Unit-2

Transmission media: -

- The computers and other devices are uses the signals to represent data.
- These signals are transmitted fro one device to another device in the form of electromagnetic energy.
- Electromagnetic energy is a combination of electrical and magnetic fields.
- The transmission media are divided into two parts. [1] Guided media [2] Unguided media.
- The popular guided media are magnetic media, twisted pair, co-axial cable, fiber-optics cable.
- The unguided media are radio transmission, microwave transmission, infrared and millimetre transmission, light wave transmission.

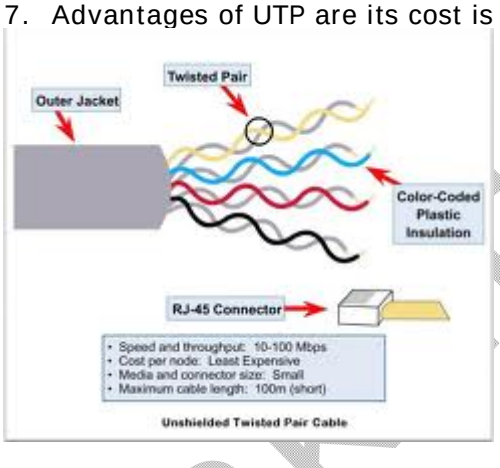
Guided media: -

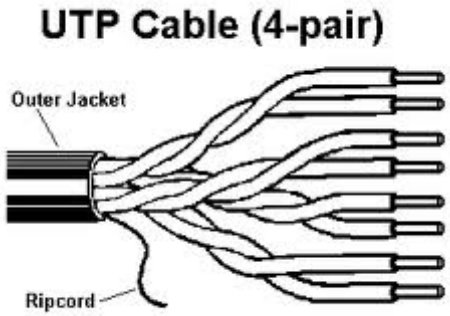
Magnetic media: -

- Disks and tapes are one of the most popular methods for transmitting data from one computer to another.
- But the problem is that the source and destination have to close with each other.
- If you want to transmit your data to another town in less time it would take to drive there.
- Or another type of method of transfer will be needed.

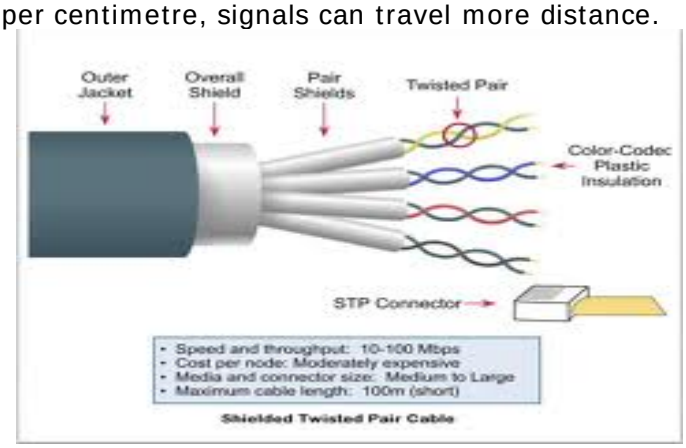
Twisted pair: -

- The twisted pair comes in two forms: Unshielded twisted pair (UTP) and Shielded twisted pair (STP).
- **Unshielded twisted pair (UTP): -**
  1. UTP cable is the most common type of communication media in use today.
  2. The frequency range of UTP is 100Hz to 5MHz.
  3. This frequency is suitable for both data and voice.
  4. They are used in LAN environment.
  5. A twisted pair is consisting of two conductors.
  6. The plastic insulation is colour-banded for identification.
  7. Advantages of UTP are its cost is very low, flexible, and easy to install.



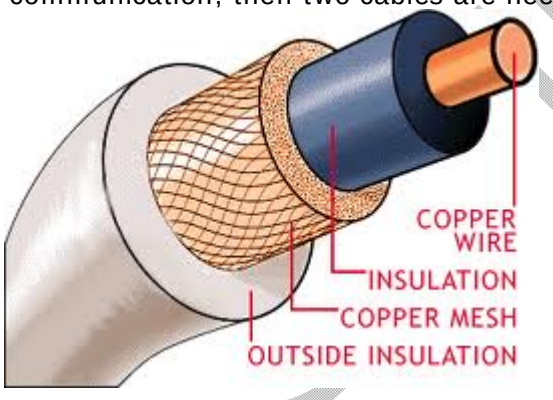


- **Shielded twisted pair (STP): -**
  1. STP has a metal foil covering that each pair of insulated conductor.
  2. The metal foil is prevents the electromagnetic noise.
  3. It also avoids the crosstalk.
  4. STP has same quality and same connectors as UTP.
  5. The twists allow the signals to travel on copper wire.
  6. The more twists per centimetre, signals can travel more distance.



