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Semester : *4th*

ID # : *15366*

Examination : *Final Term Examination*

Subject : *Data Communication And Networks*

Submitted To : *Engr. Ghassan Husnain Sir*

Dated : *27th June 2020*

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ID # : 15366
Subject : Data Communication and Network
Depth : BS (CS)
Assignment : Final Term Assignment
Date : 27-06-2020

Q1: Ans: (b) Solution:

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

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

$$N = S \times \gamma$$

$$N = 3000 \times 4$$

$$\boxed{N = 12000 \text{ bps}}$$

or

$$\boxed{N = 12 \text{ Kbps}}$$

10(a) Ans:- Solution:

Bandwidth = 4KHz = 4000 Hz
Number of voice channels = 10
Guard bands = 500Hz using FDM

For 10 channels we will need 10-1 = 9 guard channels

Bandwidth used by guard channels = $9 \times 500 = 4500$ Hz

Bandwidth for 10 channels $= 10 \times 4000$
$= 40000$ Hz

Total bandwidth required $= 4500 + 40000$
$= 44500$ Hz
$= \boxed{44.5 \text{ kHz}}$ Ans.

(1)(c) Ans.

Data Element:-
A data element is the smallest piece of information to be exchanged, the bit.
Data elements are what we need to send.

Signal Element:-
A signal element is the smallest unit of signal that is constant.
Signal elements are what we can send.

(1)(d) Ans.

Link:-
In multiplexing, Link refers to the physical path.
One link can have many (n) channels.

Channel:-
In multiplexing, channel refers to the portion of a link that carries a transmission between a given pair of lines.
In multiplexed - system channels

share bandwidth of one link.

(1)(c) Ans

Techniques in Serial Transmission:

There are three techniques in serial transmission which are;

1. Asynchronous Transmission.
2. Synchronous Transmission.
3. Isochronous Transmission.

1. Asynchronous Transmission:

- Asynchronous transmission is so named because the timing of a signal in unimportant.
- In asynchronous transmission, we send 1 start bit (0) at the beginning and 1 or more stop bits (1s) at the end of each byte.
- There may be a gap between each byte.

2. Synchronous Transmission:

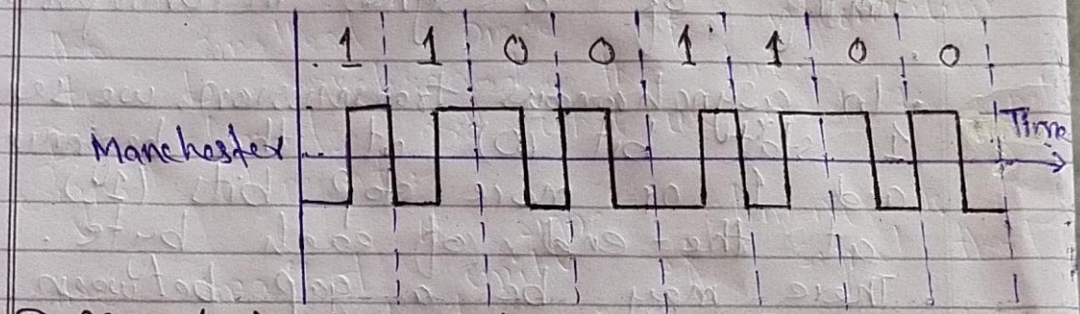
- In Synchronous transmission, we send bits one after another without start or stop bits or gaps.
- It is the responsibility of the receiver to group the bits.
- Synchronous transmission is faster than synchronous transmission.
- For this reason, it is more useful for high speed applications such as transmission of data from one computer to another.

