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Subject : Communication and Networkes

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Question No 1

Part a Sol:-

Voice channel bandwidth = 4KHz

Channels = 10

Guard band = 500Hz

Bandwidth = ?

As we have 10 channels, we require at least 9 guard bands. So the required bandwidth is at least

$$10 \times 4 + 0.5 \times 9 = 44.5 \text{ KHz}$$

Part B Sol:

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 Ans

Signal element:

(i) In data communication, a signal element carries data element.

(ii) A signal element is the shortest unit (time wise) of a digital signal.

(iii) Signal elements are what we can send.

(iv) Signal elements are the carriers for Data elements.

Data Element:

(i) In data communication, our goal is to send data elements

(ii) A data element is the smallest entity that can represent a piece of information, this is the bit.

(iii) Data elements are what we need to send.

(iv) Data elements are being carried by signal elements.

Part (d) Ans

Link:

Link refers to the physical path. ~~channel~~

Channel:

Channel refers to the portion of a link that carries a transmission between a given pair of lines.

Part (e) Ans:

Following are the three different techniques in serial transmission.

(1) Asynchronous:

In this technique

Part (a) Ans

(5)

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 without any gaps i.e. regular intervals.

(iii) Asynchronous:

It sends a block of data asynchronously.

Part (

(A)

Question No 2

Part a Ans:

Ans 8-bit stream for the given case is.

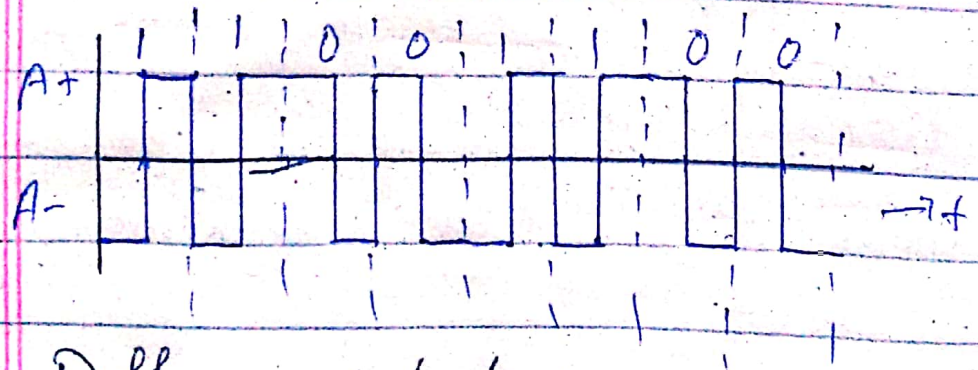
11000100

Ans.

Part (B) Ans.

(a) 11001100

Manchester:



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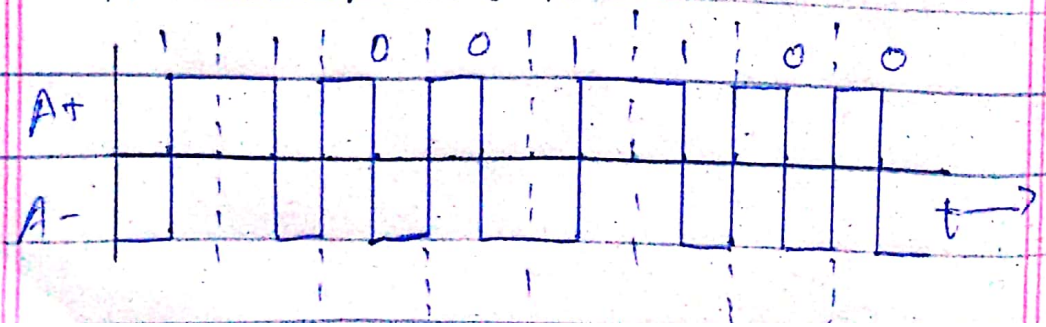

