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program: BSCS
Department: Computer Sci
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NOte: Attempt all questions

QNO#1

See(a)

Assume that a voice channel occupies a bandwidth of 4KHz. We need to multiplex 10 voice channels with guards bands of 500Hz using FDM. Calculate the required bandwidth.

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

then $B = (4KHz) \times 10 + (500Hz) \times 9 = 44.5KHz$

Part (b)

Given:

$r = 4$

$S = 3000$

$N = ?$

Formula:

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

or

$$N = S \times r$$

$$= 3000 \times 4 = 12000 \text{ bps}$$

Part (c)

Signal element & data element

* In data communications, our goal is to Send data elements.
* A data entity is the Smallest entity that can represent a piece of information: this is the bit
* In digital communications, a Signal element carries data elements.
* A Signal element is the Shortest unit (time wise) 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.

Part (d)

link refers to the physical path while Channel refers to the portion of a link that carries a transmissions between a given pair of lines.

Part (e)

The three different techniques in Serial transmissions are:-

(I) **ASynchronous** - In this we Send 1 Start bit at the begining & 1 or more Stops bits at the end of each byte i,e irregular intervals

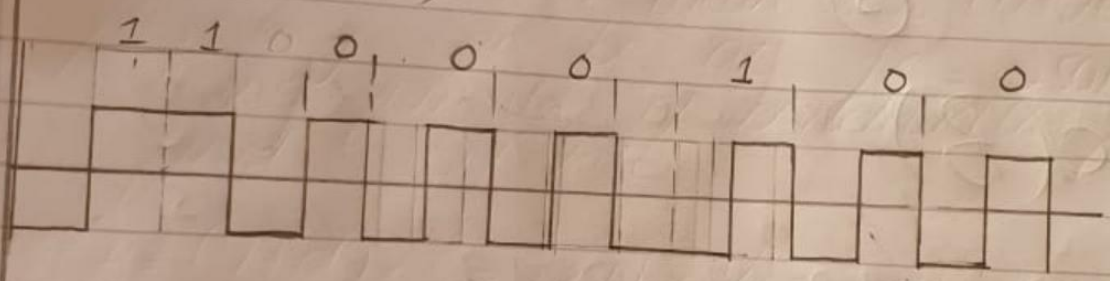
II) **Synchronus** - In this we Send bits in a Serial order with out any gaps i,e regular intervals

III) **ISynchronous** - it Sends a block of data asynchronously.

(4)