3. Isochronous Transmission:

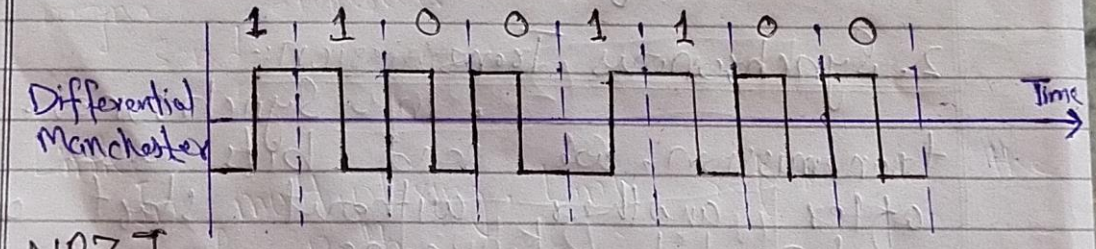
- In isochronous transmission, there is no in-dependency at all. All bits in the whole stream must be synchronized.
- It sends a block of data asynchronously.

Q2:
Ans(b) a. 11001100

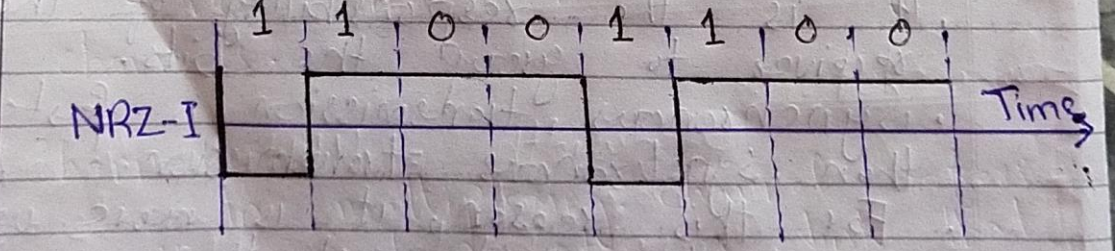
Manchester:



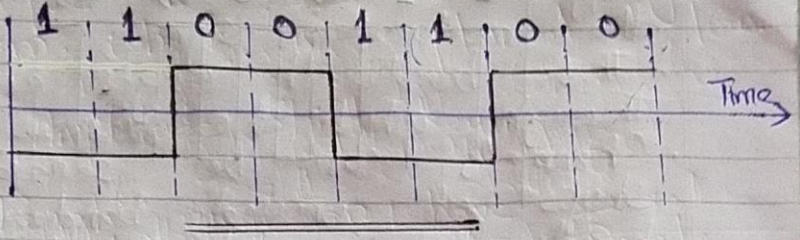
Differential Manchester:



NRZ-I:

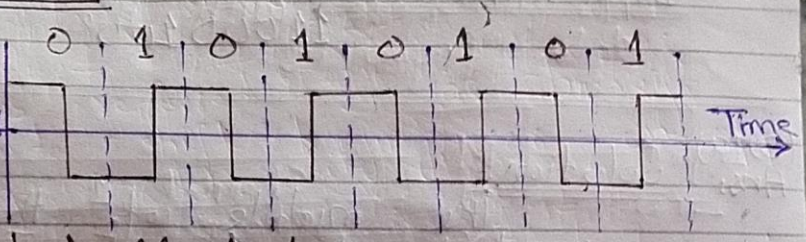


NRZ-L:-

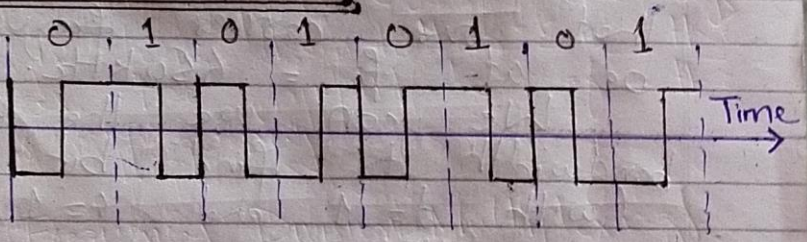


b. 01010101

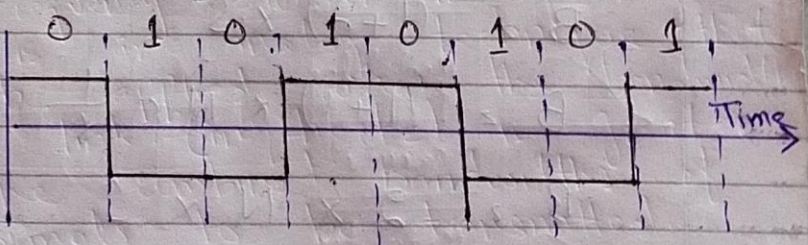
Manchester:-



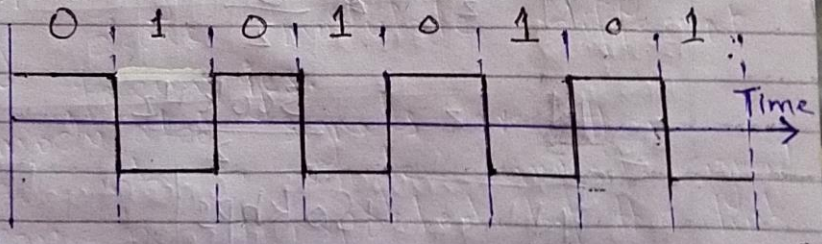
Differential Manchester:-



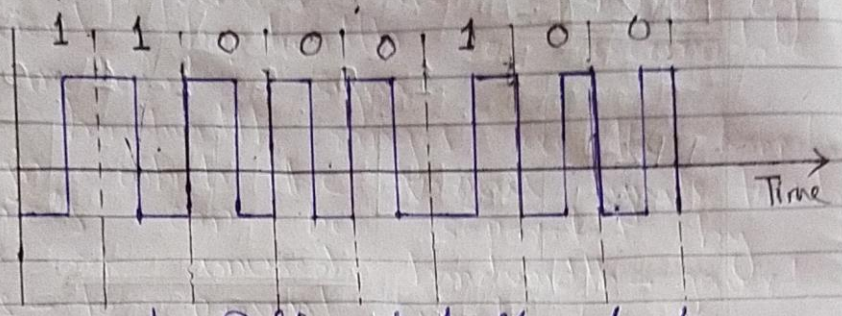
NRZ-I:-



NRZ-L:-



(2)(a) Ans.



b. Differential Manchester

Diff-Manchester:-
11000100

(3)(a) Ans:

Solution:-
The middle of the bandwidth is located at 650kHz. This means that our carrier frequency can be at $f_c = 650kHz$.
We can use the formula for bandwidth to find bit rate (with $d = 1$ and $r = 1$)

$$B = (1+d) \times S$$

$$B = (1+1) \times N \times \frac{1}{r} \quad \therefore \boxed{S = N \times \frac{1}{r}}$$

$$B = 2 \times N \times 1$$

$$N = \frac{B}{2}$$

$$N = \frac{300kHz}{2}$$

$$\boxed{N = 150kbps}$$

(3)(b) Ans: Binary Amplitude Shift keying technique is used in the given diagram, which is explained below:

Binary Amplitude Shift keying:

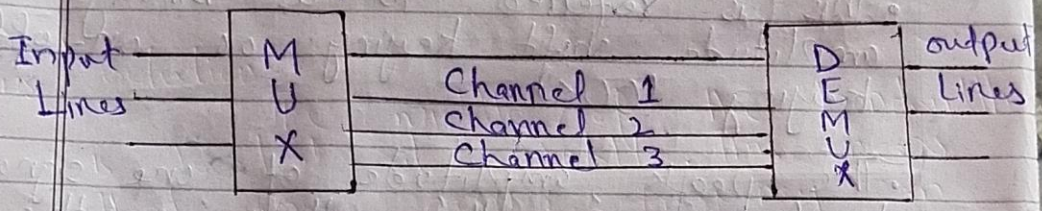
- Although we can have several levels (kinds) of signal elements, each with a different amplitude, ASK is normally implemented using only two levels.
- This is referred to as binary amplitude shift keying or on-off keying (OOK).
- The peak amplitude of one signal level is 0; the other is the same as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

