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Subject = Data Communication & Network

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⇒ Q1

Part (A) a sec a

Ans: To multiplex 10 voice channels, we need nine guard bands. The required bandwidth is then B = (4KHz) x 10 + (500Hz) x 9 = 44.5kHz

sec b

⇒ Q1 Part (B) Solution:-

In this case, $r = 4$

$S = 3000$, and $N$ is unknown

We can find the value N from, $S = N \times \frac{1}{r}$

$N = S \times r$ , $N = 3000 \times 4$

$N = 12$ kbps.

⇒ Q1 Part (C) sec c.

Signal Element Versus Data Element

- In data communications, our goal is send data elements.
- In data element is the smallest entity that can represent a piece of information: that is the bit.
- In digital data communications, a signal element carries data elements.
- A signal element is the shortest unit (timewise) 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 carried; signal elements are the carries.

## Q1 Part (E) Sec e.

The three different techniques in serial transmission are:

① Asynchronous.

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

② Synchronous: In this, we send bit in a serial order without any gaps. i.e, regular intervals.

③ Isynchrounous: It sends a block of data asynchronously.

## Q1 Part (D) sec d.

- 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.

Q2 Sec c.

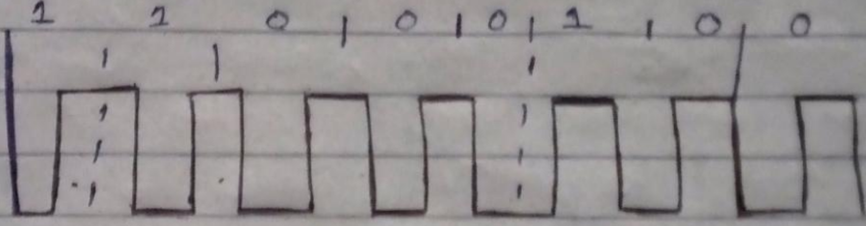
The middle of the bandwidth is located at 650 kHz. Thus means our carrier frequency can be at $f_c = 250$ kHz

Using formula of bandwidth for find bit rate.

$B = (1+d) \times S = 2 \times N \times \frac{1}{r} = 2 \times N = 300$ kHz

$N = 150$ kbps.

Q2 Sec b. (a)




Diff Manchester:-

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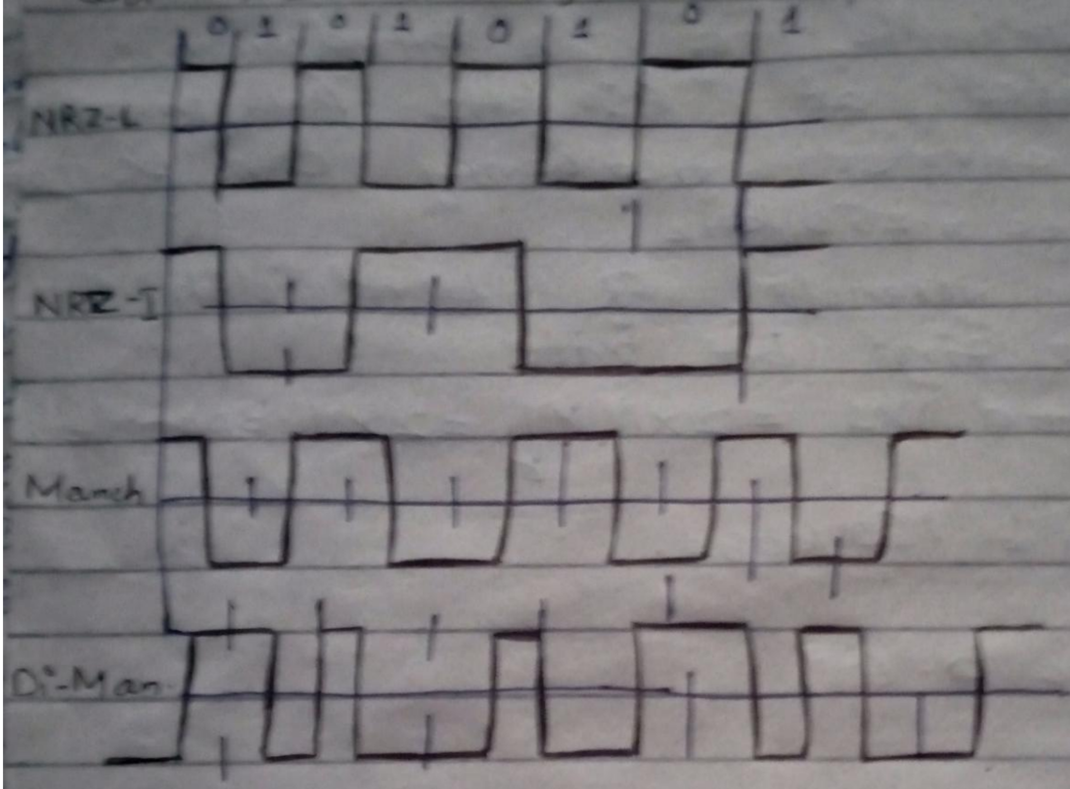
ID: 14736. Page - 4

Q8 Sec. b. (b)



→ Q No 4

(a)

