Principle of Communication (BEC-28)

Amplitude Modulation

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Communication channels

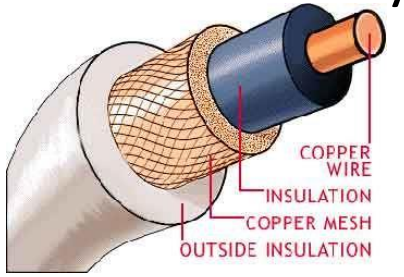
- Medium for the propagation of signals.
- Types:

✓Open Wire Lines: telephone and Telegraph transmission lines, low attenuation (0.4 dB/Km).

✓Paired Cables: Telephone Networks for short distance (Inside building, building to local office), 0.05 dB/Km.

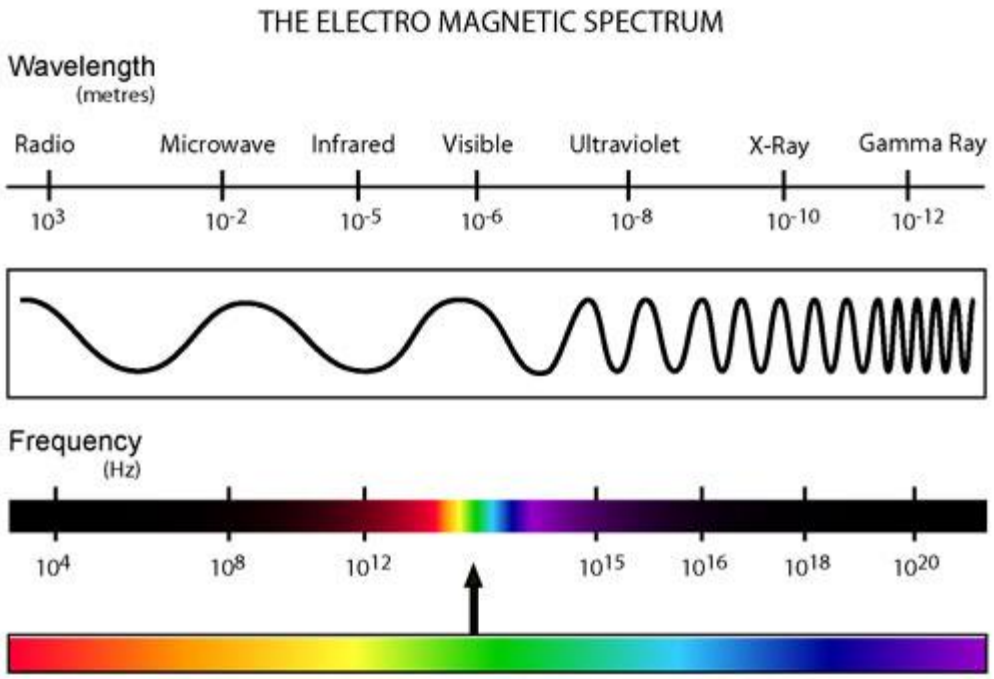
✓Quad cables: Differential pair of conductors for carrying the differential signals, 0.25 dB/Km.

✓Coaxial cables: Single wire conductor at the centre of cylindrical cable separated by dielectric, 5 dB/Km.



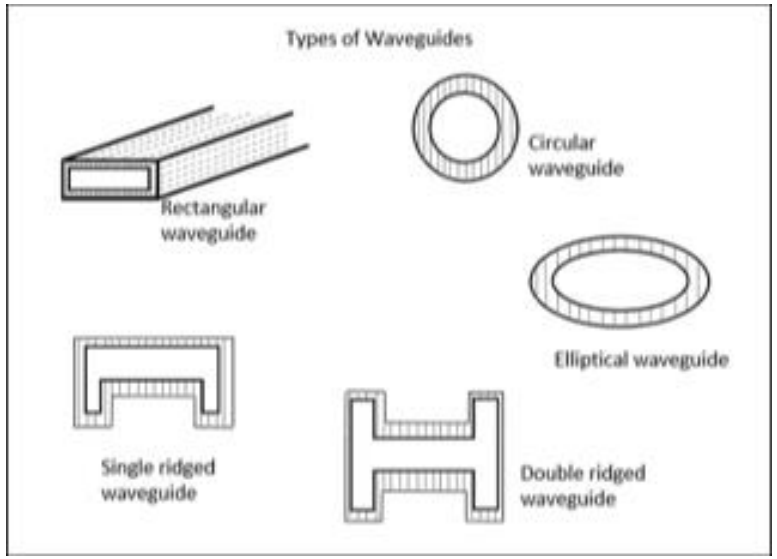
Communication channels……

✓Radio: Wireless propagation (Atmosphere/Free space). Electromagnetic signal transmitted by antenna.



Communication channels……

✓Waveguide: Hollow conductor of Rectangular/ Circular/ Elliptical/ Single Ridged/ Double Ridged cross section. Offers very high bandwidth (Hundreds of MHz). Attenuation 0.5 dB/Km.

