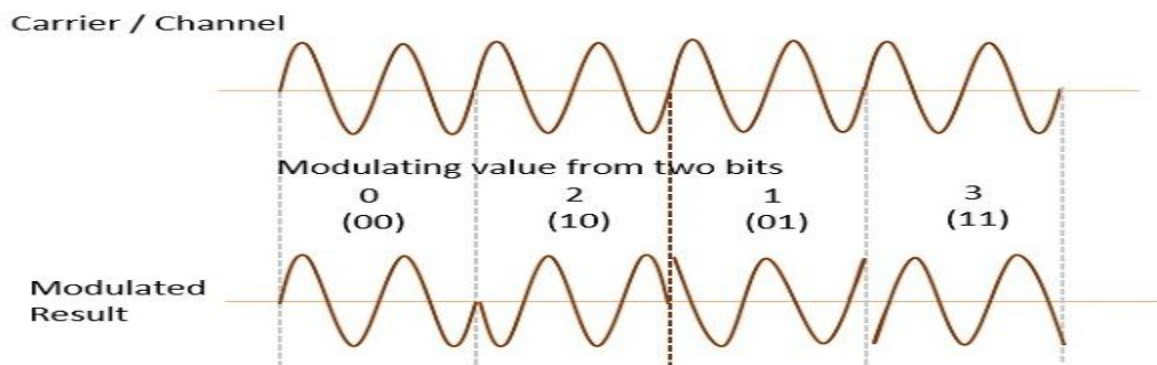


Following is the image of BPSK Modulated output wave along with its input.



Following is the image of BPSK Modulated output wave

along with its input.



Q2) Sec a) Find the 8-bit data stream for the following case:



Answer(sec a) :

8 bit data Stream :

Differential Manchester: 110001000

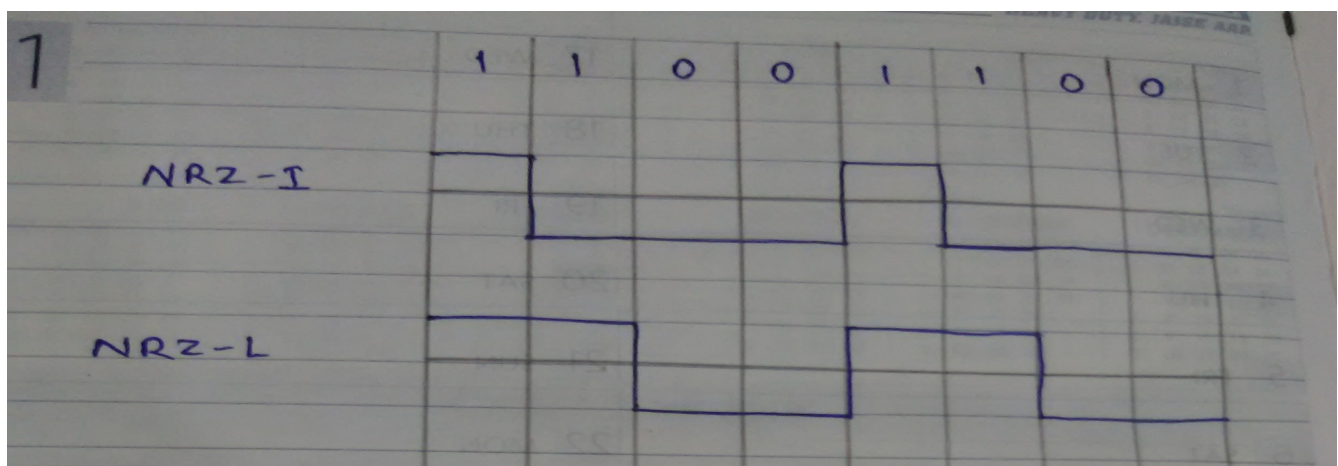
Q2) Sec b) Draw the graphs of the NRZ-I and NRZ-L schemes for each of the following data streams:

a. 11001100

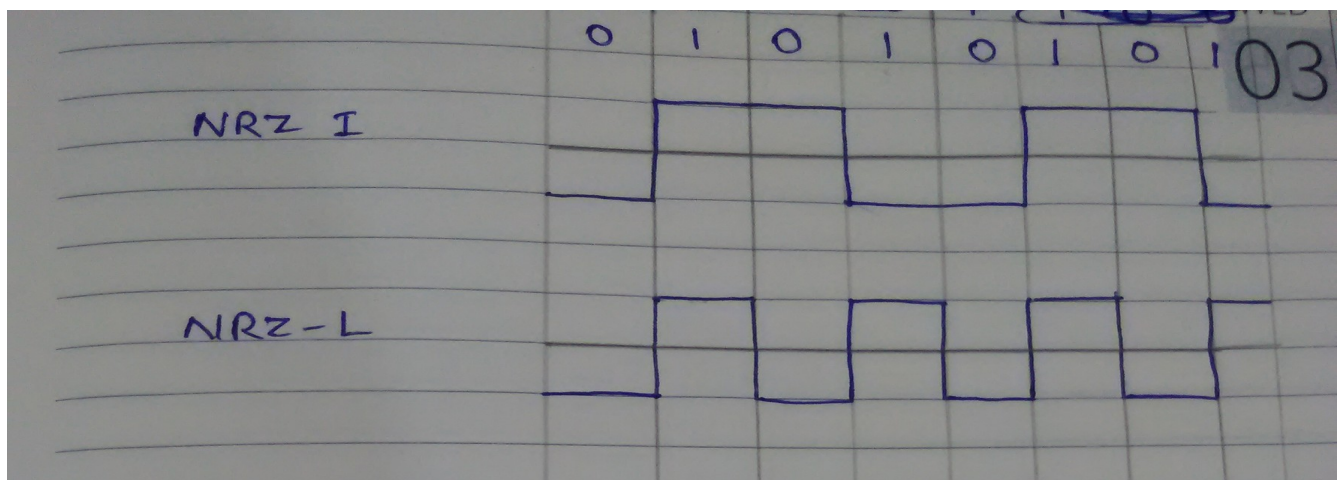
b. 01010101

Answer(sec b):

a. 11001100



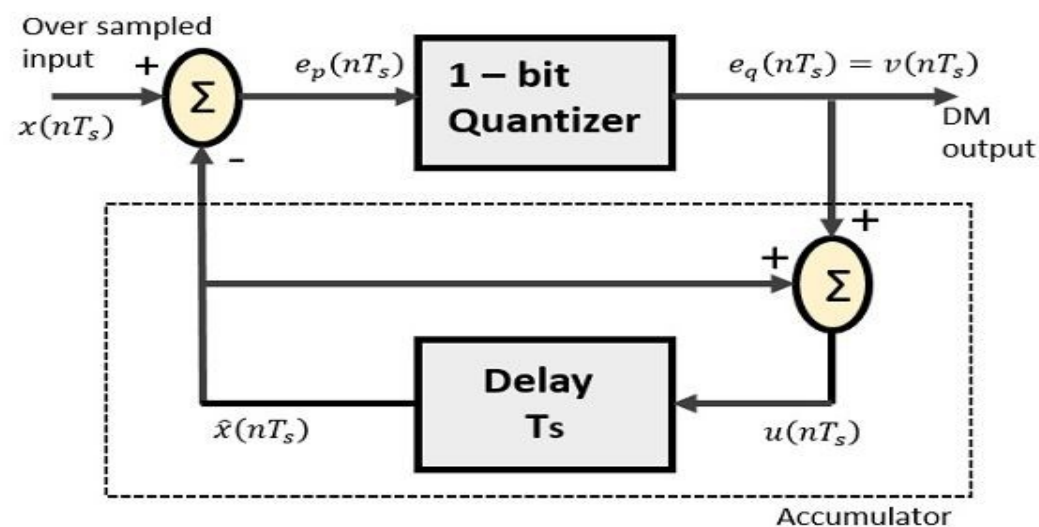
b. 01010101



Q2) Sec c) Briefly explain the working of Modulator and De-modulator of Delta Modulation with the help of diagrams?

