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Paper :- Data Comunication & Network

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-:Q1 :-

Sec (a)

Solution:-

For 10 channels

we need at least 9 guard bands

This means that the required bandwidth is at least

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

$$\therefore 44.5 \text{ KHz}$$

:Q1:-

Sec (b)

Given :-

$r = 4$

$S = 3000$

Required :-

find the bit rate

Solution :-

In this case $r = 4$

$S = 3000$ and N = unknown

we can find the value of N from

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

$N = S \times r$

putting value

$N = 3000 \times 4$

$N = 12000$ bps

-:Q1:-

Sec (c)

Data element:-

A data element is the smallest piece of information to be exchanged, the bit.

⇒ Data element are what we need to send.

⇒ Data element are being carried by through signal.

Signal element:-

A signal element is the smallest unit of a signal that is constant.

⇒ Signal element are what we can send.

⇒ Signal element are the carrier of Data.

:Q1:-

Sec (d)

In multiplexing, The word link refers to the physical path The word channel refers to the portion of a link that carries a transmission between a given pair of lines. One link can have many (n) channels.

-:Q1:-

Sec (e)

Serial Transmission plays a vital role in data transmission. It transfers bit by bit.

The three different technique in serial transmission are:

(i) Asynchronous:-

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

(ii) Synchronous:-

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

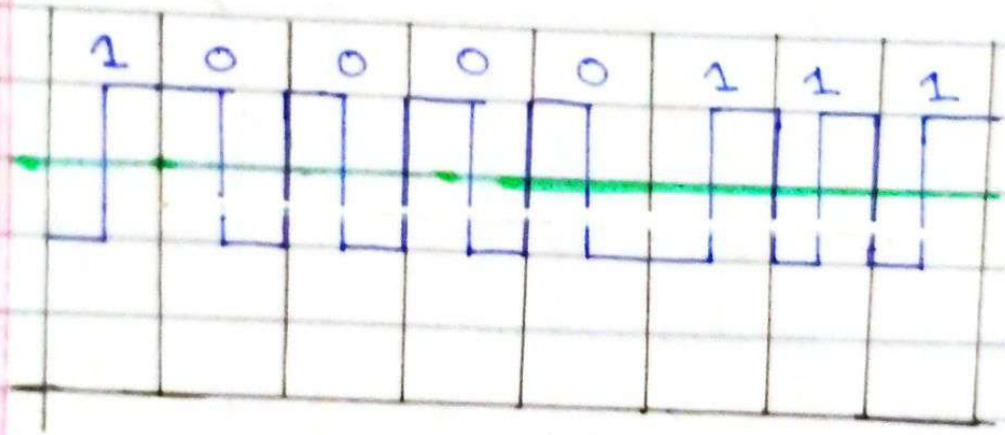
(iii) Isynchraonous:-

It sends a block & data asynchronously.