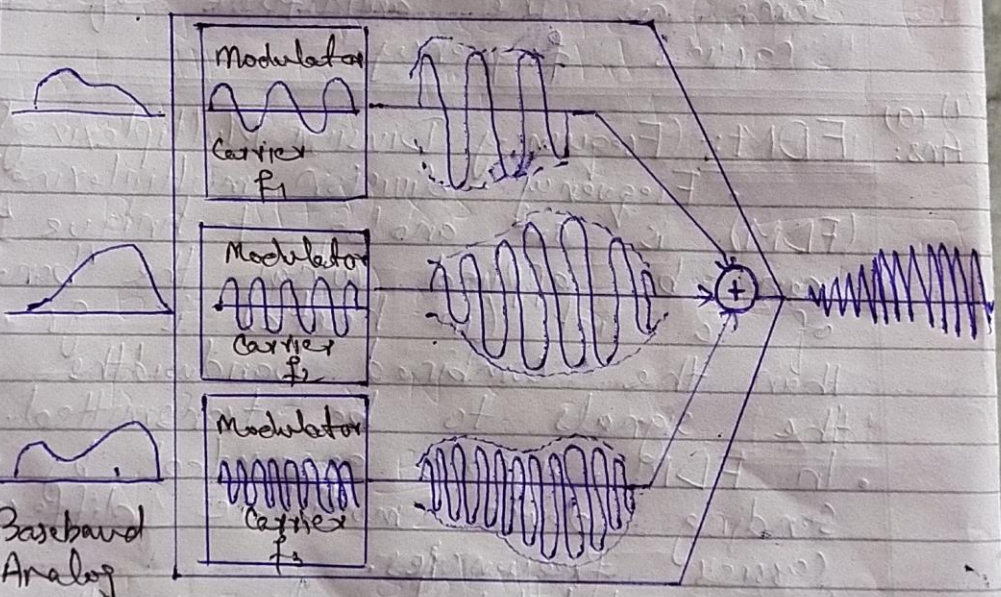
(4) (a) Ans:

FDM: (Frequency Division Multiplexing)

- 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 bandwidths of the signals to be transmitted.
- In FDM, signals generated by each sending device modulate different carrier frequencies.
- The modulated signals are then combined into a single composite signal that can be transported by the link.

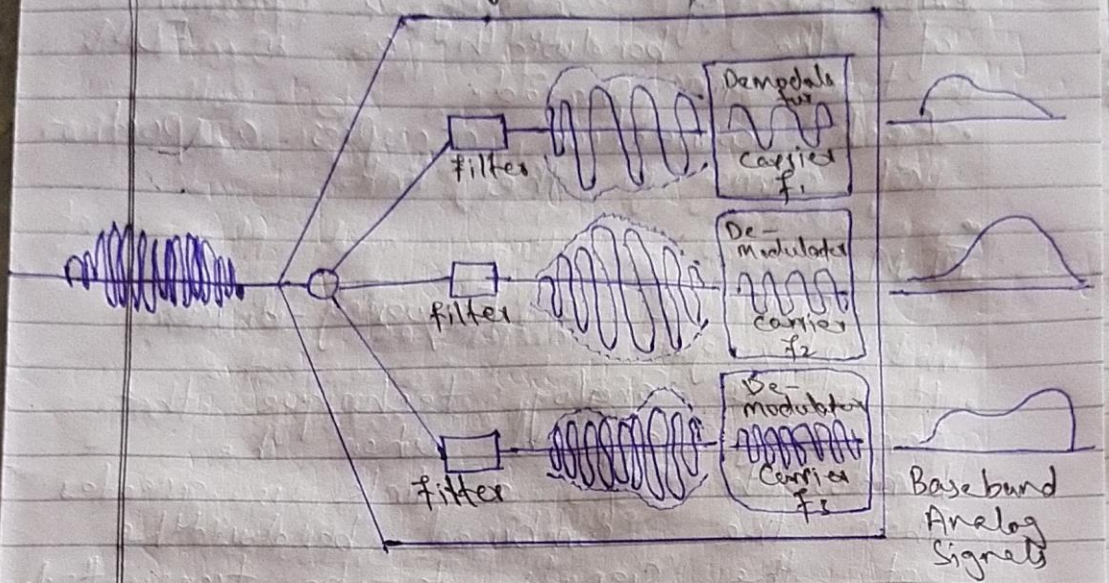
- Carrier frequencies are separated by sufficient bandwidth to accomodate the modulated signal.
- These bandwidth ranges are the channels through which the various signals travel.
- Channels can be separated by strips of unused bandwidth - guard bands - to prevent signals from overlapping.
- In addition, carrier frequencies must not interfere with the original data frequencies.