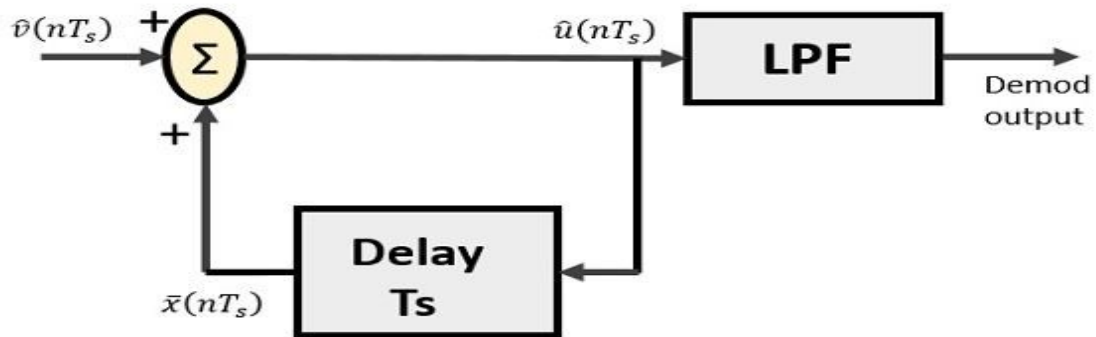
Answer(Sec-c):

The Delta Modulator comprises of a 1-bit quantizer and a delay circuit along with two summer circuits. Following is the block diagram of a delta modulator.



The delta demodulator comprises of a low pass filter, a summer, and a delay circuit. The predictor circuit is eliminated here and hence no assumed input is given to the demodulator.

Following is the diagram for delta demodulator.



Q3) Sec a) What is the Nyquist sampling rate for the band-pass signal with bandwidth of 850 KHz if the lowest frequency is 350 KHz?

Answer(3a):

$$f(\text{max}) = 350 + 850 = 1200 \text{ kHz}$$

$$\text{Nyquist sampling rate} = 2 \times 1200 \text{ kHz}$$

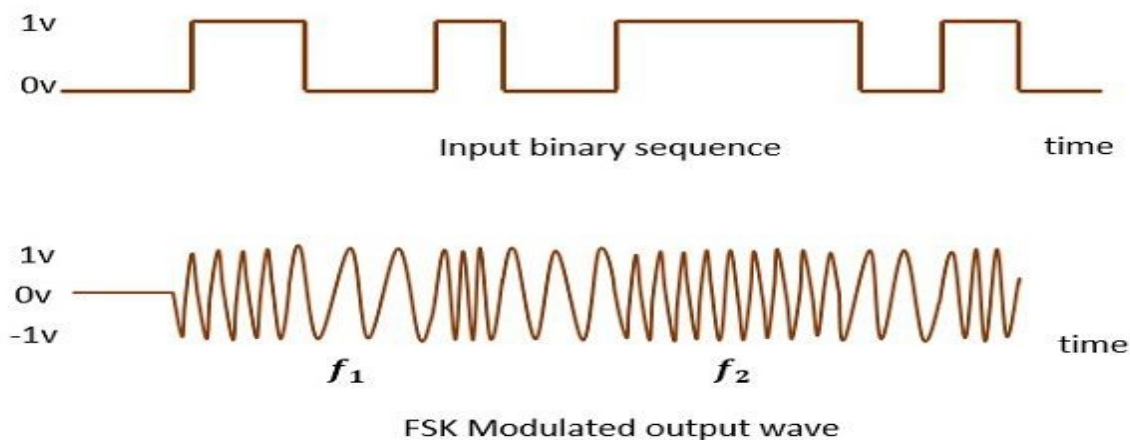
$$= 2400000 \text{ samples per second.}$$

Q3) Sec b) Define and explain FSK and PSK with the help of diagrams.