Coaxial cable: -

- Coaxial cable is also known as coax cable.
- Coaxial cable caries signals of higher frequency range then the twisted pair.
- The frequency range of coaxial cable is 100 KHz to 500 MHz.
- Coaxial has central core conductor of copper wire.
- The copper wire enclosed in insulating sheath.
- The outer metallic foil cover protect from noise.
- This outer metallic foil cover is also protected by plastic cover.
- Two type of coaxial cable is available for network. [1] Baseband coaxial cable (50 OHM) [2] Broadband coaxial cable (75 OHM).
- **Baseband coaxial cable (50 OHM): -**
  1. Data reading through this material is easy.
  2. Baseband coaxial cable is an insulated copper wire covered with a mesh conductor with coating of plastic cover.
  3. That is provides a combination of high bandwidth with low noise.
  4. This kind of cable is used in long distance telephone line.
- **Broadband coaxial cable (75 OHM): -**
  1. In networking, the term “broadband” refers to any cable that uses analog transmission.
  2. The broadband coaxial cable is used for long distance transmission.
  3. In broadband coaxial cable an amplifiers are needed.
  4. These amplifiers transform the cable into a unidirectional cable.
  5. If we want to two-way communication, then two cables are needed.



Fiber optics principle: -

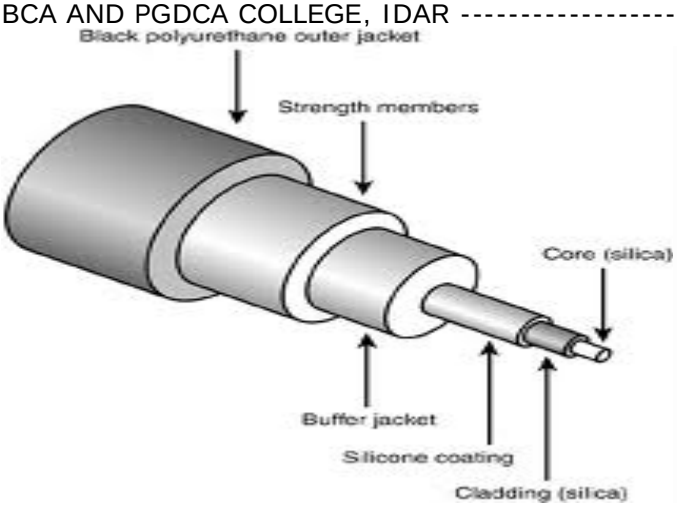
- Optical fiber is made of glass.
- The optical fiber transmits the signals in the light form.
- **The nature of light: -** Light is a form of electromagnetic energy. It travels in vacuum 300,000 kilometre/second. The speed of light is depends on density of medium.
- **Refraction: -** Light travels in a straight line. If a ray of light travelling through one medium and it enter in another medium the ray change the direction. This change of direction is known as refraction.
- **Critical angle: -** The ray of light is moving from a denser medium into a less dense medium it increases the angle from vertical to horizontal. This angle is known as critical angle.
- **Reflection: -** When the angle become greater than the critical angle, is called reflection.

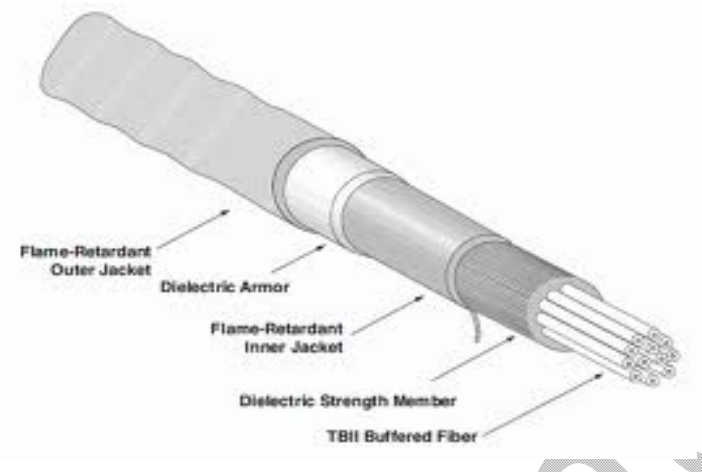
Fiber optics cable: -

- In fiber optics cable a glass is covered by cladding.
- The beam of light as a series of on-off flashes that represent 1 and 0 bits.
- The communication over fiber optics required a source of light, fiber optics cable, and a destination to detect the light.
- The light stays within the fiber because of the critical angle of light.
- The light never escapes the fiber line until the receiver detects it.
- The two kind of propagation mode is available. [1] Multimode [2] Single mode.

