Name Jibran
Id 14472
Subject Data Communication & Network
Department BS(CS)
Semester 4th

Q(1) part (a)

To multiplex 10 voice channels, we need nine guard bands. The required bandwidth is

then $B = (4\ KHz) \times 10 + (500\ Hz) \times 9$

$$= 44.5\ KHz$$

Q(1) part (b)

Solution:-

In this case, $r = 4$, $S = 3000$ and N is unknown. We can find the value of N from

$$S = N \times \frac{1}{r}$$

$$N = S \times r$$

$$N = 3000 \times 4$$

$$N = 12000\ bps$$

Q (1)
Part (c)

Signal Element Versus Data Element

* In data communications, our goal is to send data elements.
* A data element is the smallest entity that can represent a piece of information: this is the bit.
* In digital data communications, a signal element carries data elements.
* A signal element is the shortest unit of a digital signal.
* In other words, 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.

Q(1) part (d)

Answer:-

Link refers to the physical path while channel refers to the portion of a link that carries a transmission between a given pair of lines.

Q(1) part (e)

The three different techniques in serial transmission are:

(i) Asynchronous:-

In this, we send 1 start bit at the beginning and 1 or more stop bits at the end of each byte. i-e irregular intervals.

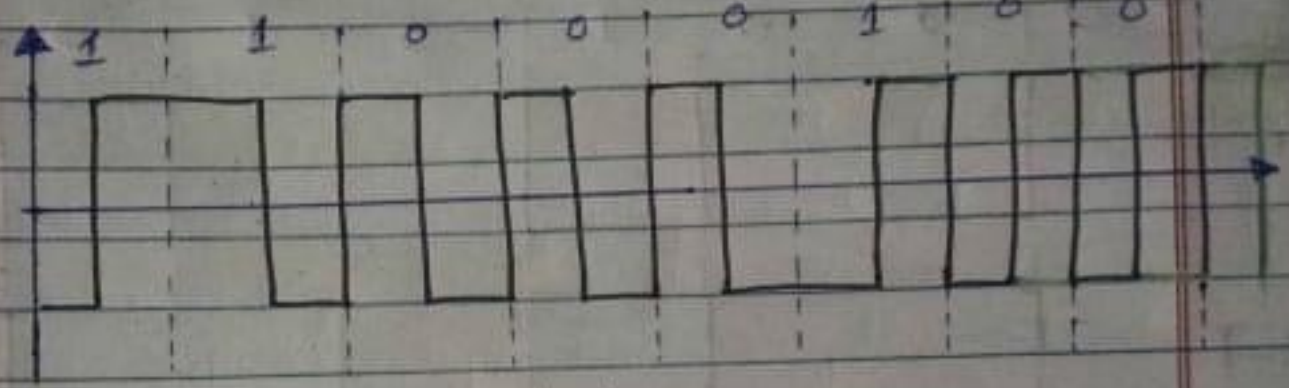
(ii) Synchronous:

In this, we send bits in a serial order with out any gaps. i-e regular intervals.