-: Q 2 :-

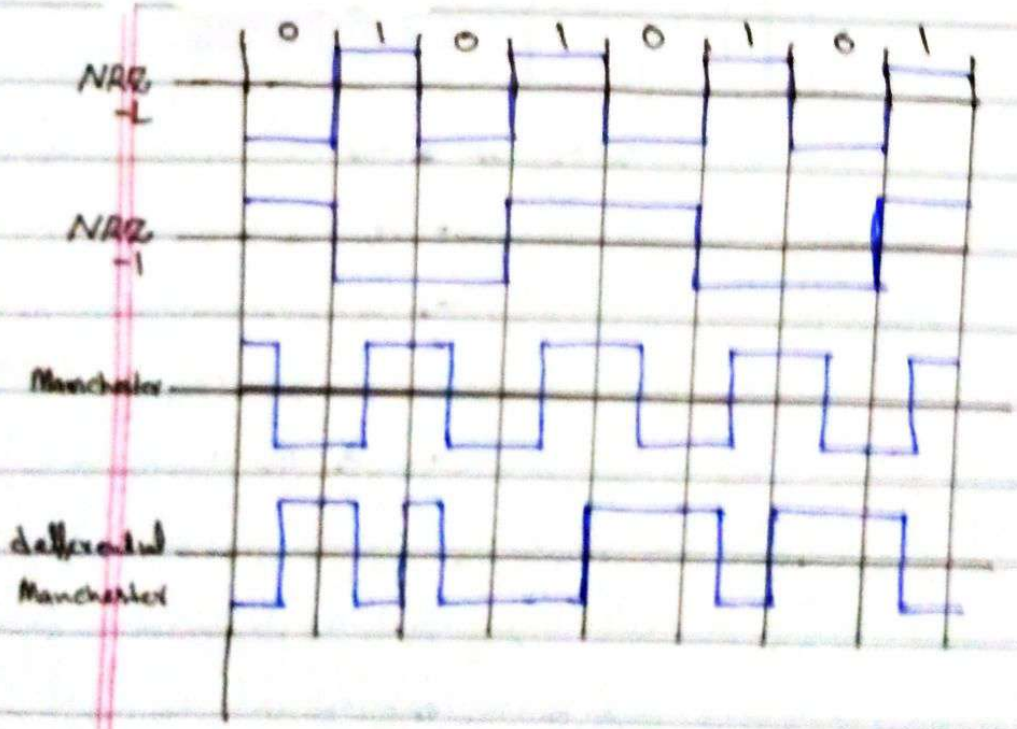
Sec (a)

