'COMMUNICATION SYSTEM'

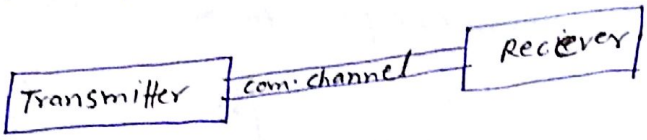
Communication → It is process of transmission of information from one place to another place without distortion.

Each & every communication system have 3-basic part.

(i) → Transmitter → It is source of information which propagate the information towards the distant end with via communication channel.

(ii) → Reciver → It is device which recive the information from communication channel which transmited by transmiter.

(iii) → communication channel → It is medium in blw transmitter & receiver & receiver which propagate the signal from one place to another place.



Classification of communication system

on the basis of Information →

(1) → voice communication → Eg → Radio, Mobile, Telephone, T.V

(2) → picture communication → Eg → T.V, Internet, Mobile.

(3) → Document communication → Eg → FAX (Fascimile transmission)

(4) → code communication → Eg → Internet, telegraphy.

on the basis of signal →

(i) → Analog communication

(ii) → Digital communication.

on the basis of channel → (20Hz to 20KHz)

$$I = (P/A) \propto a^2 f^2$$

(1) → Line communication
- (a) → Two wire communication
- (b) → co-axial "
- (c) → optical fibre

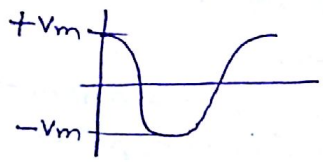
(2) → Wireless communication
- (a) → Ground Wave propagation
- (b) → Sky Wave propagation
- (c) → Space Wave propagation.

On the basis of Modulation (MHz to GHz)

$y = A\sin(\omega t + \phi)$

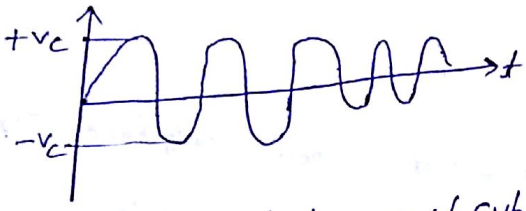
|i| → Amplitude Modulation (A·M)
|ii| → Frequency Modulation (F·M)
|iii| → Phase Modulation (P·M)

|1| → Message signal → only electricity Wich contain the information.



$V_m = V_m \cos \omega_m t$ → 20 Hz to 20 KHz

|2| → carrier Wave → It is a high frequency Wave Wich propagate the Message signal from one place to another place Without distortion.



$V_c = V_c \cos(\omega_c t + \phi)$ → MHz to GHz

Modulation → It is process of superimposing of low frequency msg. signal (20Hz to 20KHz) over high frequency carrier Wave (MHz to GHz)
or, Variation in Amplitude or, frequency or, phase of carrier Wave a/c to the msg. signal is known Modulation.

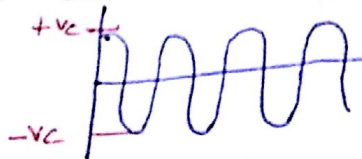
Modulation is 3-type

|1| → A·M → to change in amplitude of carrier Wave a/c to msg. signal by keeping the phase & Freq const.

|a| → Message signal →

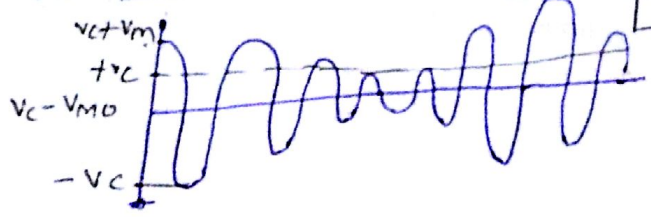
$V_m = V_m \cos \omega_m t$

|b| → carrier Wave →



$V_c = V_c \cos\theta(\omega_c t)$

|c| → A·M Wave →



$V_{AM} = (V_c + V_M \cos \omega_m t)\cos \omega_c t$

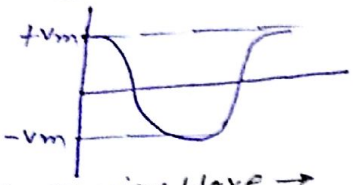
$$P_T = P_c\left(1+\frac{m^2}{2}\right)$$

P_T = total power require to transmittion A·M Wave from radio station.

P_c = power carrier.