(iii) isynchronous:-

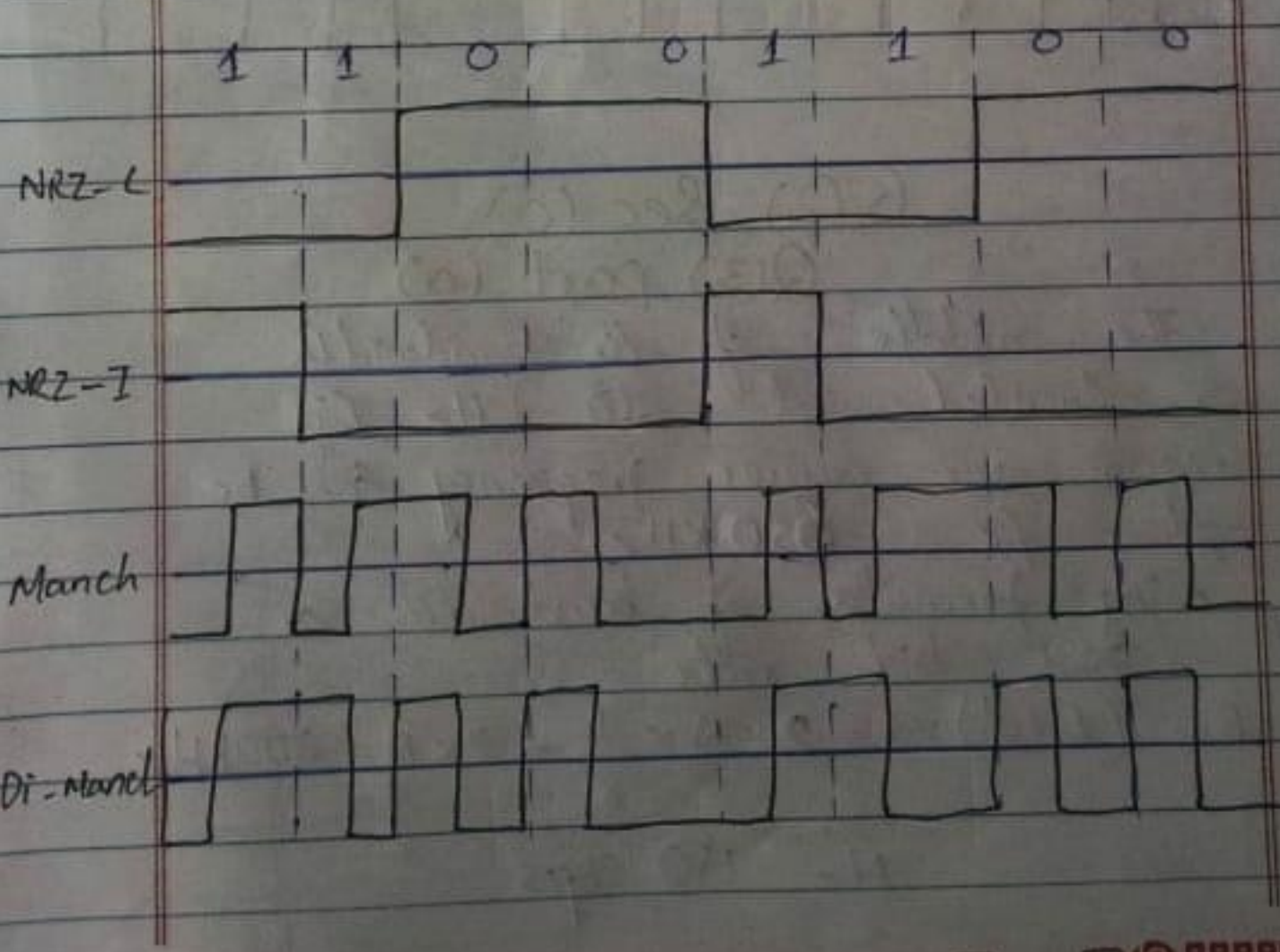
It sends a block of data asynchronously.

Q(2)
Sec (a)