- **Multimode propagation: -** In a multimode propagation multiple light source moves through cable by using multimode step-index fiber and multimode graded-index fiber.

- **Single mode propagation:** - Single mode uses step-index fiber and a highly focused source of light that limits beams to small range of angle.





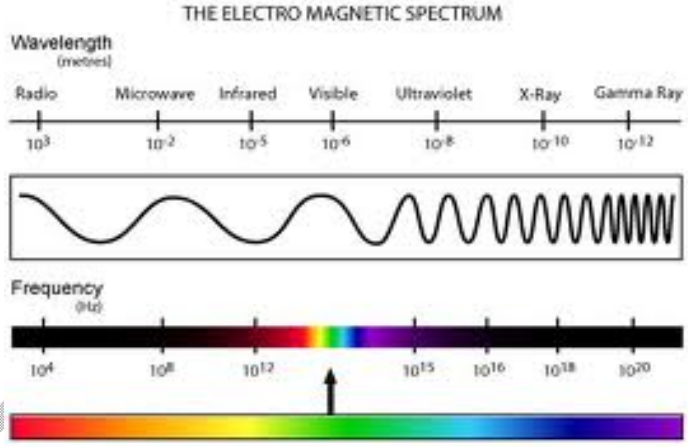
Comparison of fiber optics and copper wire: -

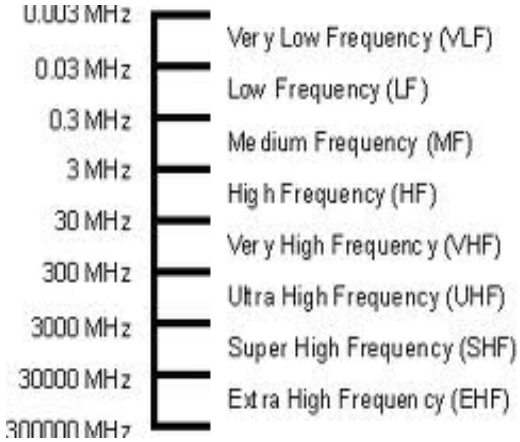
Fiber optics	Copper wire
1. Fiber optics transmission uses the light ray.	1. Copper wire uses the electricity.
2. Fiber optics transmission does not affect from noise.	2. Copper wire transmission can affect from noise.
3. The signals can run for long distance without regeneration.	3. Long distance electric signals required regeneration.
4. Fiber optics provides higher bandwidth.	4. Copper wire does not provide higher bandwidth.
5. The fiber optics cables are expansive.	5. Copper wire cables are less expansive.
6. Installation and maintenance is very difficult.	6. Installation and maintenance is less difficult.

Unguided media (Wireless transmission): -

Electromagnetic spectrum: -

- The wireless communication, transport electromagnetic waves without using physical conductor.
- Signals are broadcast in air.
- Consider the following figure.