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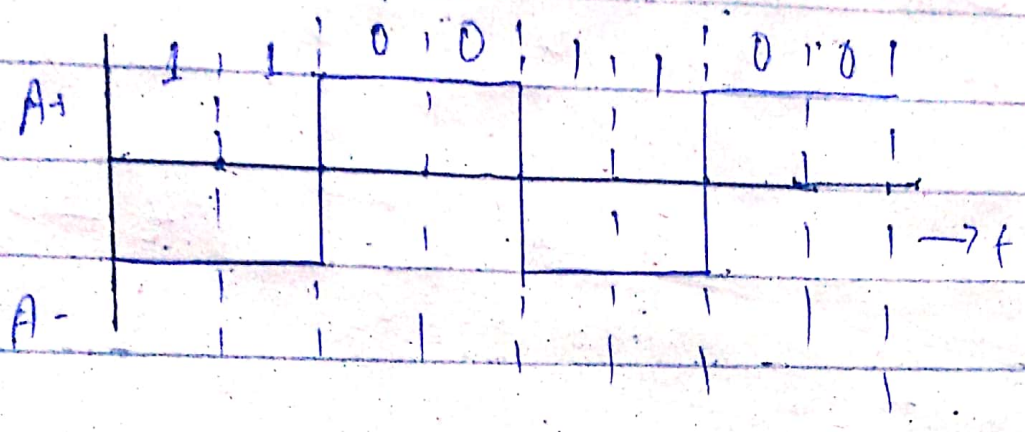
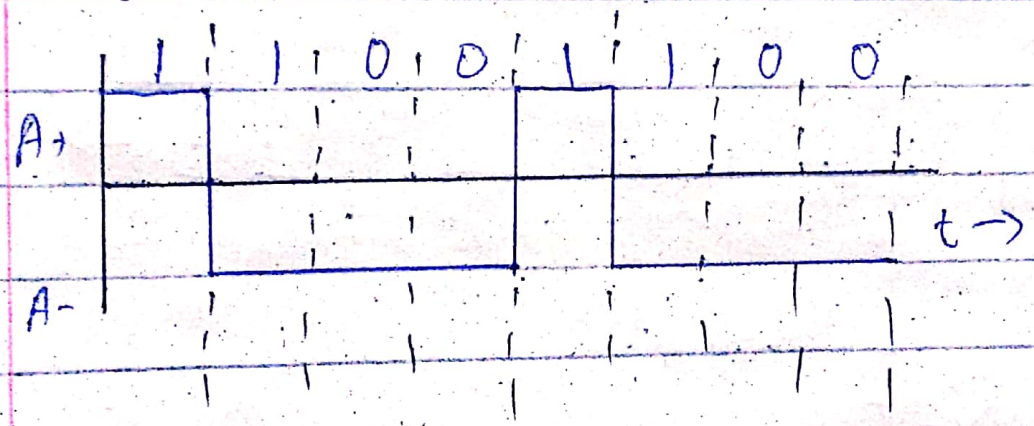
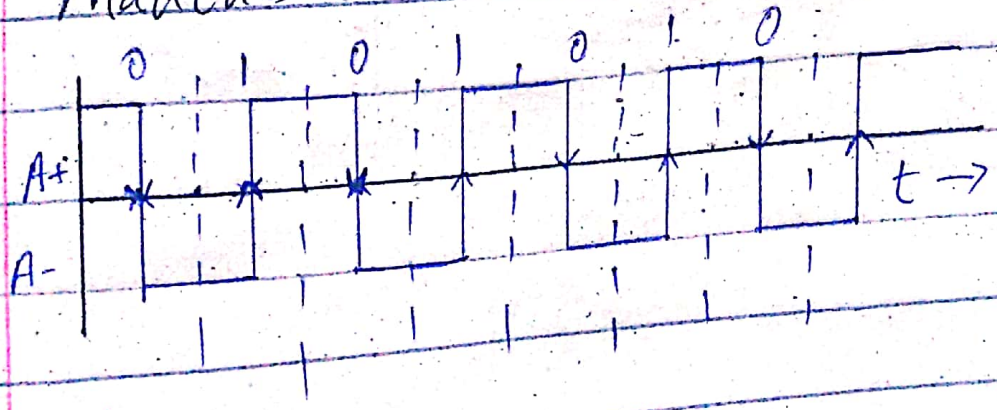