- Figure above is conceptual illustration of multiplexing process.

De-multiplexing Process:



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

Differentiation:

TDM:

- TDM is Time-division multiplexing.
- It is a digital process that allows several connections to share the

high bandwidth of a link.
- Instead of sharing a portion of the bandwidth as in FDM, time is shared.
- Each connection occupies a portion of time in the link.

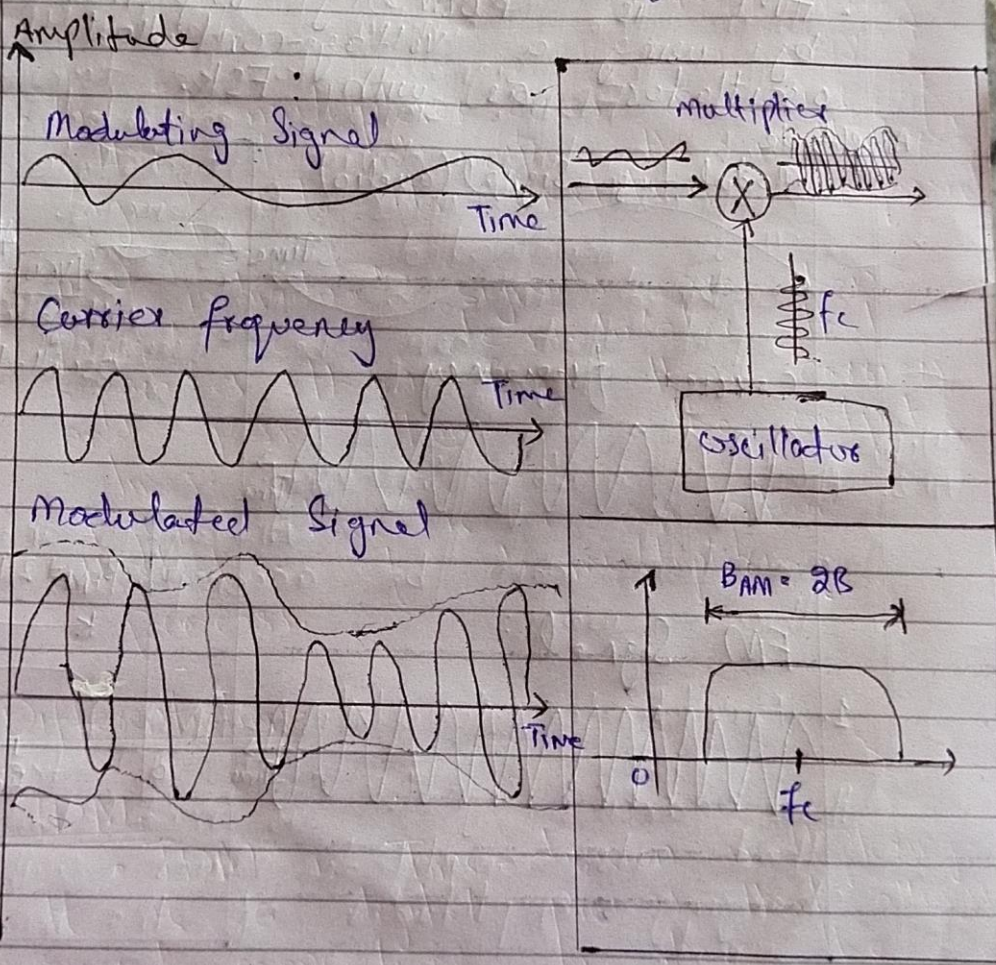
FDM:
- FDM is a Frequency-division multiplexing.
- It is a analog technique that can be applied when the bandwidth of a link is greater than the combined bandwidths of the signals to be transmitted.
- In FDM, signals generated by each sending device modulate different carrier frequencies.
- These modulated signals are then combined into a single composite signal that can be transported by the link.