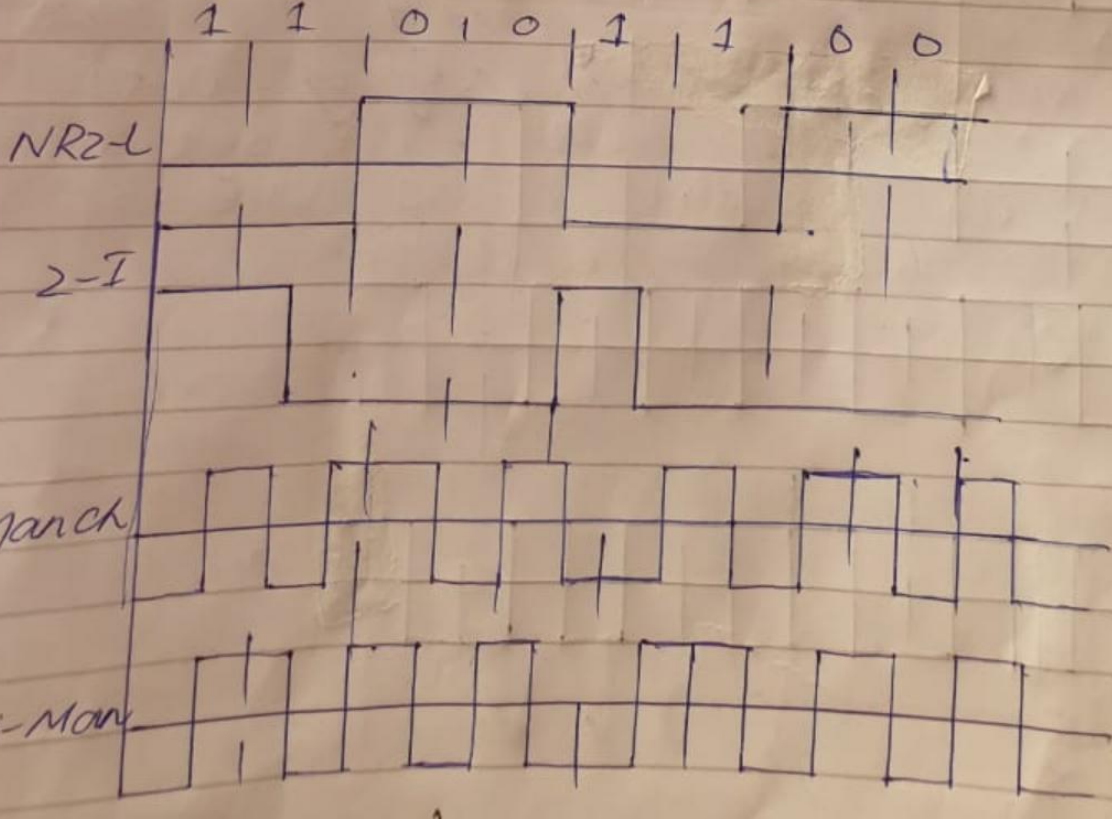
Q NO #2

Set (a)