NRZ-I



(b) 01010101

Manchester



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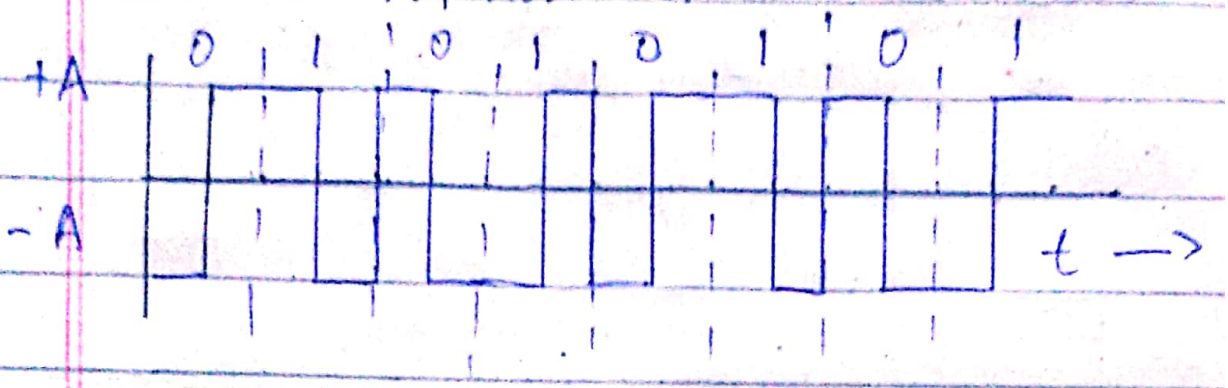

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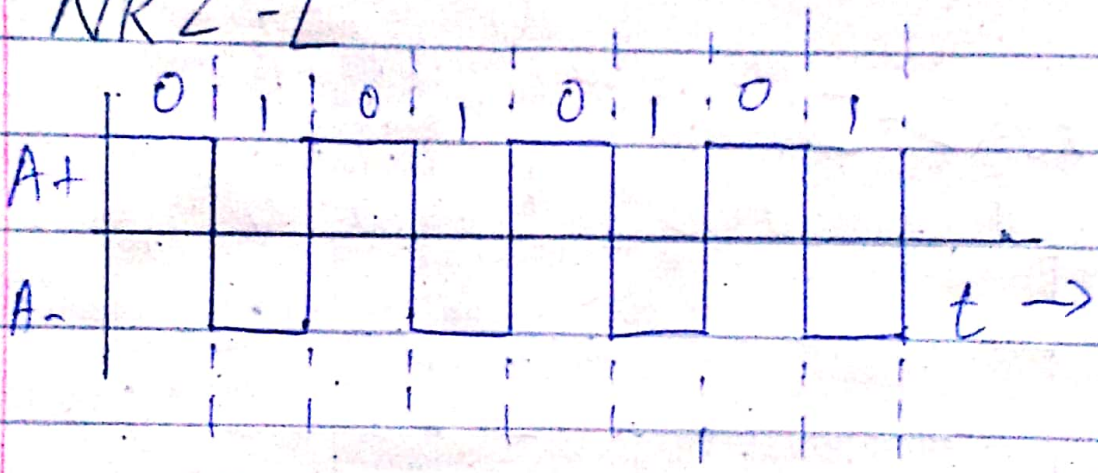

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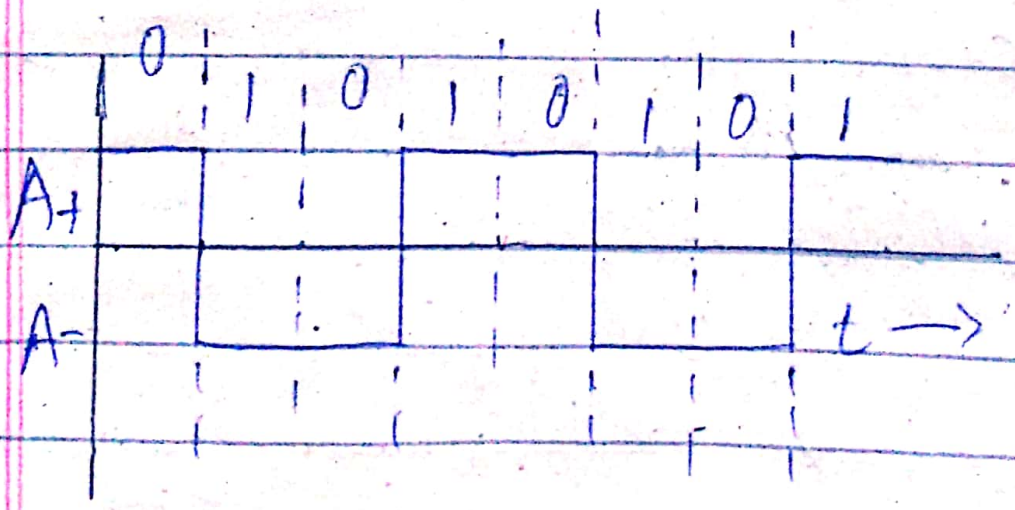


Part (c) Sol:- (9)

Bandwidth = Highest frequency - lowest frequency.