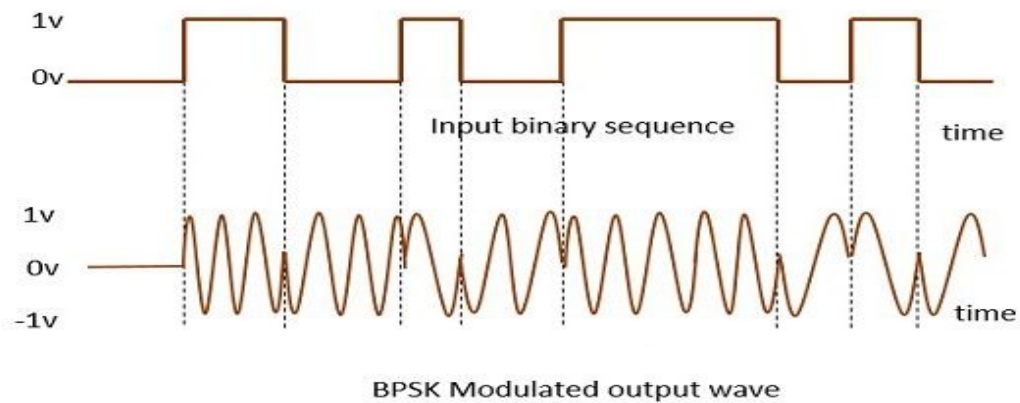
Answer (3b):

Frequency Shift Keying (FSK) is the digital modulation technique in which the frequency of the carrier signal varies according to the discrete digital changes. FSK is a scheme of frequency modulation.

Following is the diagram for FSK modulated waveform along with its input.



Phase Shift Keying (PSK) is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications.



Q3) Sec c) We have an available bandwidth of 200 kHz which spans from 500 to 700 kHz. What are the carrier frequency and the bit rate if we modulated our data by using ASK with $d = 1$?

Answer (3c):

The middle of the bandwidth is located at 600 kHz. This means that our carrier frequency can be at $f_c = 600$ kHz. We can use the formula for bandwidth to find the bit rate (with $d = 1$ and $r = 1$).

$$B = (1+d) * S = 2 * N * 1/r = 2 * N = 200 \text{ kHz}$$

$$N = 100 \text{ kbps}$$

Q4) Sec a) Which shift keying technique is used in the following diagram? Briefly explain

Answer(4a):

The digital data to be transmitted is the binary number 10110. Two amplitudes are used to directly represent the data, either 0 or 1. In this case, the modulation is called binary amplitude shift keying or BASK. The signal is divided into four pulses of equal duration which represent the bits in the digital data. The number of bits used for each character is a function of the system, but is typically eight, seven of which represent the 128 possible characters, the last bit is used to check for errors.

Q4) Sec b) Briefly explain Analog to Analog conversion techniques with the help of diagrams?

Answer(4b):

Analog to Analog conversion can be done in three ways:

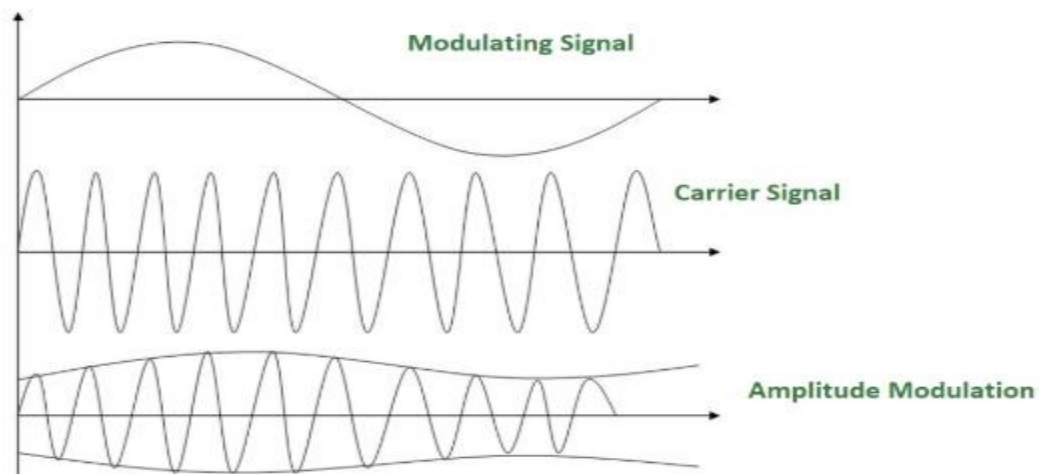
1. Amplitude Modulation

2. Frequency Modulation

3. Phase Modulation

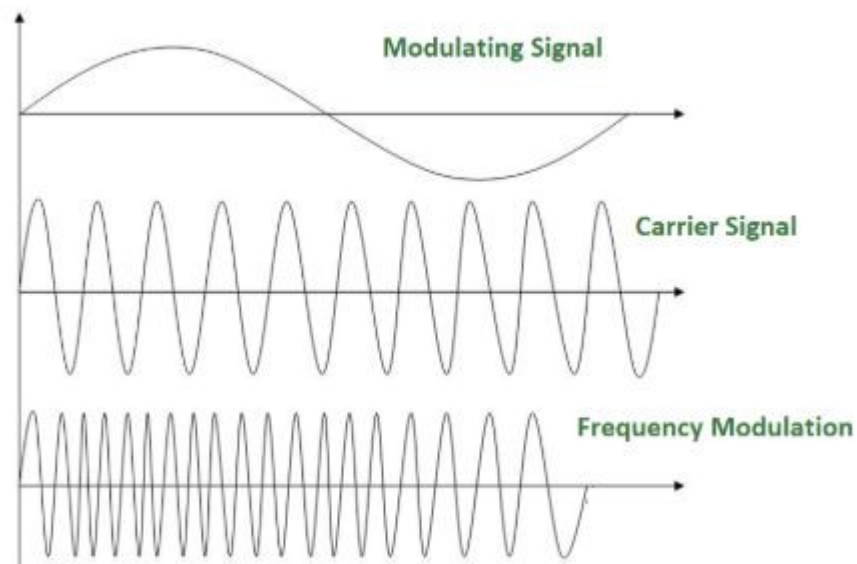
1. Amplitude Modulation:

The modulation in which the amplitude of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping phase and frequency as constant. The figure below shows the concept of amplitude modulation:



2. Frequency Modulation:

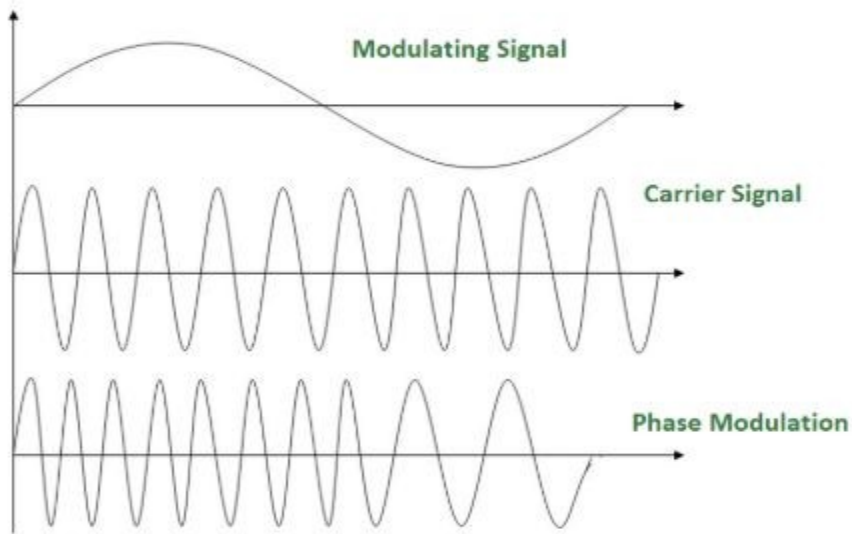
The modulation in which the frequency of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping phase and amplitude as constant. The figure below shows the concept of frequency modulation:



3. Phase Modulation :

The modulation in which the phase of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping amplitude and frequency

as constant. The figure below shows the concept of frequency modulation:



The End