8-bit data Stream :-

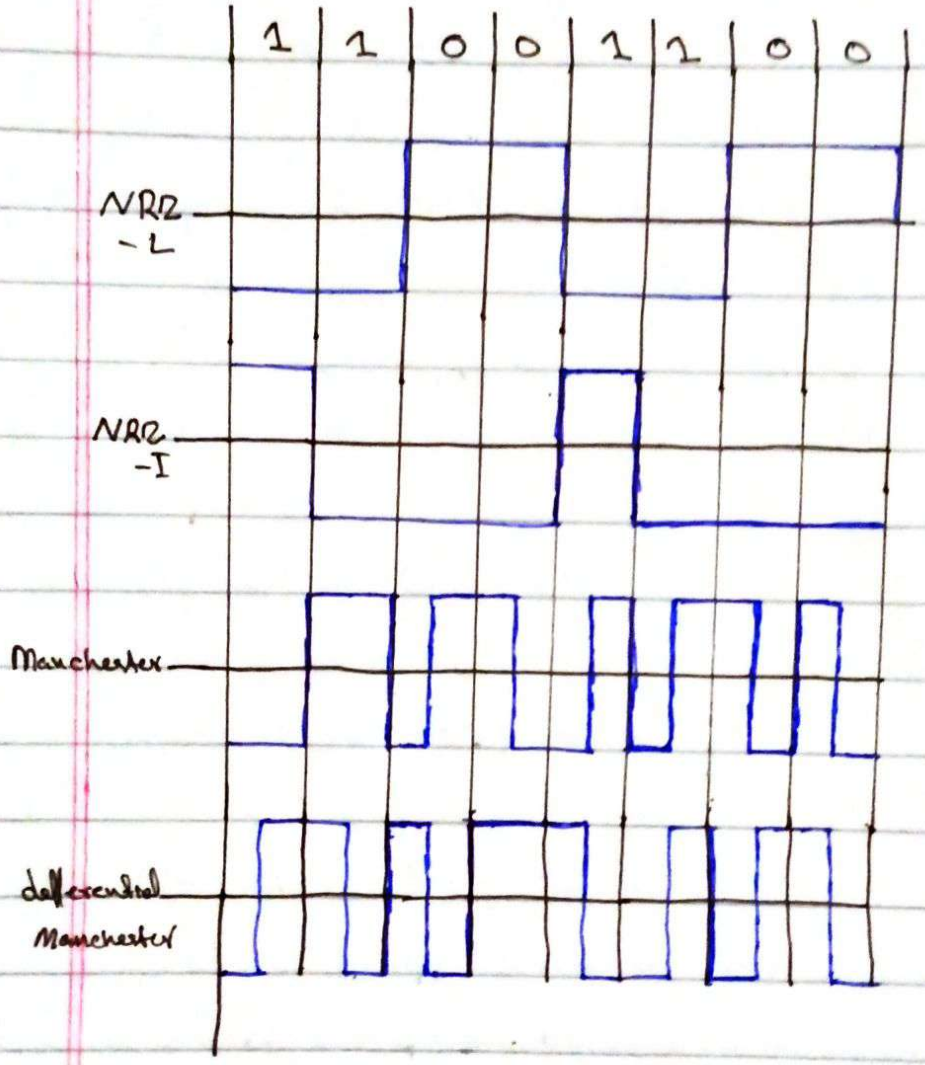


-: Q 2 :-

(i) 01010101 Sec (b) Part (i)



ii) 11001100



Q2:-

Sec (c)

Solution:-

Bandwidth = Highest frequency − Lowest frequency

= 950 KHz = x − 450 KHz

x = 950 + 450

x = 1400 KHz

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

Hence

Nyquist Sampling Rate = 2 * 1400 KHz

= 2800 KHz

-:Q3:-

Sec (a)

Solutions-

The middle & the Band with is located at 650 kHz. Thus means that our carries frequency can be at $f_c = 650$ kHz we can use the formular for Band with to find the bitrate with $\lambda = 1$

$x = 300$ kHz

500 to 800 kHz

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

$B = 2S$

$B = 2\left(N \times \frac{1}{2}\right)$

$B = 2(N)$

$300 = 2N$

$N = 2/300$

$N = 150$ kbs

-: Q3 :-

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 ~~single~~ signal level is 0; the other is the same as the amplitude of the carrier frequency.

:Q4:-

Sec (a)

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 signals to be transmitted.

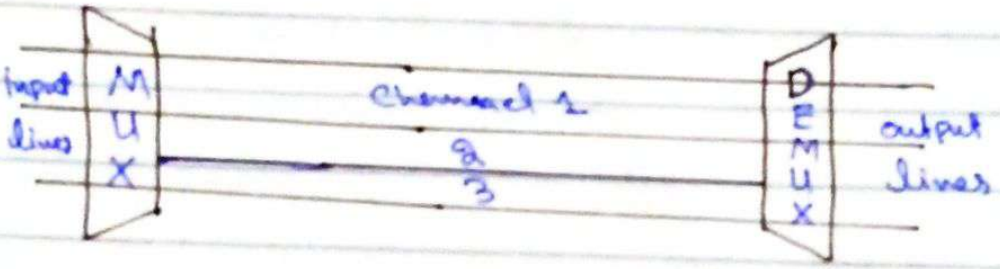
⇒ In FDM signals generated by each sending device modulate different carrier frequencies.