950KHz = x - 450 KHz

x = 950 + 450 = 1400KHz

Nyquist Sampling Rate =>
should be at least twice the maxium frequency

Hence

Nyquist Sampling Rate =

2 x 1400 KHz = 2800 KHz

Question No 3
Part (a) Sol:

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

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

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

Ans

(11)

Part (b) Sol:

Binary Amplitude shift keying technique is used in the given diagram

* 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 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.

Question No 4

Part (a) Ans.

FDM:

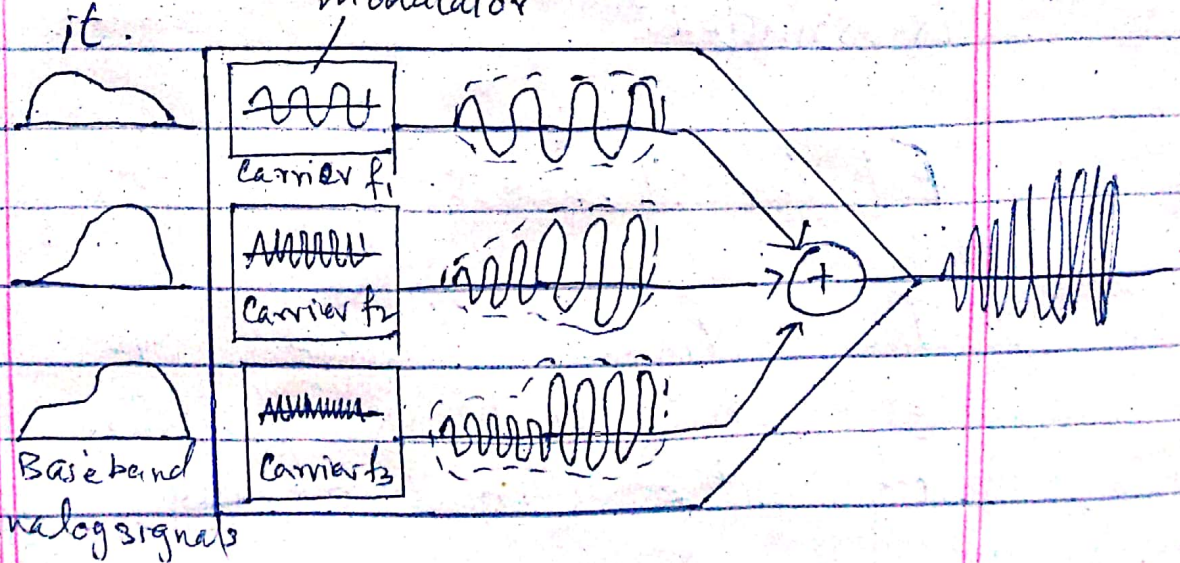
Frequency-division multiplexing (FDM) is an analog technique that can be applied when the bandwidth of a link (in hertz) is greater than the combined bandwidth of the signals to be transmitted.

FDM Process:

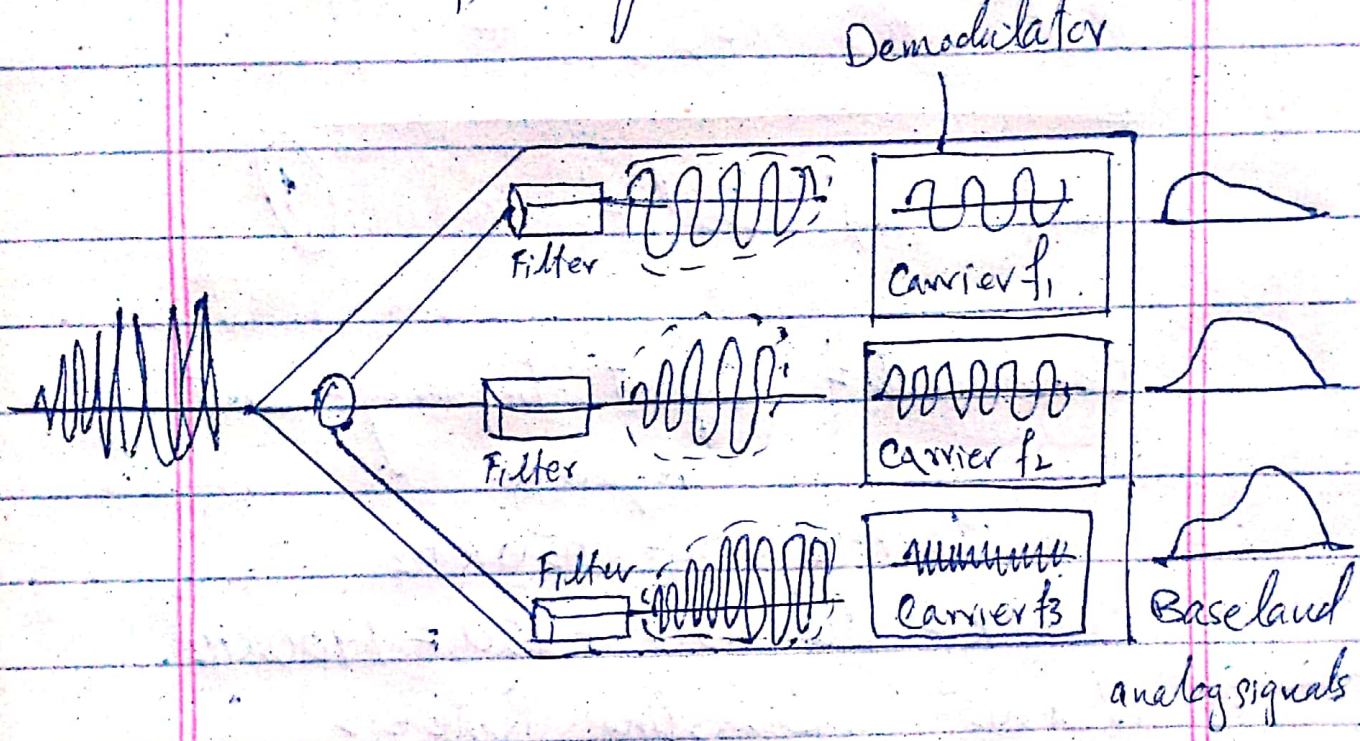
The Figure below is a conceptual illustration of the multiplexing

process.

- Each source generates a signal of a similar frequency range
- Inside the multiplexer, these similar signals modulate different carrier frequencies (f_1, f_2, f_3).
- The resulting modulated signals are then combined into a signal composite signal that is sent out over a media link that has enough bandwidth to accomodate it.



De-multiplexing Process



- The de-multiplexer uses a series of filters to decompose the multiplexed signal into its constituents component signals.
- The individual signals are then passed to a demodulator that separate them from their carriers and passes them to the output lines.
- Figure above is a conceptual illustration of de-multiplexing process.

Difference between TDM and FDM:

- Both TDM and FDM are multiplexing technique
- The main difference is between FDM and TDM is that in FDM, individual signals are given, different frequencies within a common bandwidth for transmission.
- Whereas in TDM, the multiple signals are transmitted in different time slots on a single channel.
- FDM is used for analog transmission of signals.

- Whereas TDM can be used for both analog and digital

Part (b) Ans

Analog to analog conversion can be accomplished in three ways:

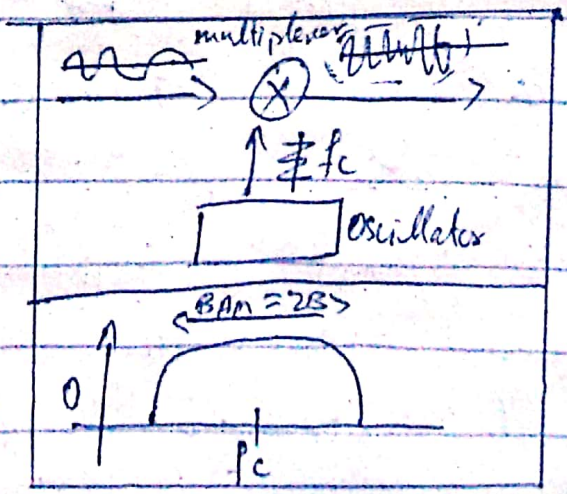
(1) Amplitud Modulation.