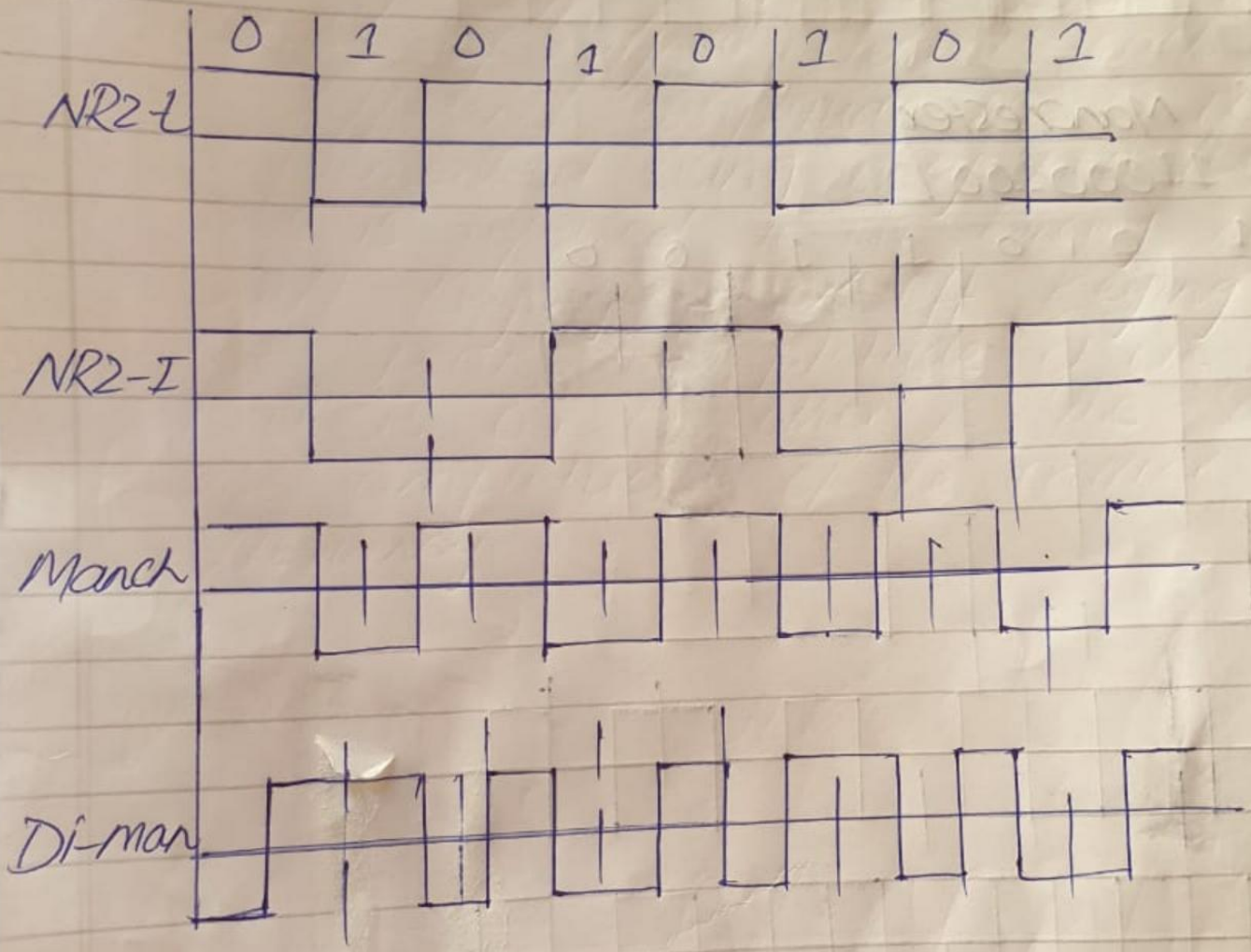
Diff Manchester

11000100



(5)

Sec(B)



(6)

Part (C)

Bandwidth = Highest frequency - lowest frequency

950KHz = x - 450KHz

x = 950 + 450 = 1400 KHz

Nyquist Sampling rate => Should be at least twice the maximum frequency

Hence,

Nyquist Sampling rate = 2 * 1400KHz = 2800KHz

QNO#3

Sec ~~D~~ (A)

The middle of bandwidth is located at 650KHz. Thus mean our carrier frequency can be at fc = 250KHz using formula of bandwidth for find bit rate.