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

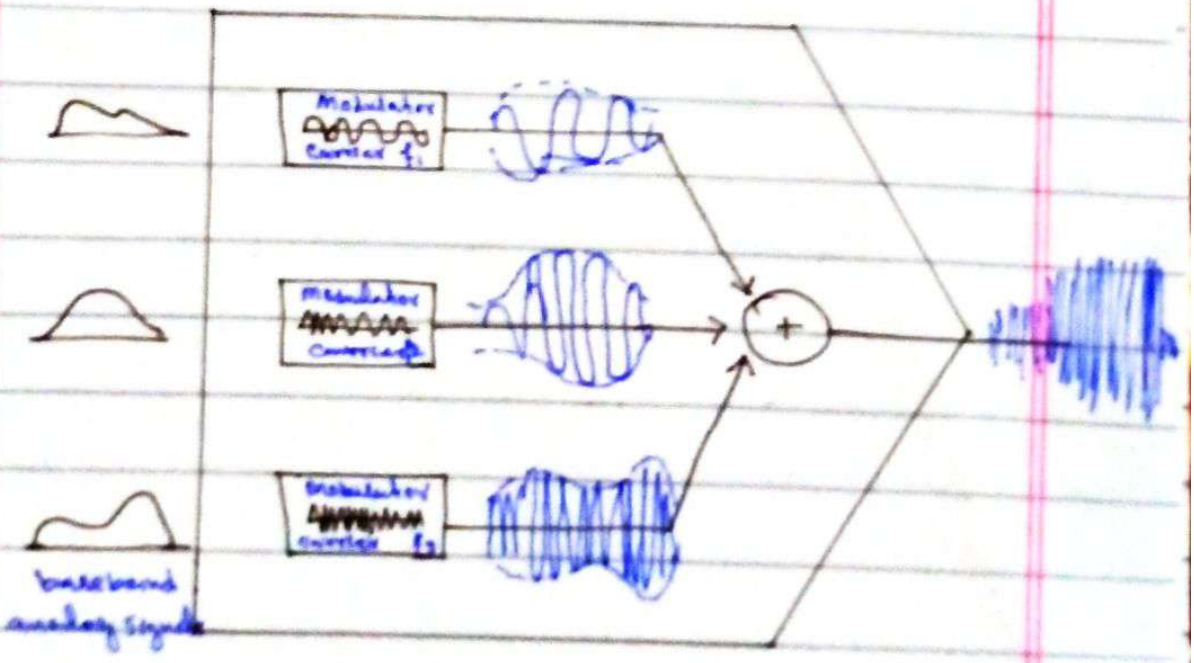
⇒ Carrier frequencies are seperated by sufficient bandwidth to accommodate the modulated signal.

⇒ These bandwidth ranges are the channels through which the various signals travel.

- Channels can be seperated by strips & unused bandwidth - guard bands - to prevent signals from overlapping.
- In addition, carrier frequencies must not interfere with the original data frequencies.



FDM Process :-



⇒ Figure above is a Conceptual illustration of the multiplexing process.

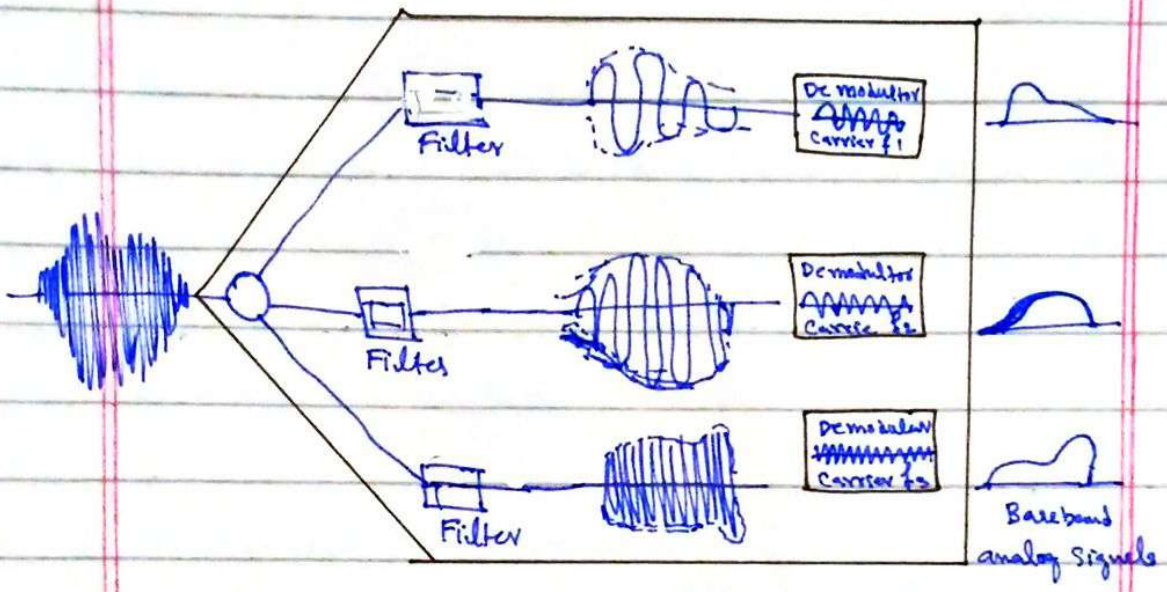
⇒ Each source generates a signal of a similar frequency range.