→ FDM MULTIPLEXING & DEMULTIPLEXING

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

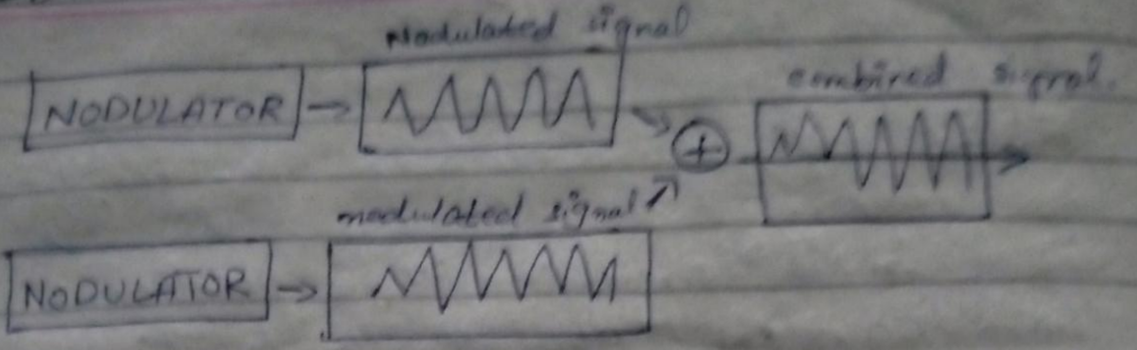
→ In FDM, signals ~~gte~~ generated by each sending device modulates different carrier frequencies.

→ These modulated signals are then combined into a single composite signal that can be transported by the link.

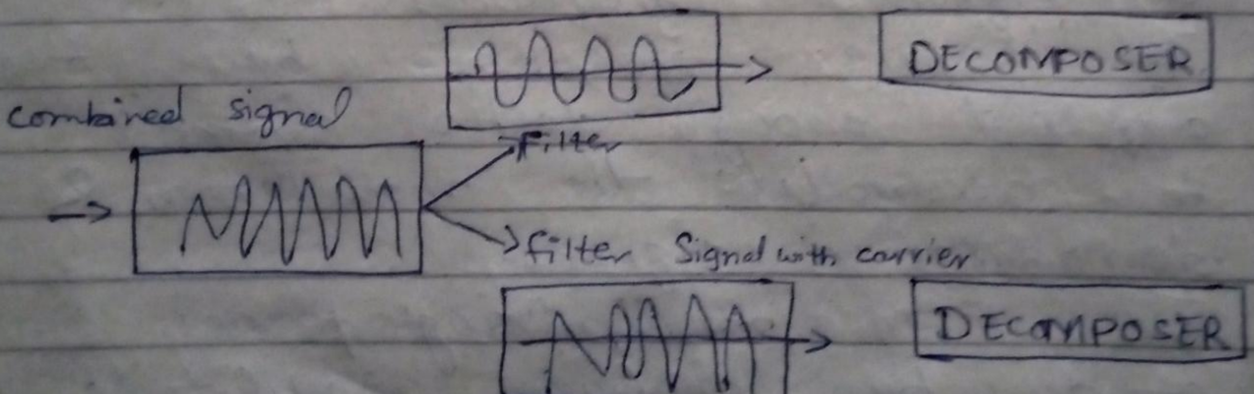
→ In FDM each signal is assigned a different frequency.

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

→ The FDM multiplexing process starts by applying amplitude modulation into each signal by using different carrier frequencies as $f_i$ and $f_j$ 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 recieves.




- DIFF B/WEEN FDM & TDM:
- Both FDM & TDM are multiplexing techniques.
- The main difference b/ween FDM &

TDM is that in FDM, indusual signals are given different frequency with in a common bandwith for transmission.

-> Where as in TDM, the multiple signals are transmitted in different time slots on a single channel.

-> And FDM is used for analouge transmition of signals eg:- Audio signals at radio is achieved by FDM.

-> Whereas TDM can be used for both analouge & digital signals.

Q No 4.
(b)

-> ANALOG TO ANALOG CONVERSION:

-> Analog to analog conversion, is the representation of analog information by analog signals.
e.g:- Radio.

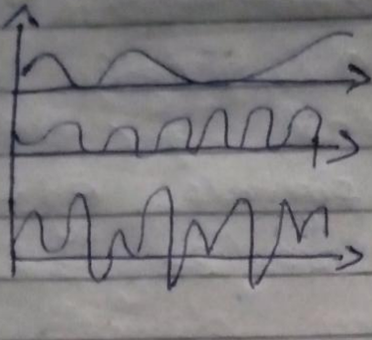
-> There are 3 ways to accomplish analog to analog conversion.

1. AMPLITUDE MODULATION: (AM)

-> In AM transmition the carrier signal is modulated so its amplitude varies with the changing amps of the modulating signals

ID: 14796. Page ⑧

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

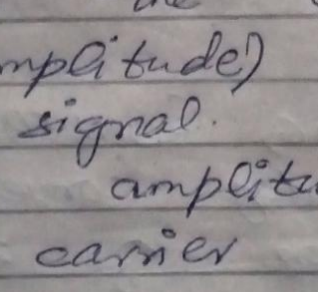


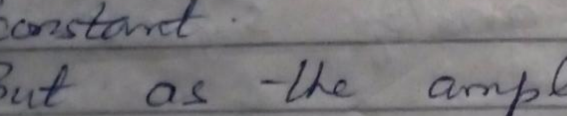

## ② FREQUENCY MODULATION (FM).

→ 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.



Q3. Sec a.

The middle of the bandwidth is located at 650 kHz. This means our carrier frequency can be at $f_c = 250$ kHz.

using formula of bandwidth for find bit rate

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Q3. Sec - b:-

Binary Amplitude Shift keying:-

=> Althrough we can have several levels of signal element, each with a different amplitude, ASK is normally implemented using only two levels.

=> This is refered 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.