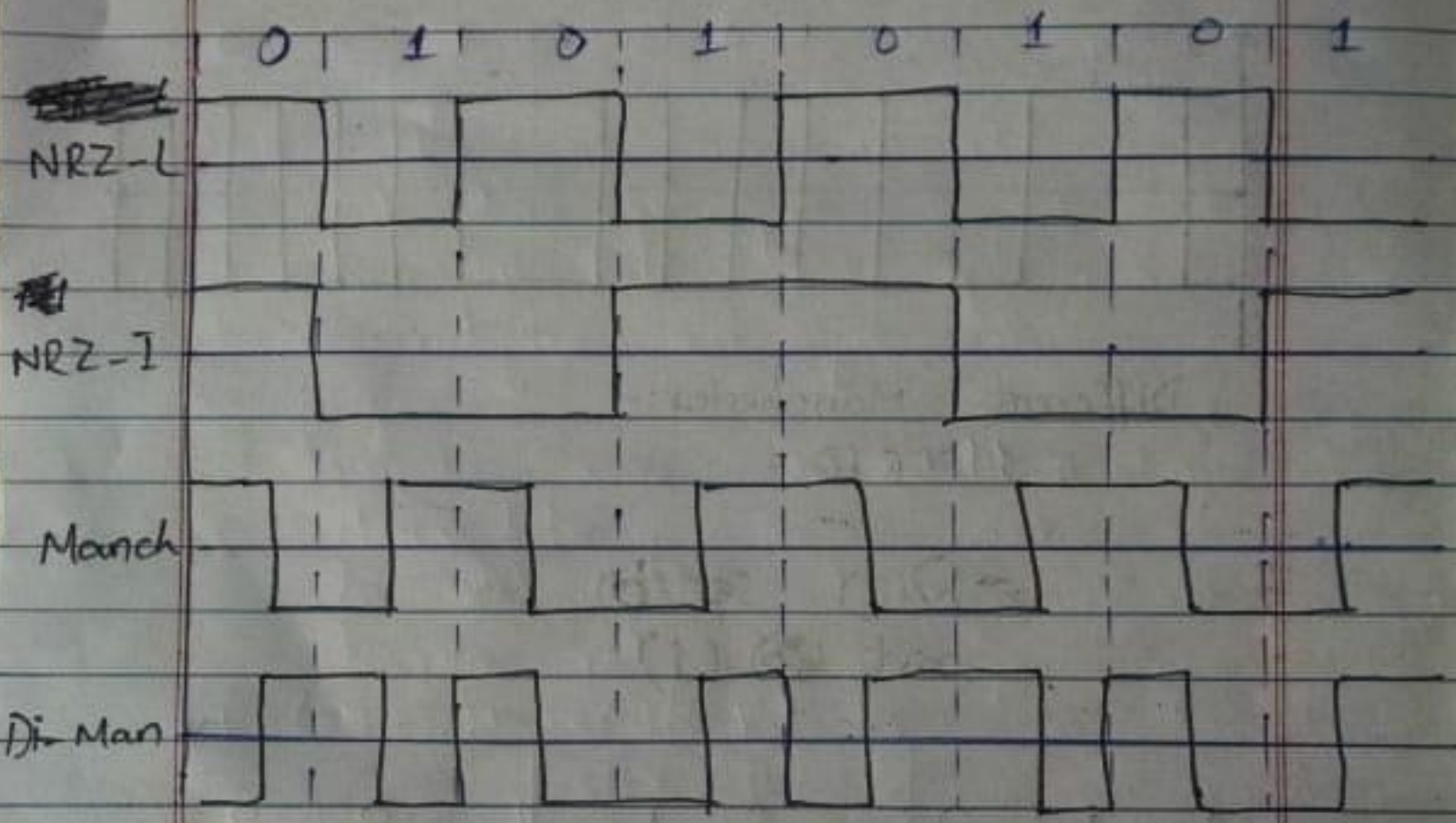


Different Manchester:-
11000100

Q(2) sec (b)
part (1)



Q(2) Sec (b) part (2)



Q(2) Sec (c)

Solution:-

Bandwidth = Highest frequency - lowest frequency.

$950KHz = x - 450KHz$

$x = 950 + 450 = 1400KHz$

Nyquist sampling Rate => should be atleast twice the maximum frequency

Hence, Nyquist Sampling Rate $= 2 \times 1400\ KHz$

$= 2800\ KHz$

Q(3)
part (a)

The middle of the bandwidth is located at 650 KHz. This means our carrier frequency can be at $f_c = 650$ KHz using formula of bandwidth or find bit rate.

$$B = (1+d) \times S = 2 \times N \times \frac{1}{\gamma}$$

$$= 2 \times N = 300 \text{ KHz}$$

$$\boxed{N = 150 \text{ Kbps}}$$

Q(3)
part (b)

Binary Amplitude shift Keying:-

* Although we can have several levels of signal elements, each with a different amplitude, Ask is normally independent using only two levels.
* This is referred to as binary amplitude shift keying or on-off keying (OOK).