$$B = (1+d) \times S = 2 \times N \times 1/6 = 2 \times N = 300KHz$$

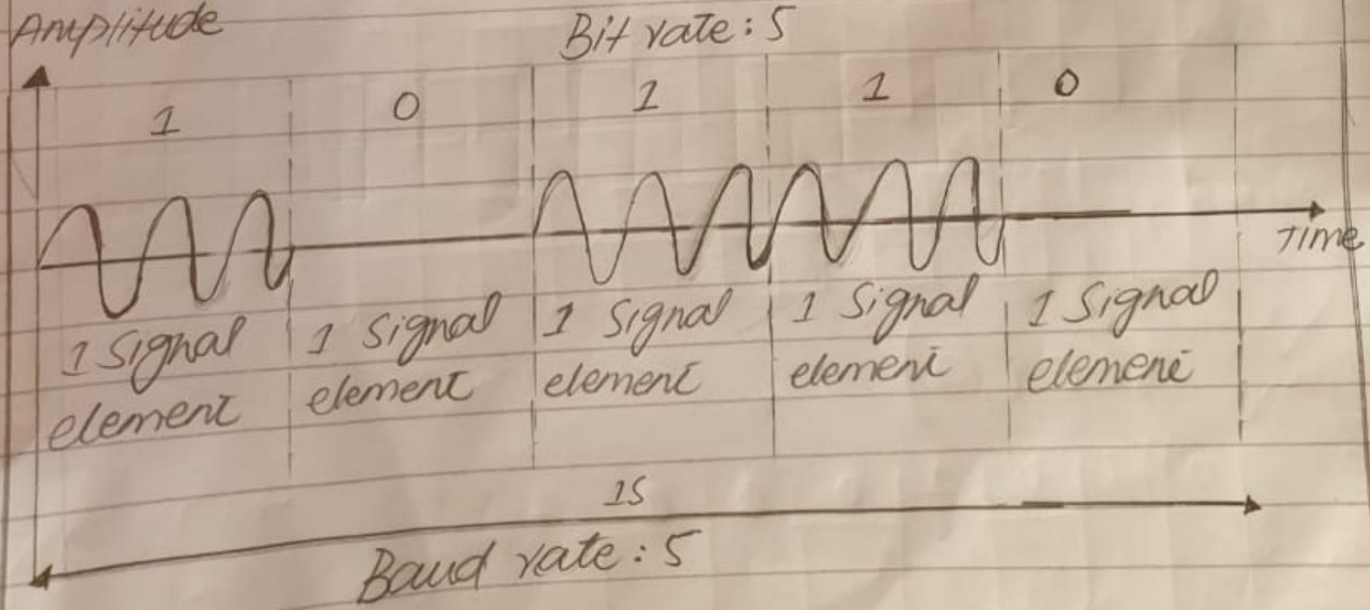
$$N = 150KBps.$$

Q NO#3

Sec(B)

* Binary Amplitude Shift Keying:-

* Although we can have several levels (kinds) of signal elements, each with a different amplitude, ASK is normally implemented using only two levels.
* This is referred to as binary amplitude Shift Keying or on-off Keying (OOK).
* The peak amplitude of one signal level is 0; the other is the same as the amplitude of the carrier frequency.



Q NO#4

(a)

FDM multiplexing & DEMultiplexing:-

→ FDM is analog technique that can be applied with the bandwidth of a link (Hz) is greater than the applied bandwidths of the signals to be transmitted.

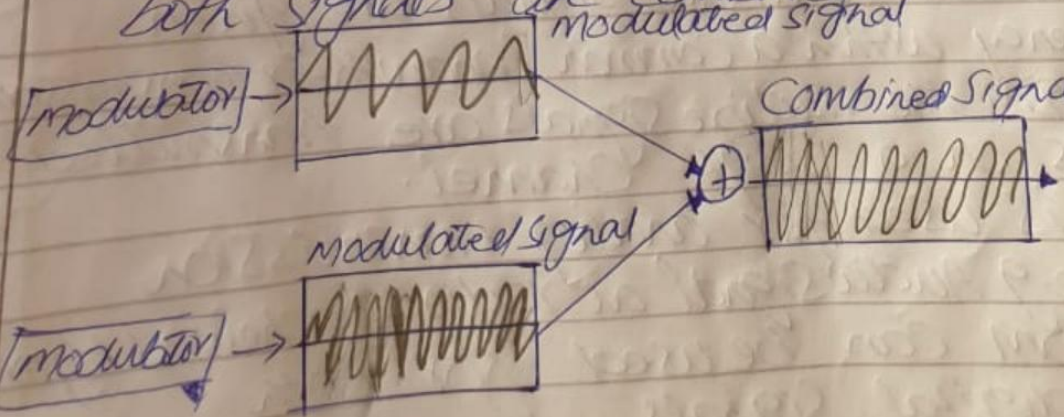
→ In FDM signals generated by sinding device modulator different carrier frequencies.

* These modulating signals are then combined into a single composite that can be transported by the link.

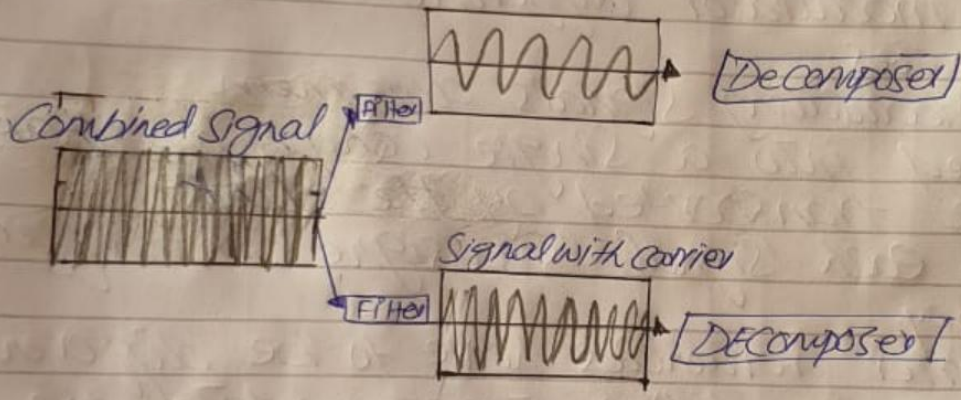
→ In fdm each signal is assigned in different frequency.