(4)(b) Ans: Analog-to-analog Conversion:

Analog-to-analog conversion can be accomplished in three ways:

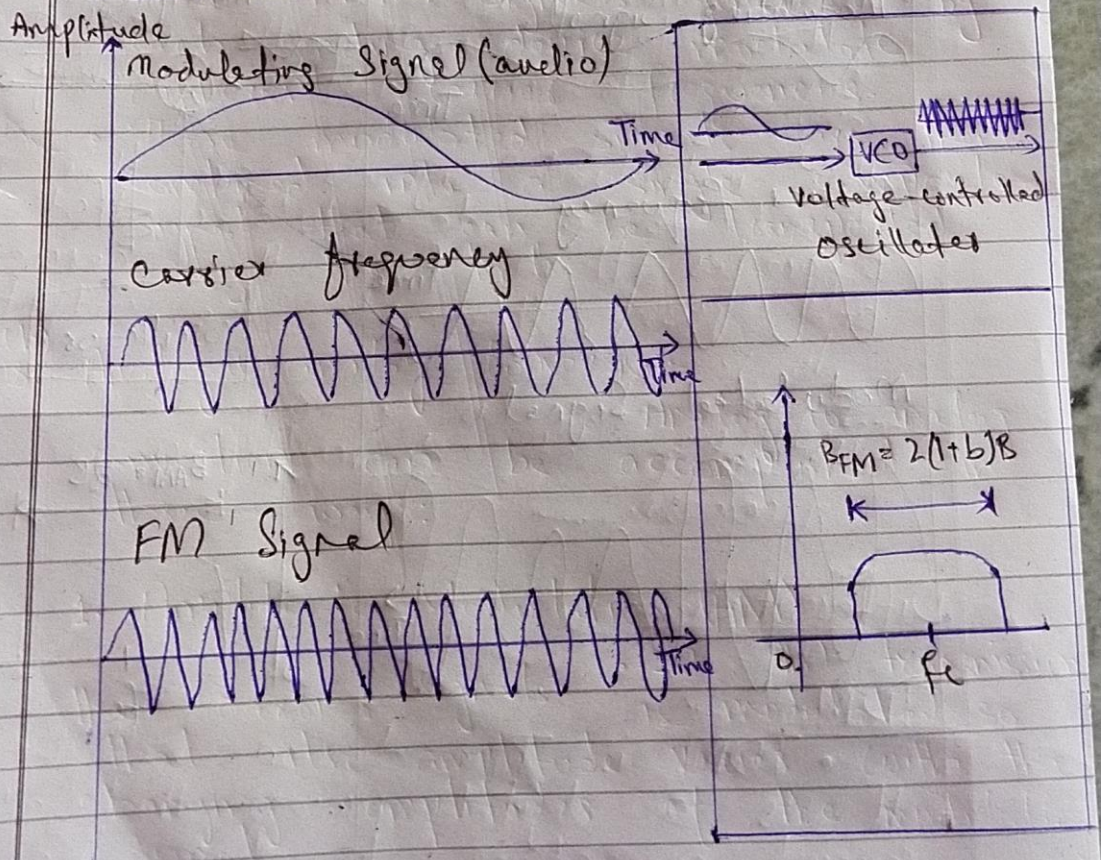
1. Amplitude Modulation: (AM)
- In AM transmission the carrier signals is modulated so that its amplitude varies with the changing amplitudes of the modulating signal.