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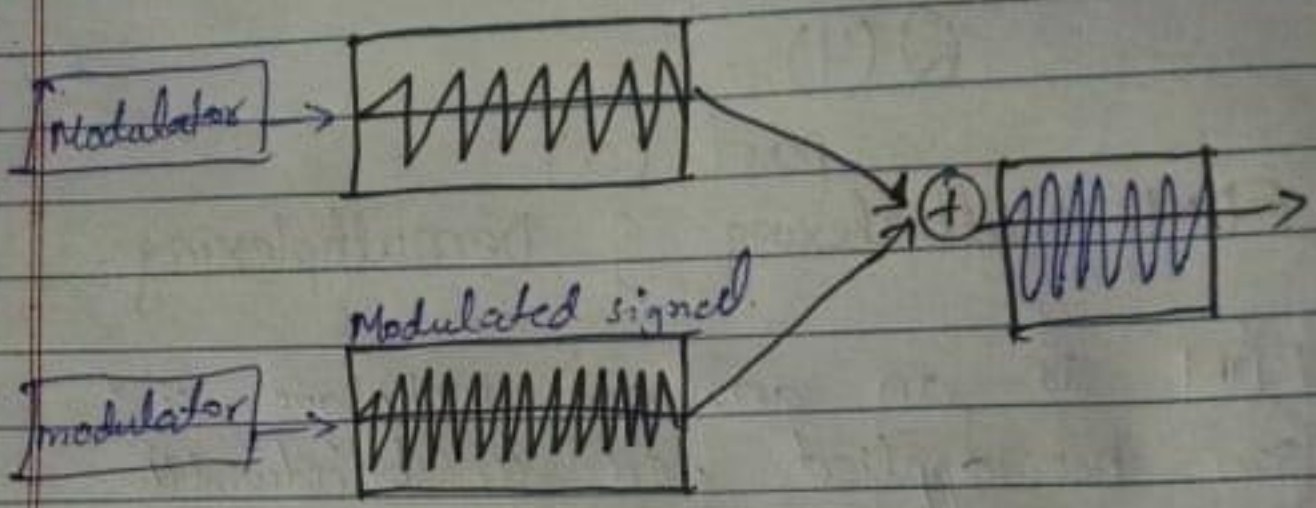
* The peak amplitude of one signal level is 0; the amplitude of the carrier frequency.

Q(4)

part (a)

FDM Multiplexing & Demultiplexing:-

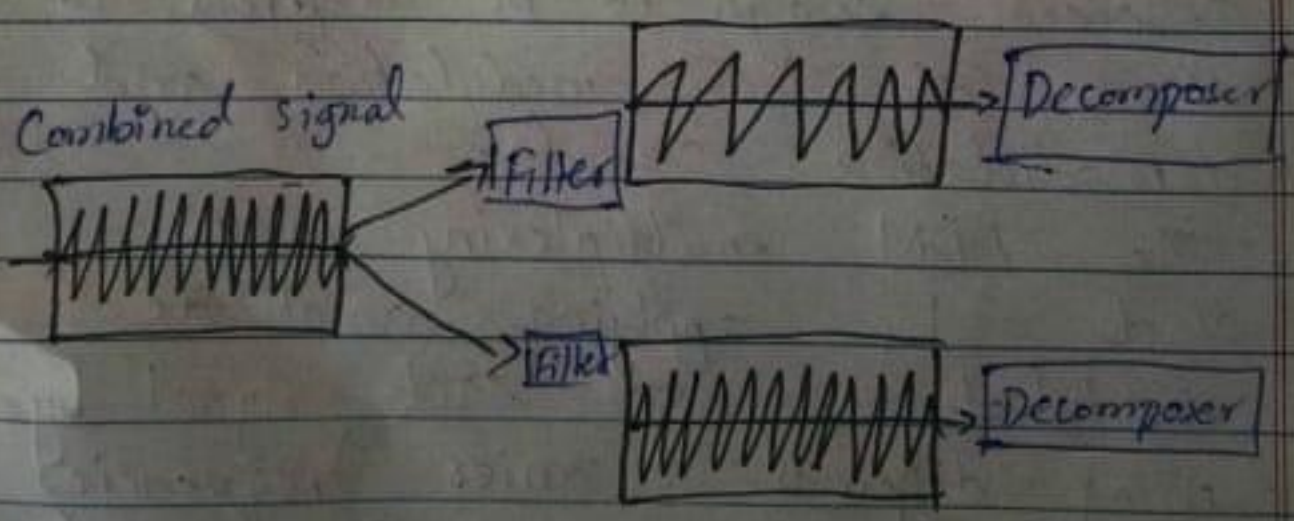
* FDM is an analogue technique that can be applied when the bandwidth of a link (Hz) is greater than the applied bandwidth of the signals to be transmitted.
* In FDM, signals generated by each sending device modulates different carrier frequencies.
* These modulating signals are then combined into a composite signal that can be transported by the link.
* In FDM each signal is assigned a different frequency.
* The carrier frequencies have to be different enough to be different to accomodate the modulation and demodulation signals.
* The FDM multiplexing process starts by applying amplitude modulation into each signal by using different carrier frequencies as fi and fj then both signals are combined.



