INTRODUCTION.

* The main objective of communication system is to transfer information from one place to another place by using electrical signals.

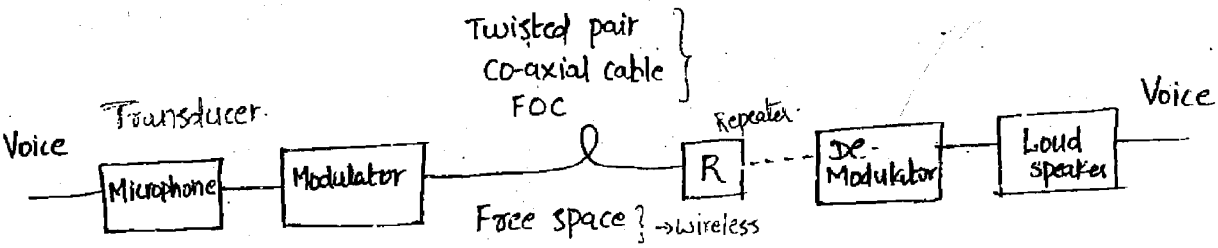
Voice → 300 - 3.5 KHZ → Telephone

Audio → 20 - 20 KHZ → Radio.

Video → 0 - 4.5 MHZ → T.V.

Data → Pulse width → Internet

Block diagram:



* The no. of repeaters required in a communication link depends on the distance, type of the cable used, Txtd power, and type of modulation technique used.

Need for Modulation:

① To reduce the size of the antenna:-

Voice, Audio and video signals consists of significant low freqs. In wireless communications the size of the antenna [illegible] not possible to transmit low

freq signal directly into free space. To overcome this problem a modulator is used which converts low freq signal into a high freq signal. As the freq increases, wavelength (λ) decreases and the size of the antenna also decreases.

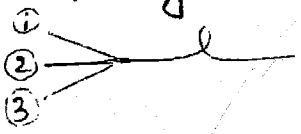
Ex: $c = f\lambda$.

$$\downarrow\lambda = \frac{c}{f\uparrow}$$

Antenna height may be $\frac{\lambda}{2}, \frac{\lambda}{4}$ etc.

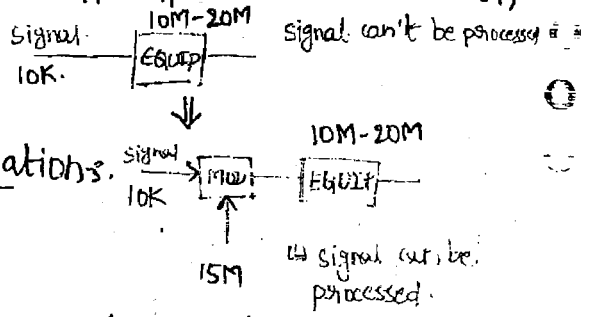
② For Multiplexing:

Transmission of more than one signal through the same communication channel is called as Multiplexing. But multiplexing is possible only with modulation.



③ To reduce the effect of Noise:

If a signal is txtd through a channel, distortion occurs due to noise. To determine the effect, Signal to Noise ratio is used. But S/N ratio depends on type of modulation technique.



④ To overcome equipment limitations.

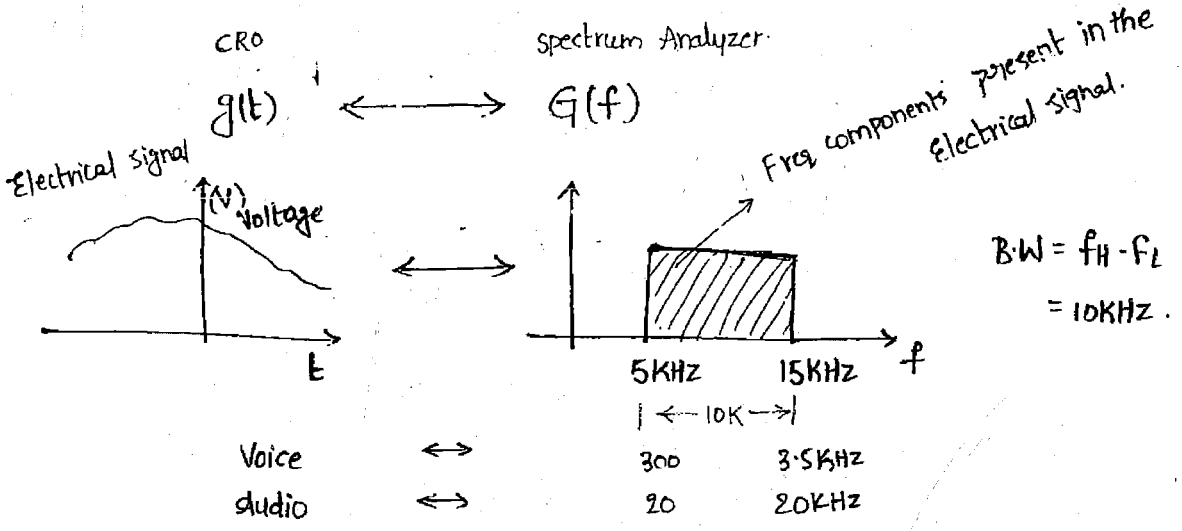
⑤ For freq allocation.