→ The carrier frequencies have to be different enough to be different accomodate the modulation & demodulation signals.

→ The fdm multiplexing process start by applying amplitude ~~into~~ e modulation into each signal by using different carrier frequencies as f_i & f_j then both signals are combined.



→ In the demultiplexing process we use filters of different kind to decompose the multiplexed signals into its constituent component signals
→ Then each signal is passed to an amplitude demodulation process to separate the carrier signals from the message signals
→ The message signals is then sent to the reciever



DIFF B/W FDM & TDM:-

Both FDM & TDM are multiplexing technique

* The main difference b/w FDM & TDM is that in FDM individual signals are given different frequency within a common bandwidth for transmission
* Where as in TDM the multiple signals are transmitted in different slots on a single channel.
* And FDM is used for analog transmission of signal e.g Audio signal at radio is acheived by FDM
* Whereas TDM can be used for both analog & digital signals.

QNO#4

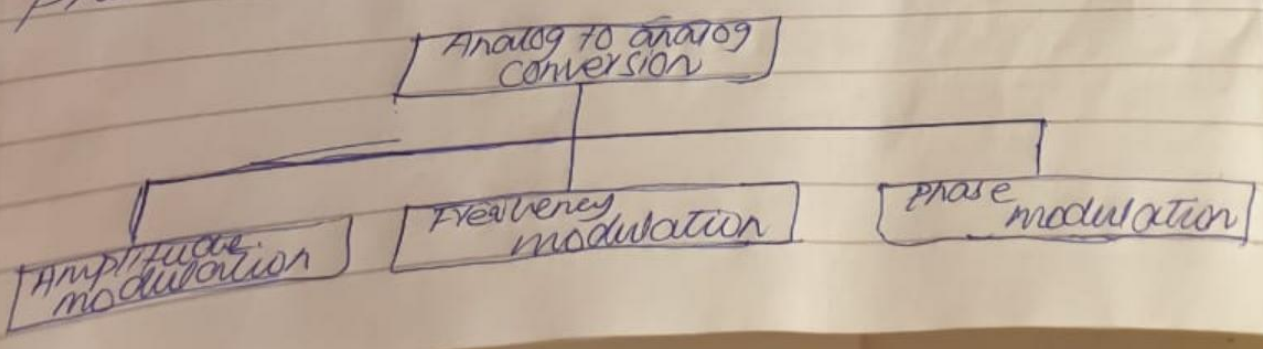
Part (b)

Analog to Analog conversion

Analog to analog conversion, or analog modulation is representation of analog information by an analog signal.

* One might ask why we needed if the medium is band-pass.
* One may ask why we need to modulate an analog signal; its already analog.
* Modulation is needed if the medium is band-pass in nature or if only a band-pass channel is available to us.
* An example is radio.
* The government assigns a narrow bandwidth to each radio station
* The analog signal produce by each station is a low pass signal, all in the same range
* To be able to listen to different station the low pass signals need to be shifted each to a different range.