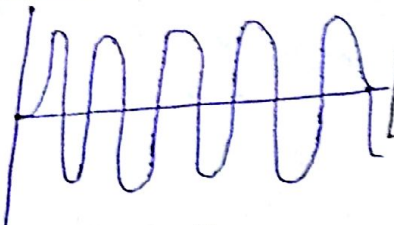
|2| → F·M → to change in the frequency in the carrier Wave a/c to the message signal by keeping the amplitude & phase const.

|i| → Message signal →



$V_M = V_m \cos \omega_m t$

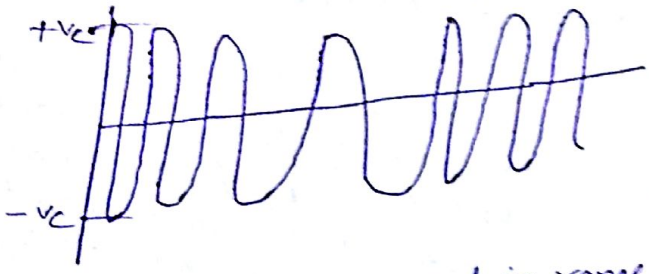
|ii| → carrier Wave →



$V_c = V_c \cos \omega_c t$

|iii| → F·M Wave →

$V_{FM} = V_c \cos(\omega_c t + K V_m \cos \omega_m t)$



* F·M radio is true only in range 88 MHz to 108 MHz
* Any unwanted signal is known as the noice.

Amu 2026

Comparision b/w A·M & F·M

A·M

* cost of A·M radio station is low bcoz its transmitter ckt is not complex.
* In A·M we are adding the signal (voltage) In Amplitude (voltage)
* Less frequency band Width is required so can transmit More no. of signals at a time.
* Here noise corruption is easy so quality of signal is not so good.
* Range of A·M radio is less.

F·M

* cost of F·M radio station is very high bcoz its transmitter ckt is very complex.
* In F·M we are adding the signal (voltage in frequency).
* More frequency band width is required so, we can transmitt less no. of signals at at time.
* Here noise corruption is not easy so, quality of signal is very good.
* Range of F·M radio is More.

* → For good reception of signal, height of antena must be λ/4

Need of Modulation →

|a| → To increase the power of signal → When we shift the low freq. over high freq carrier wave than freq. of signal is ↑ so power of signal is ↑ so we can transmit the signal over longer distance without distortion.

|b| → To make the height of Antena practics →

* Before Modulation (20Hz to 20KHz)

$$\lambda = \frac{c}{f} = \frac{3\times10^8}{10KHz} = 3\times10^4 m = 30Km$$

height of Antena = λ/4 = 7.5 Km

* After Modulation (MHz to GHz)

$$\lambda = \frac{c}{f} = \frac{3\times10^8}{10MHz} = 30m$$ height of antena (λ/4) = 7.4 m.

|c| → To avoid the mixing of noise & signal → noise & voice both are lies in same frequency range, so, large chance of Interference b/c freq. gap is less but as we modulate the signal (voice) Freq. gap b/w voice & noise is ↑ so less chance of mixing & Interference.

|d| → To avoid the mixing of signal which are transmitted from diff transmitter → When large no. of signals are lies in short range (20Hz to 20KHz). so Freq gap b/w signal is less so, large chance of Interference (mixing). but when these signals are shifted over large Freq. range (MHz to GHz). So Freq gap ↑ so less chance of mixing.

Wireless communication → propagate without wire information is in the form of EMW.

|a| → Ground Wave propagation
|b| → SKY wave propagation (Ionosphere)
|c| → Space Wave propagation.

Space Wave propagation (line of sight communication)

Here, EMW (signal) is transmitted from transmitting antena to receving antena in straight line so, it is only possible up to that distance there is no obstracle b/w them.

BLECE 2016 / $d = \sqrt{2hR}$ $d \propto h^{1/2}$

$d = \sqrt{2h_1R} + \sqrt{2h_2R}$ → If two tower than add.

Sky Wave propagation → Here, signal (EMW) are transmitted from transmitting antenna towards the sky. It is reflected back. From Ionosphere by T.I.R phenomena. towards receving antena. those signals which have freq. in (< 30MHz) is reflected from ionosphere.

Those signal have freq > 30MHz refracted from Ionosphere (not Reflected) from ionospher and for it satellite is used as a reflector.

critical freq (c) → max freq. of sky wave propagation up to that the reflection from ionosphere will detect place or, just after that signal is reflected.

It depend on ion density of that place & its value is $f_c = 9\sqrt{N_0}$

N_0 → Max ion density $\left(\frac{ion}{m^3}\right)$

sky wave propagation is possible $f \leq f_c$

$N_0 = \frac{f_c^2}{81}$