= 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 single composite signal that is sent out over a media link that has enough bandwidth to accommodate it.

De-multiplexing process :-

Diagram :-



The de-multiplexer uses a series of filter to decompose the multiplexed signal into its constituent composed signals

⇒ The individual signals are then passed to a demodulator that seperates them from their carrier and passes them to the output lines.

⇒ Figure above is a conceptual illustration of de-multiplexing process.

Difference b/w TDM and FDM :-

FDM	TDM
(1) A technique that allow transmission & multiple signals using different frequency slot over a common link.	(1) A technique that permits the flow & multiple data signal over a communication link in different time domains.
(2) Multiplexing technique are analog	(2) Multiplexing technique are digital
(3) Circuit orientation are complex	(3) Circuit orientation are comparatively simple
(4) Cross talk Exist	(4) Cross talk doesn't exist.
(5) Efficiency less	(5) Efficiency more than FDM System
(6) Synchronization are not needed	(6) Synchronization are necessary.

-:Q4:-

Sec (b)

Analog to Analog Conversion :-

Analog to analog conversion (or) analog modulation is the representation of analog information by an analog signal.

⇒ One may ask why we need to modulate an analog signal; it is already analog.

⇒ Modulation is needed if the medium is band-pass in nature or if only a band-pass channel is available to us.

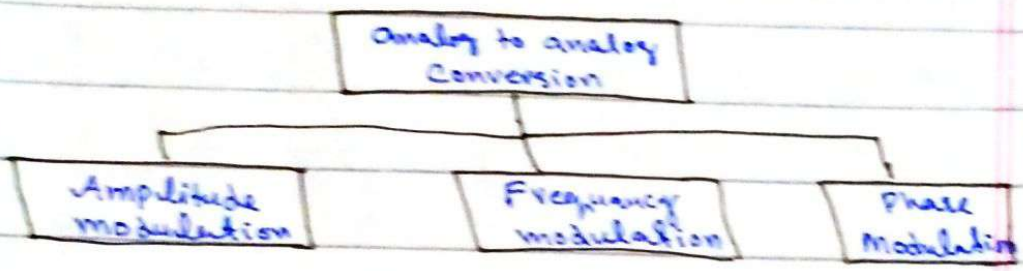
⇒ An example is radio.

⇒ The government assigns a narrow bandwidth to each radio station

⇒ The analog signal produced by each station is a low-pass signal, all in the same range.

⇒ To be able to listen to different stations, the low-pass signals need to be shifted, each to a different range

⇒ Analog to analog Conversion can be accomplished in three ways:



AM (Amplitude modulation) :-

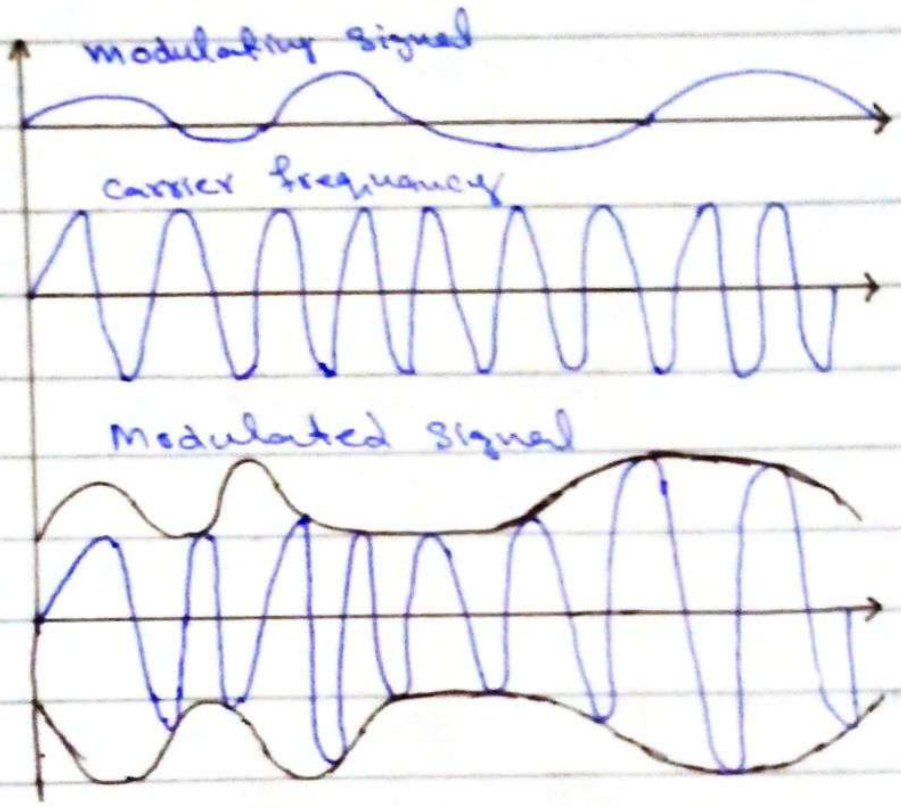
In AM transmission, the carrier signal is modulated so that its amplitude varies with the changing amplitudes of the modulating signal.

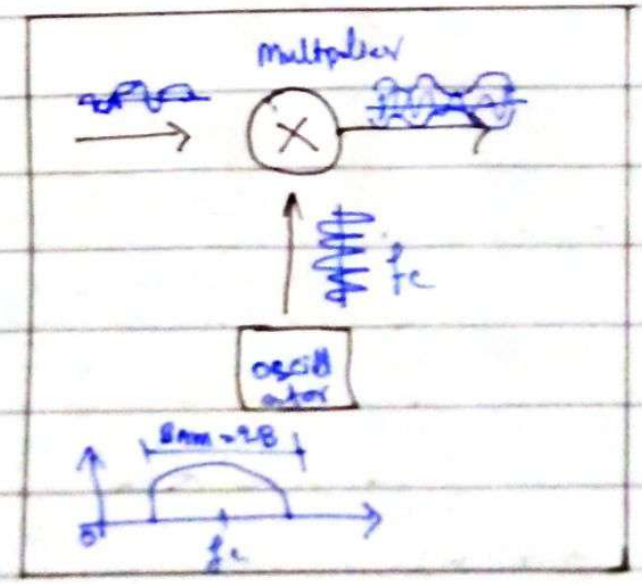
⇒ The frequency and phase of the carrier remain the same only the amplitude changes to follow variation in the information.

⇒ 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.

Diagram :-

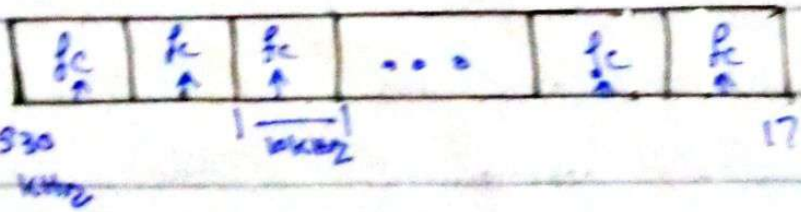

modulating signal
carrier frequency
Modulated signal


Multiplier
fc
oscill ator
2fm = 2B
0
fc

⇒ Bandwidth Allocation for AM :-

The band of an audio signal (speech and music) is usually 5 kHz.

- Therefore an AM radio station need a bandwidth of 10 kHz.
- In fact, the Federal Communications Commission (FCC) allows 10 kHz for each AM station.
- AM stations are allowed carrier frequencies anywhere between 530 and 1700 kHz (1.7 MHz).
- However each station's carrier frequency anywhere must be separated from those on either side of it by at least 10 kHz (one AM bandwidth) to avoid interference.
- If one station uses a carrier frequency of 1100 kHz, the next station's carrier frequency cannot be lower than 1110 kHz.