- 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.
- The bandwidth of an audio signal is usually 5kHz.
- Therefore an AM radio station needs a bandwidth of 10kHz.



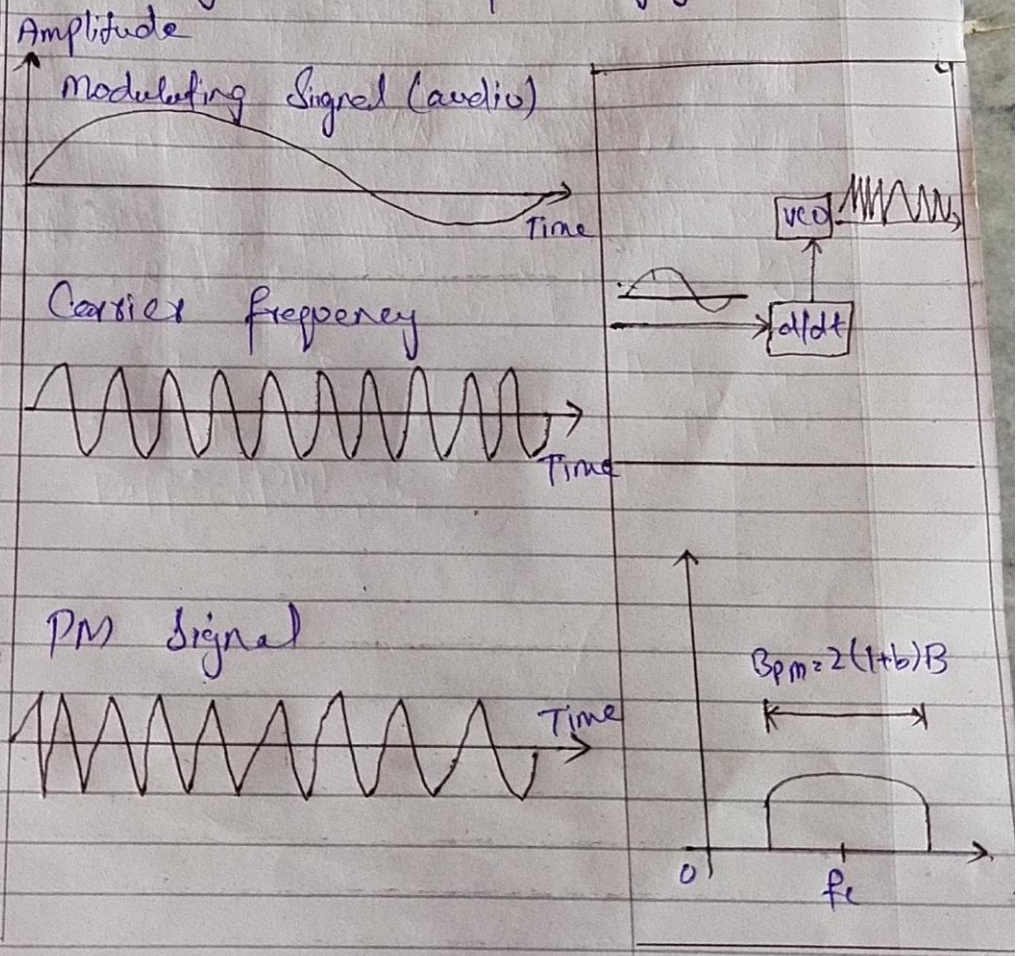
2. Frequency Modulation: (FM)

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



3. Phase Modulation:- (PM)

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



(2) (c)
Ans: We cannot find the Nyquist sampling rate for band pass signal in this case because we do not know where the bandwidth starts or ends. We do not know the maximum frequency in this signal. Because in band pass signal, the bandwidth value is lesser than the value of the maximum frequency.