⑥ To convert Wide band signal to Narrow band signal.

Review of Fourier Transform :

(2)

FT concept is required to determine the freqs present in a signal. FT converts a time domain signal into a freq domain signal. The graphical representation of a freq domain signal is called "Spectrum".

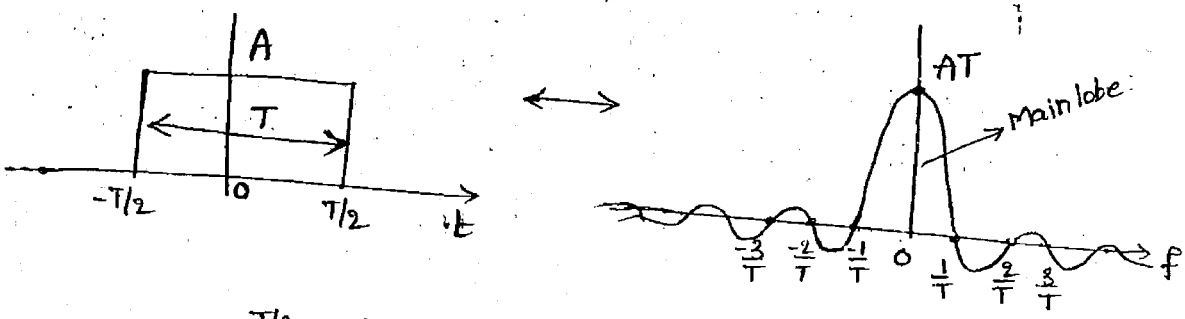


* The range of the freqs occupied by a signal is called as Bandwidth of the signal.
* Practically signal B·W should be minimum and channel B·W should be maximum.
* Practically the power required to transmit the signal should be as minimum as possible.

* $g(t) \leftrightarrow G(f)$

$$G(f) = \int_{-\infty}^{\infty} g(t)\, e^{-j2\pi ft}\, dt$$

* $g(t) \longleftrightarrow G(f)$



* $G(f) = \int_{-T/2}^{T/2} A\, e^{-j2\pi ft}\, dt$

sinc fn is = 0 at $fT = \pm 1, \pm 2, \pm 3$

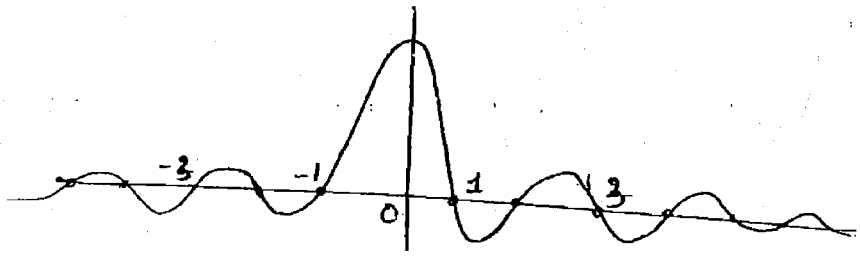
$f = \pm \frac{1}{T}, \frac{2}{T}, \frac{3}{T} \ldots$

$$G(f) = AT \frac{\sin \pi(fT)}{\pi(fT)} = AT\, \mathrm{sinc}(fT)$$

$$\boxed{G(f) = AT\, \mathrm{sinc}(fT).}$$

T: Pulse width.

* $\mathrm{sinc}(x) = \frac{\sin \pi x}{\pi x} = 0$ for $x = \pm 1, \pm 2, \pm 3, \ldots$



* $B.W = f_H - f_L$

$= \infty - 0 \rightarrow$ ∵ neg fre will not exist.

$$\boxed{B.W. = \infty}$$

* Energy $E = \int_{-T/2}^{T/2} A^2\, dt = A^2 T$ Joules. → In time domain