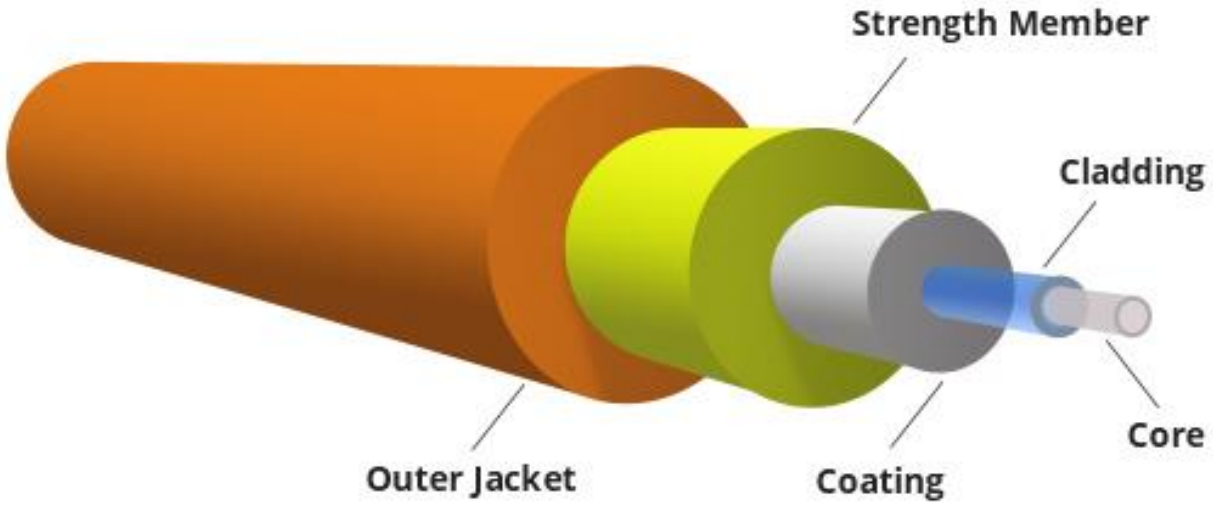


Communication channels……

- Optical Fiber: Light wave propagation with minimum loss.

  Based on Total internal reflection.

  Attenuation (0.2-0.4 dB/Km)



SIGNAL AND ITS PROPERTIES

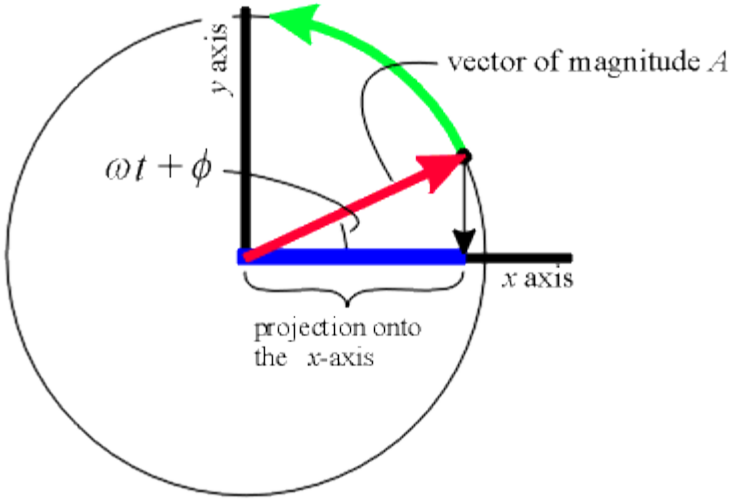
- Classification of Signals.
- Correlation and Autocorrelation.
- Power and cross Correlation.
- Fourier Transform.

Classification of Signals

- Real and Complex Signals

- Only Real Components

- Both Real and Imaginary Components
- It convey both amplitude and phase
- $x(t) = Ae^{j\omega t}$
- Amplitude=A, and phase $< x(t) = \omega t$



Classification of Signals……

- Periodic and Aperiodic Signals

- Repetitive in nature
- $x(t) = x(t + T)$; T-Time Period
- $x(n) = x(n + N)$; N-Integer
- Sampled version of analog periodic signal need not be periodic.
- For periodic, T/N should be Rational.

- Not repetitive
- $x(t) \neq x(t + T)$

Classification of Signals……

- Even and Odd Signals

- Symmetric about t=0
- $x(t) = x(-t)$
- $x(t) = Acos(\omega t)$

- Anti Symmetric about t=0
- $x(t) = -x(-t)$
- $x(t) = Asin(\omega t)$

- $x(t) = x_e(t) + x_o(t)$
- $x_e(t) = \frac{[x(t)+x(-t)]}{2}$
- $x_o(t) = \frac{[x(t)-x(-t)]}{2}$

Classification of Signals……

- Energy and Power Signals

- Finite Energy
- $E = \int_{-\infty}^{\infty} |x(t)|^2 dt$

- Finite nonzero Power
- $P = T \to \infty \frac{1}{T} \int_{-T/2}^{T/2} |x(t)|^2 dt$

P1: Calculate energy of the signal $u(t) = 2e^{-3t}, t \geq 0$ and $u(t)$ is zero elsewhere.

Solution: $E = \int_0^{\infty} 4e^{-6t} dt$ =2/3

P2: Calculate power of the signal $u(t) = 2sin0.5\pi t$

Solution: $P = \frac{1}{4} \int_{-2}^{2} 4sin^2(0.5\pi t) dt = 2$

$$x(t) = Asin(\omega t)$$

Power $P = \frac{A^2}{2}$

RMS Power $\sqrt{P} = \frac{A}{\sqrt{2}}$

Classification of Signals……

- Deterministic and Random Signals:

  Specified in any form, mathematical, graphical, etc.

  Related to random variable and described in probabilistic terms, mean, variance, distribution function, etc.

- Causal and Noncausal Signals:For causal, $x(t) = 0 \; for \; t < 0$

- Singularity Functions: Not Finite or don't have finite derivatives everywhere.

Thank You