⇒ FM (Frequency Modulation):-

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

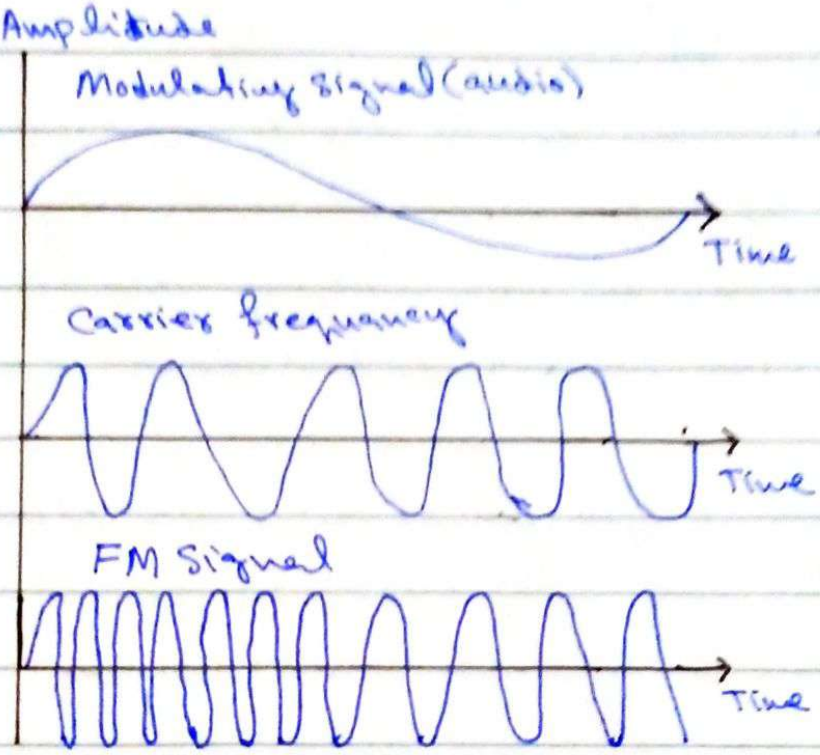
⇒ The peak amplitude and phase of the carrier signal remain constant but as the amplitude of the information signal changes, the frequency of the carrier changes correspondingly.

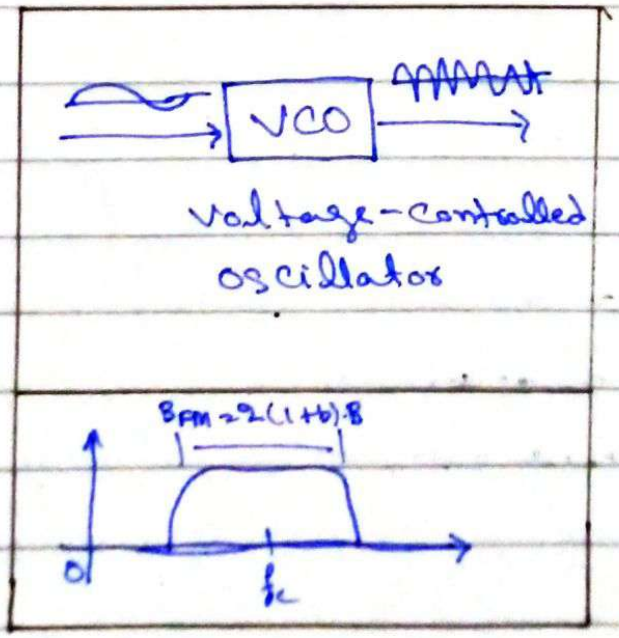
⇒ Figure shows the relationships of the modulating signal, the carrier signal and the resultant FM signal.

⇒ FM is normally implemented by using a 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.

