Transmission lines

There are basically two ways of transmitting (sending) signals from one terminal to another — unguided and guided.

Unguided → Transfer of signal into a "un-bounded medium, in such a way that the EM wave is spread over a wide area.

Guided → Bounded (सीमित) medium for transfer of EM wave. Guided transfer direct (दाद दिखाई) the energy of the signal from source to load.

Ex → Transmission lines & waveguides.

Transmission lines are the medium (माध्यम) of transfer of signal from source to the load, in a guided medium.

→ It basically consists of two or more parallel or non-parallel conductors used to connect source to load.

Why transmission lines?

→ Transmission lines can carry current of very high frequency also.

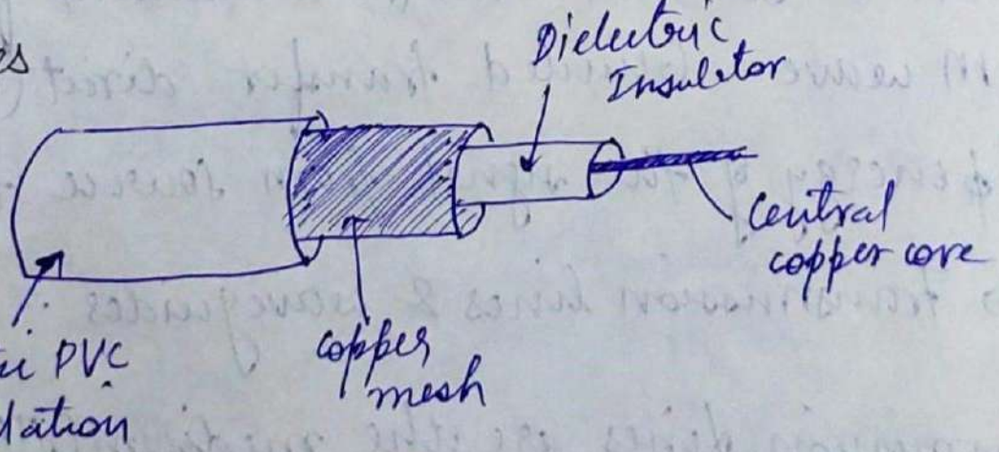
→ Transmission lines have uniform cross dimension (area), and so they have uniform impedance throughout the length of the line.

→ Transmission lines are constructed using specialized equipments, they are made in such a way that they have impedance matching to reduce reflection and minimize power losses.

Types of transmission lines

Basic types of transmission lines are - co-axial cables, parallel wire line, twisted pair cables.

① Co-axial Cables



→ Coaxial cable is a type of electrical cable consisting of an inner copper conductor, which is covered by dielectric shield. There is again a covering of copper mesh and then the whole tube is covered with insulation.

→ Inner core is used as the channel and signal is transfered through this part.

→ dielectric surrounds the core, and is used to seperate the core from the copper mesh.

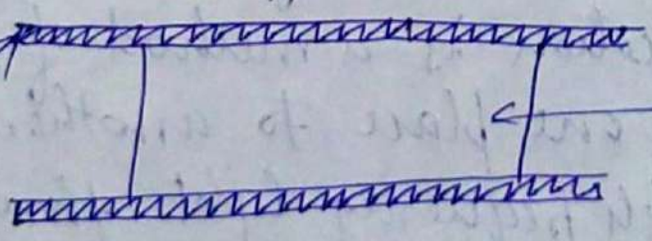
→ The copper mesh surrounding the dielectric insulator protects the signal in the core from external electromagnetic noise.

→ PVC insulation is made of Teflon or plastic coating to protect inner layers from external damage such as as fire, water etc.

② Parallel Wire line.

→ It is a transmission line consisting of two conductors of same, seperated by an insulator. The 2 conductors are of same type and have equal impedances along the length. The conductors lines are always parallel to each other and never touch each other.

→ Used in electric power lines.

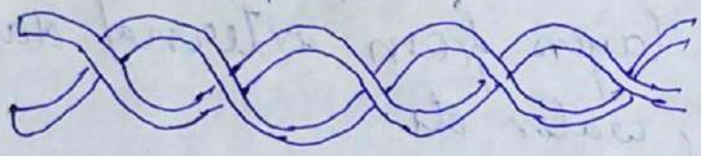


③ Twisted pair cables.

→ It is a type of T-line in which two conductors of a single circuit are twisted (मुड़ी हुई) together for improving electromagnetic transmission.

→ It reduces electromagnetic loss in form of radiation and crosstalk b/w the two conductor.

→ It helps The twisting helps in rejecting external electromagnetic interference.