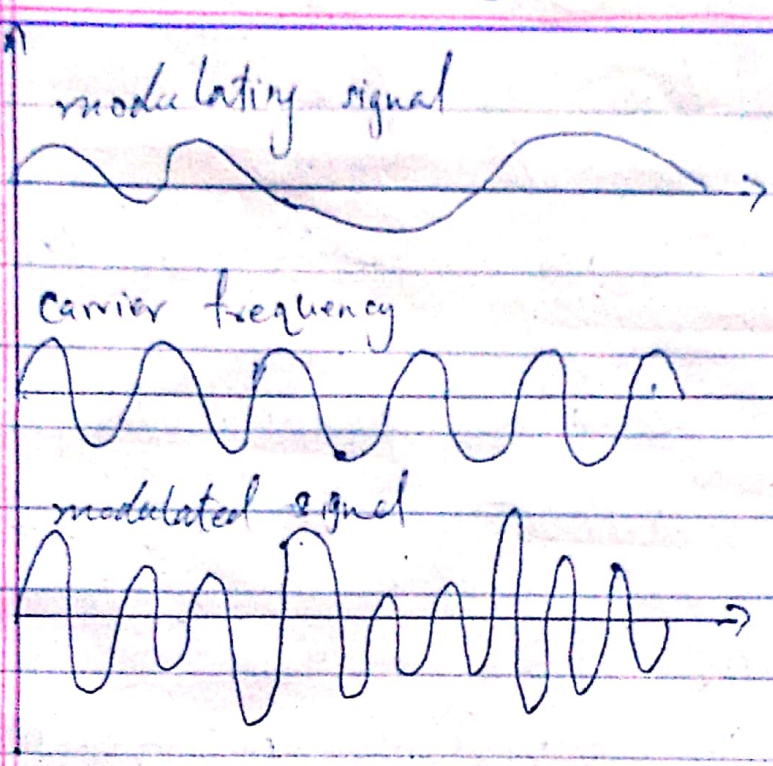
- In AM transmission, the carrier signal is modulated so that its amplitude varies with the changing amplitudes of the modulating signals.
- The frequency and phase of the carrier remain the same;

only the amplitude changes to follow variations in the information.

- The modulating signal is the envelope of the carrier.

- AM is normally implemented by using a simple multiplier because the amplitude of the carrier signal needs to be changed according to the amplitude of the modulating signal.





(ii) Frequency Modulation:

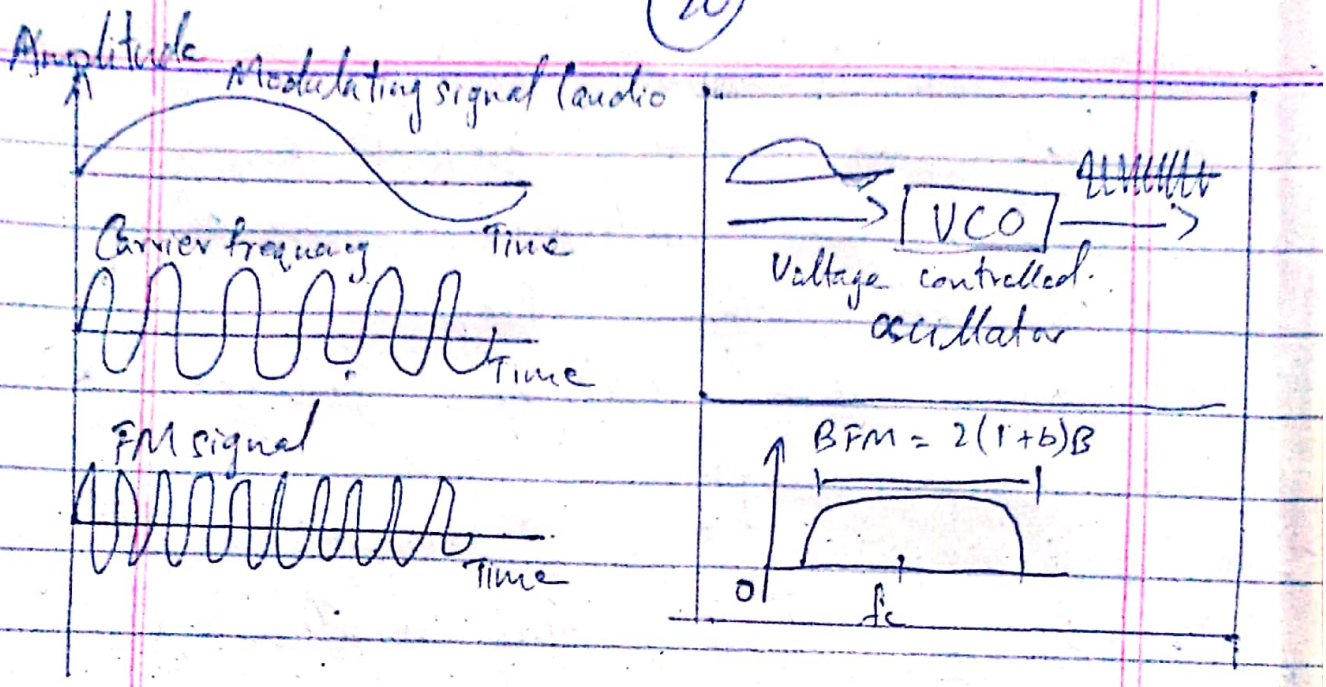
- In FM transmission, the frequency of the carrier signal is modulated to follow the changing voltage level of the modulating signal.
- The peak amplitude and phase of the carrier signal remain constant,