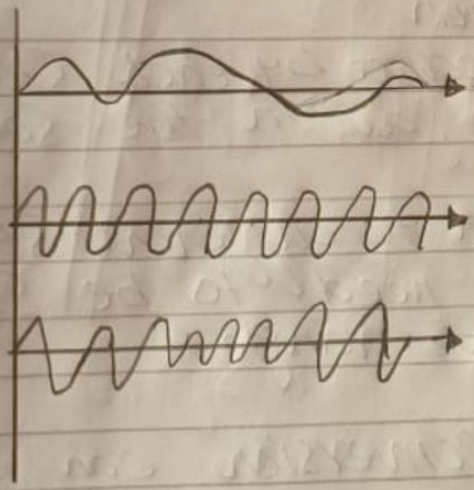
* Analog to analog conversion can be accomplished in three ways:
* Amplitude modulation (AM)
* Frequency modulation (FM)
* phase modulation (PM)



* Amplitude modulation

In AM transmission the carrier signal is modulated so that its amplitude varies with changing amplitude of the modulating signal

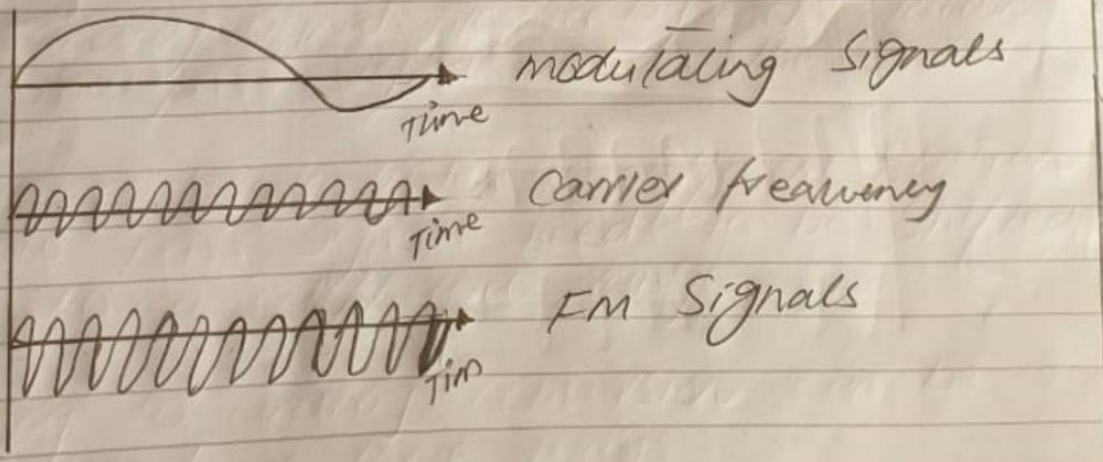
* The frequency & phase of the carrier remain the same only the amplitude changes to follow variation in the information.
* The modulating signal is the envelop of the carrier.
* AM is normally implemented by using a simple multiplier because the amplitude of the carrier signals need to be changed according to the amplitude of the modulating signals.

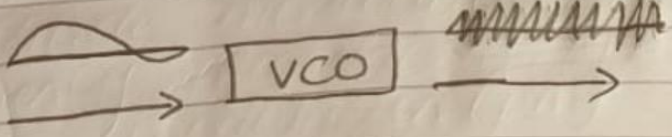


FM (Frevuency modulation)

In FM transmission the frevuency of the carrier signal is modulated to follow the changing voltage level of modulating signal.

* The peak amplitude & phase of the carrier signal remain constant, but as the amplitude of the information signal changes the frevuency of the carrier changes correspondingly
* Figure show the relationship of the modulating signal, the carrier signal & the resultant FM signal
* FM is normally implemented by using a voltage-controlled oscillator as with FSK.
* The frevuency of the oscillator changes according to the input voltage which is amplitude of the modulating signals.





PM (Phase modulation)

In PM transmission, the phase of the carrier signal is modulated to follow the changing voltage level of the modulating signals

* The peak amplitude & freeveney of the carrier signal remain constant, but as the amplitude of the information signal changes the phase of the carrier changes correspondingly
* Figure show the relationship of modulating signals, the carrier signals & the resultant PM signal.