Diagram :-


Amplitude
Modulating signal (audio)
Time
Carrier frequency
Time
FM Signal
Time


VCO
voltage-controlled
oscillator
$B_{FM} = 2(1+b)B$
0
f_c

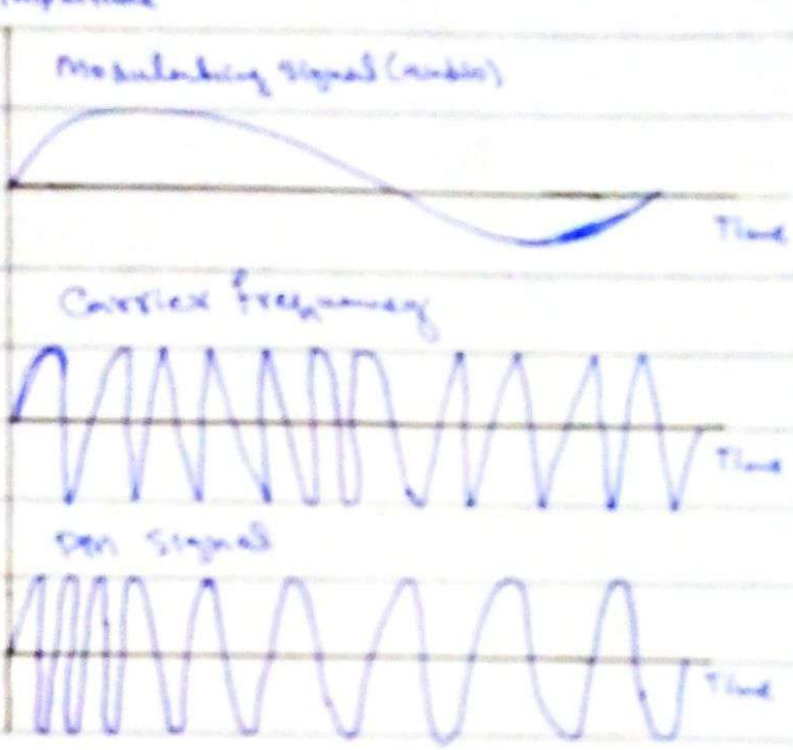
⇒ PM (Phase Modulation) :-

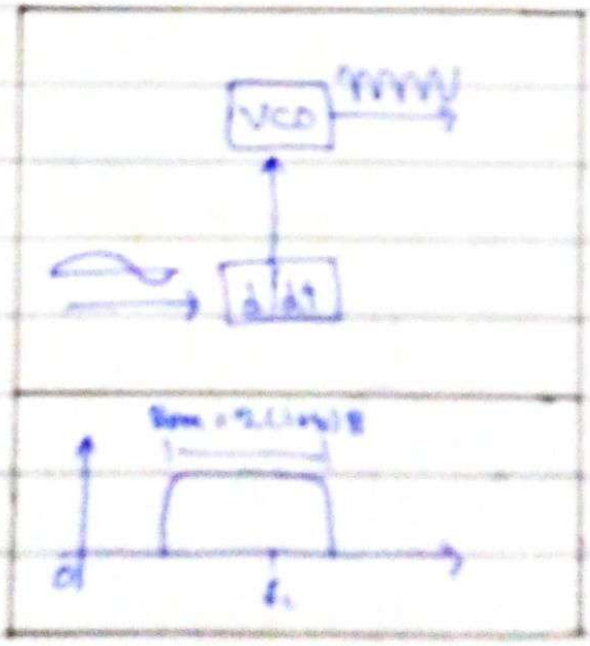
In PM transmission, the phase of the carrier signal is modulated to follow the changing voltage level (amplitude) of the modulating signal.

⇒ The peak amplitude and frequency of the carrier signal remain constant but as the amplitude of the information signal changes, the phase of the carrier changes correspondingly.

⇒ Figure shows the relationships of the modulating signal, the carrier signal and the resultant PM signal.

Diagram :-


Amplitude
Modulating Signal (audio)
Time
Carrier frequency
Time
FM Signal
Time


VCO
Time
f1