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

- Figure shows the relationship of the modulating signal, the carrier signal and the resultant FM signal.

- FM is normally implemented by using voltage-controlled oscillator as with FSK.

- The frequency of the oscillator changes according to the input voltage which is the amplitude of the modulating signal.

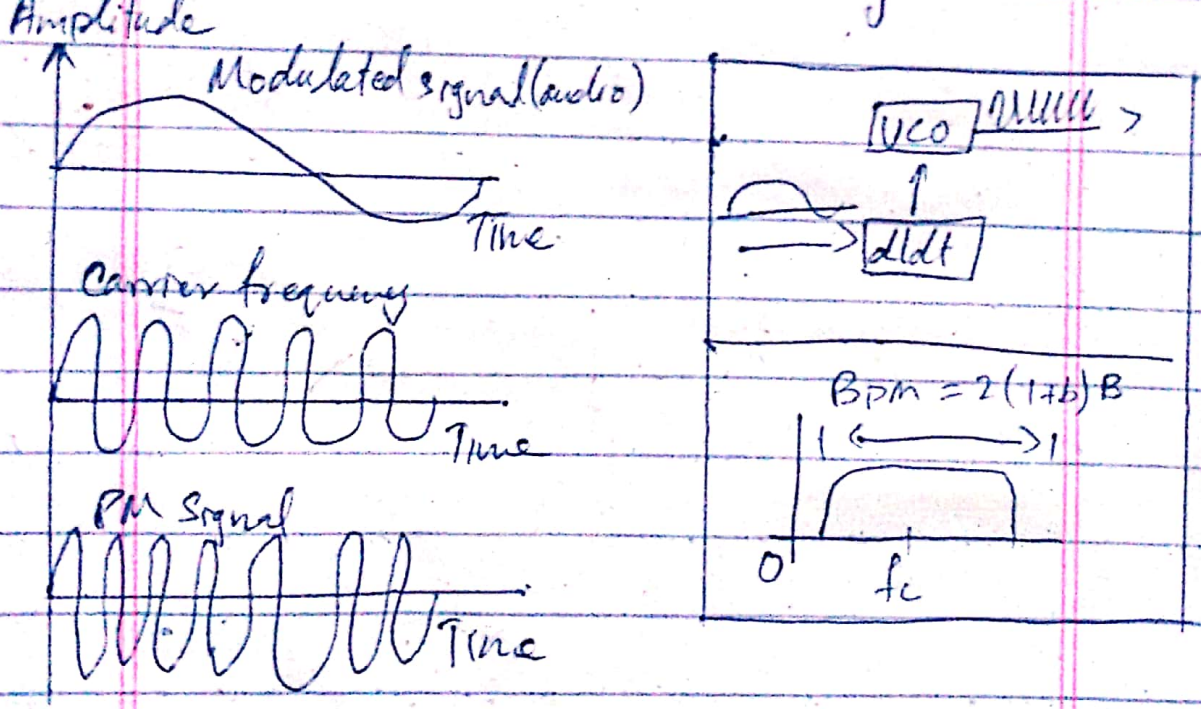


(iii) Phase Modulation.

- In PM transmission, the phase of the carrier signal modulated to follow the changing voltage level of the modulating signal.
- The peak amplitude and frequency of the carrier remain constant, but as the amplitude of the information

signal changes, the phase of carrier changes correspondingly.

- Figure show the relationships of the modulating signal, the carrier signal, and the resultant PM signal.



the information