④ Optical Fibre Cable

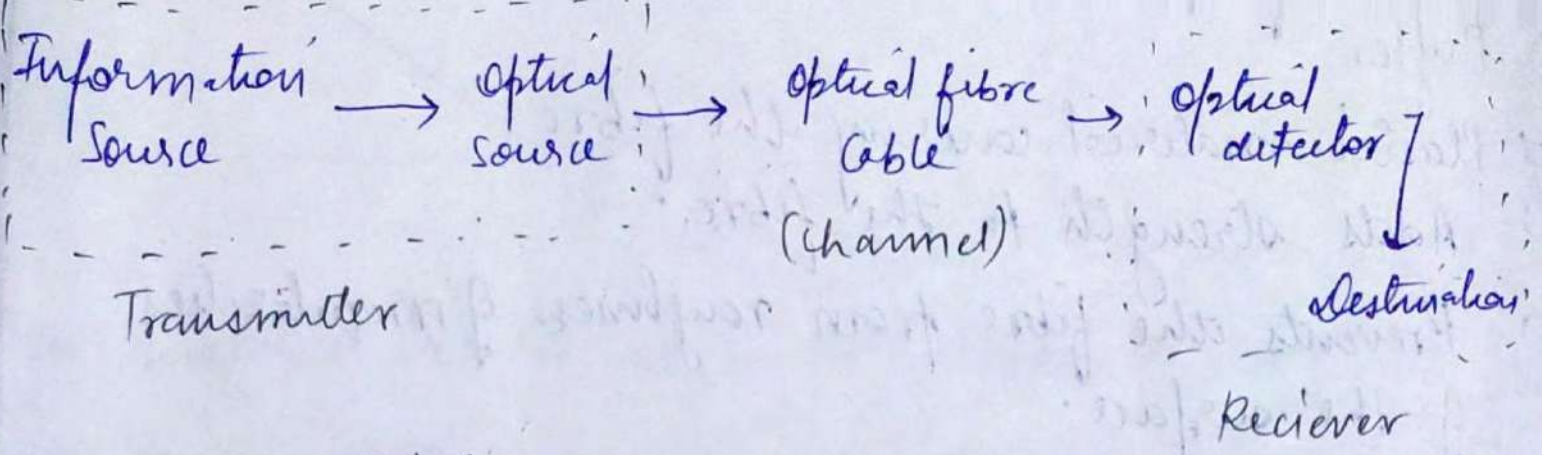
→ An optical fibre is a flexible (लचीला), transparent fiber made from drawing glass (silica).

→ It is used to transmit light b/w two ends of the fiber

→ It have a wide usage in the feild of optical communication, where transmission can happen over long distances and at high bandwidth.

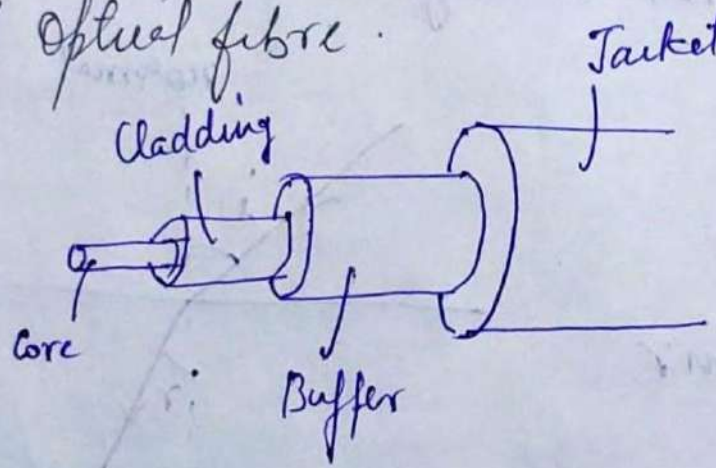
→ Optical communication is a method of transmitting information from one place to another by sending pulses (waves) of high frequency light through an optical fibre.

→ The most important advantage of optical communication is that it has almost effect of external electromagnetic noise on the s/g.



Optical communication System
Block diagram.

Structure of Optical fibre.



Core

→ Innermost layer, made up of glass or quartz.
→ Refrative index $\eta = 1.5$.
→ diameter 10 μm – 100 μm
→ light is transmitted from one end to the other through the core by the phenomenon of total internal reflection (TIR)

(2) Cladding -

→ One or more layer of material surrounding the core.
→ Lower refrative index than core, $\eta = 1.45$.
→ It helps the light to stay within the core by TIR at the boundary of core and cladding.
→ Made of glass.

(3) Buffer

→ Plastic material covering the fibre.
→ Adds strength to the fibre.
→ Prevents the fibre from roughness of irregularities of the surface.

(4) Jacket

→ Made of plastic to provide strength and prevent from external damage.

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