→ In the demultiplexing process, we use filters of different kinds to decompose the multiplexed signals into its constituent component signals.

* Then each signal is passed to an amplitude demodulation process to seperate the carrier signals from the message signals.

* The message signal is then sent to the reciever



Difference between FDM and TDM:

* Both FDM and TDM are multiplexing techniques.
* The main difference b/w FDM and TDM is that in FDM, individual signals are given different frequency within a common bandwidth for transmission.
* Whereas in TDM the multiple signals are transmitted in different time slots on a single channel.
* And FDM is used for analogue transmission of signals e.g. Audio signals at radio is achieved by FDM.
* Whereas TDM can be used for both analog and digital signals.

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Q(4)
part (b)

Analog to Analog Conversion:-

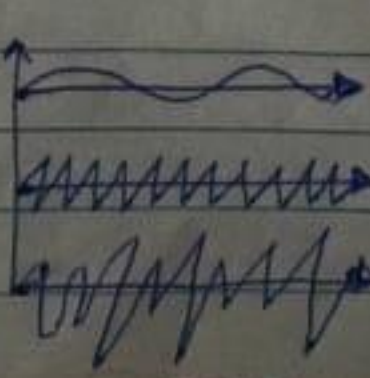
* Analog to Analog Conversion, is the representation of analog information by analog signals
e.g. radio.

* There are three ways to accomplish analog to analog conversion.

(1) Amplitude Modulation : (AM).

* In AM transmission the carrier signal is modulated so its amplitude varies with the changing amplitudes of the modulating signals.

* The frequency and phase of the carrier remain the same. Only amplitude changes to follow variation in information.

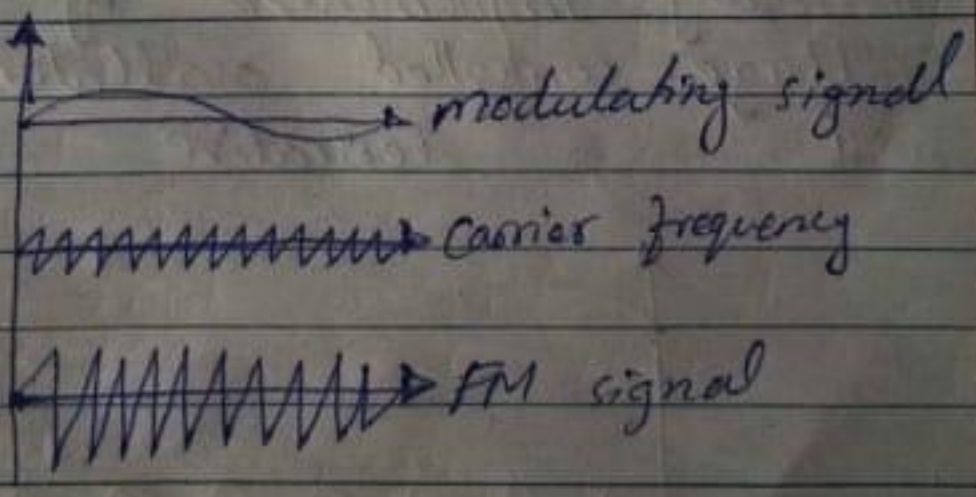


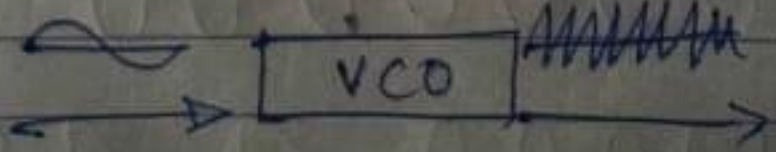
(2) Frequency Modulation (FM):-

* In FM transmission, the frequency of the carrier signal is modulated to follow the changing voltage level (amplitude) of the modulating signal.

* The peak amplitude and phase of the carrier signal remain constant.

* But, as the amplitude of the information signal changes, the frequency of the carrier changes correspondingly.





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3) Phase Modulation:- (PM)

* 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.

* Phase modulation is practically similar to Frequency Modulation, but in Phase modulation frequency of the carrier signal is not increased. It is normally implemented by using a voltage-controlled oscillator along with a derivative