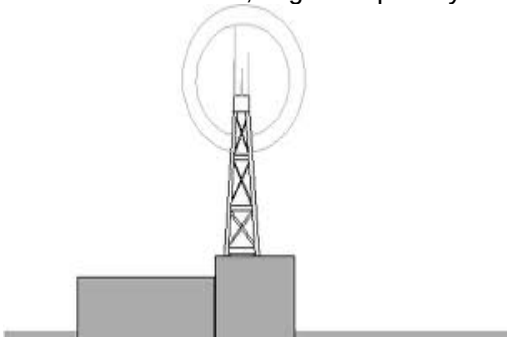


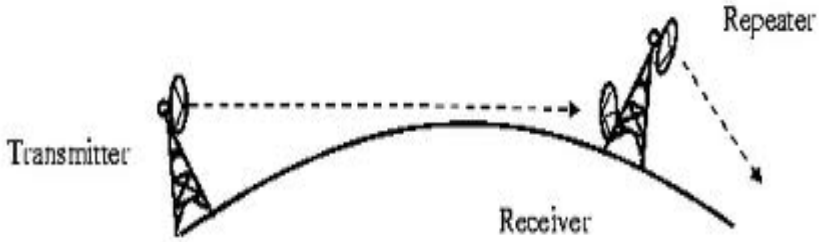
- **Very low frequency (VLF): -** The frequency range for VLF is 3 KHz to 30 KHz. VLF waves are propagated as surface waves. They are propagating in air. VLF waves are used mostly for long-range.
- **Low frequency (LF):** - The frequency range for LF is 30 KHZ to 300 KHz. LF waves are also propagated as surface waves. LF waves are used for long-range in air.
- **Middle frequency (MF): -** The frequency range of MF is 300 KHz to 3 MHz. The MF signals are propagated in the troposphere. These signals are absorbed by ionosphere. Use of MF transmission in AM radio.
- **High frequency (HF): -** The frequency range for HF is 3 MHz to 30 MHz. The HF signals use in ionosphere propagation. These frequencies are entered into ionosphere and back to earth. These frequencies are used in long distance communication like telephone, aircraft, telegraph, etc…

- **Very high frequency (VHF): -** The frequency range for VHF is 30 MHz to 300 MHz. VHF waves are used in line-of-sight propagation.
- **Ultrahigh frequency (UHF): -** The frequency range for UHF is 300 MHz to 3 GHz. UHF waves are used in line-of-sight propagation. These frequencies are used in television, mobile and cellular communications.
- **Super high frequency (SHF): -** The frequency range for SHF is 3 GHz to 30 GHz. These waves are used in space propagation. Uses for SHF include satellite microwaves and radar communication.
- **Extremely high frequency (EHF): -** The frequency range for EHF is 30 GHz to 300 GHz. These waves are used in space propagation. Uses for SHF include satellite microwaves and radar communication.

Radio wave transmission: -

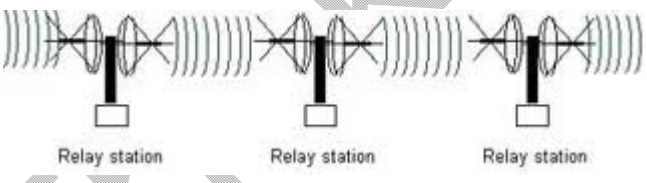
- Radio waves are easy to generate.
- They are Omni-directional.
- Radio waves have low transmission rates.
- Depending on their frequency, the radio waves are can not travel very long distance.
- The radio waves are absorbed by the earth.
- In some cases, high frequency radio waves are reflected back to earth by ionosphere.





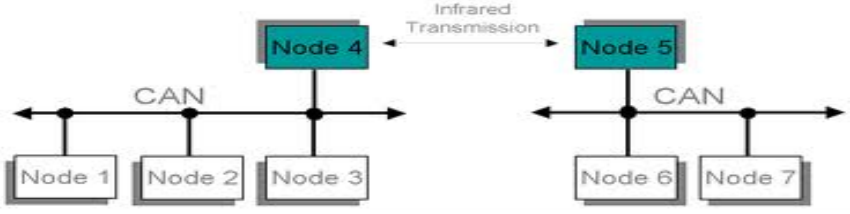
Microwave transmission (Terrestrial microwave): -

- The microwave transmission requires line-of-sight.
- Microwave transmission is travel in straight line.
- A source can be directly focused in its destination.
- Because they travel in straight line, the curve of the earth can affect to microwave transmission.
- The solution of this problem is the addition of repeaters in between source and destination.
- The microwaves are used for long distance communication.
- Microwave transmission is used in cellular, mobile phones, door opener etc…



Infrared and millimetre waves: -

- These waves are used for close-range communication.
- They do not pass through objects.
- Infrared communication in one room do not affect to the another infrared communication in another room.
- The infrared communication is more secure than other such as radio transmission, microwave transmission.
- It cannot be used outside because of infrared transmission is affected by sun light.



Light wave transmission: -

- Laser light can be used for light wave transmission.
- It is relatively low cost.
- We can connect the buildings' LAN by using light wave transmission.
- The laser light is difficult to target on the destination's receiver.
- Because the laser light beam is very small.
- Laser light also diffuses easily in poor atmospheric conditions, such as rain, sun heat, bad weather.