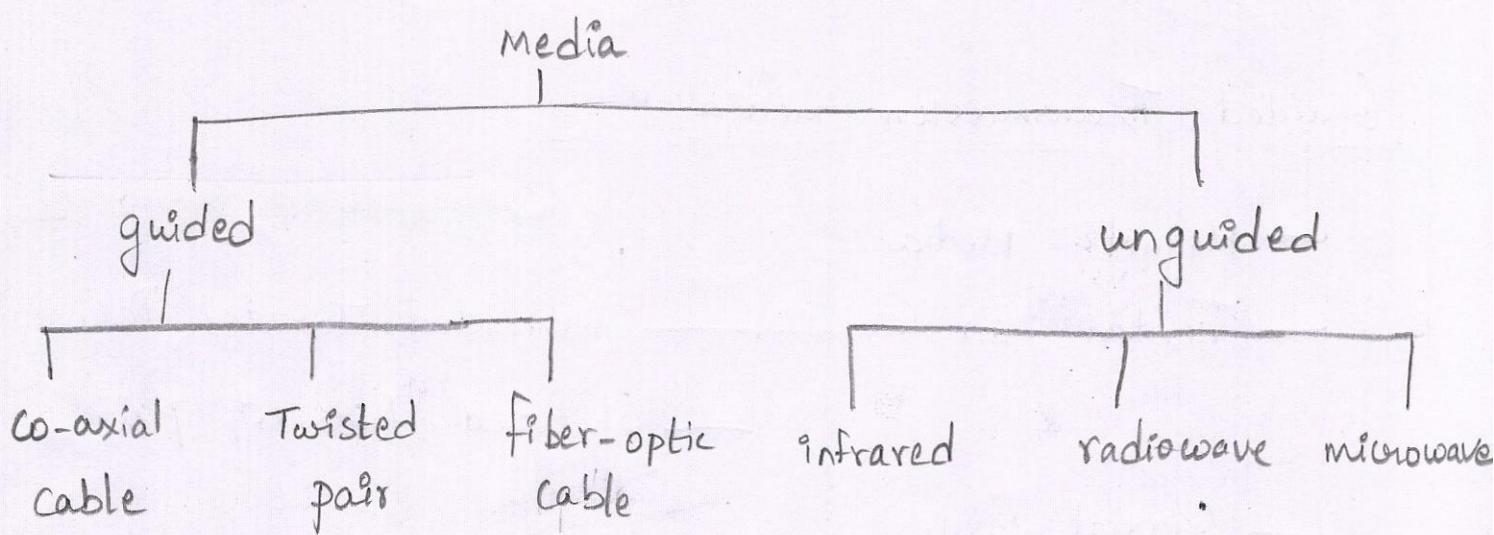


Transmission media :-

- Transmission medium: It is the physical path between the sender & receiver in a data transmission system.
- It is included in the physical layer of the OSI protocol.
 - Ex:- free space, metallic cable, fiber-optic cable

Guided Transmission media :

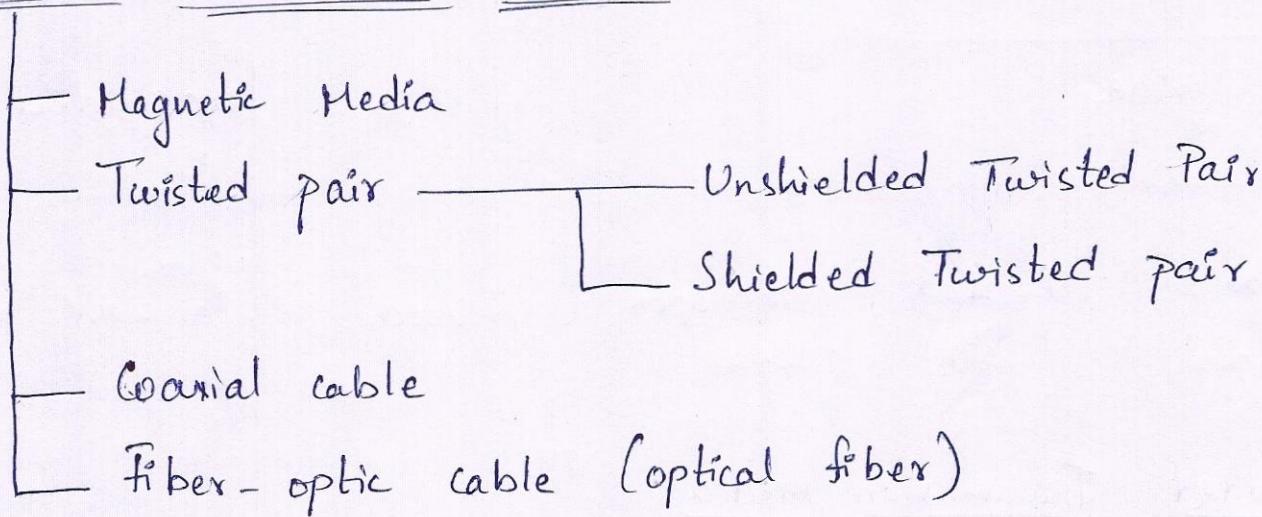
- It uses a cabling system that guides the data signals along a specific path.
- Data signals are bound by the cabling system.
- So, it is also known as Bound Media.
- Only the devices physically connected to the medium can receive data signals propagating through a guided transmission media.

Ex:- Copper wire, optical fiber.

Unguided Transmission media:

- It consists of a means for the data signals to travel but nothing to guide them along a specific path.
- The data signals are not bound to a cabling system.
So, they are called Unbound media.
Ex:- Wireless Systems.

Guided Transmission media:



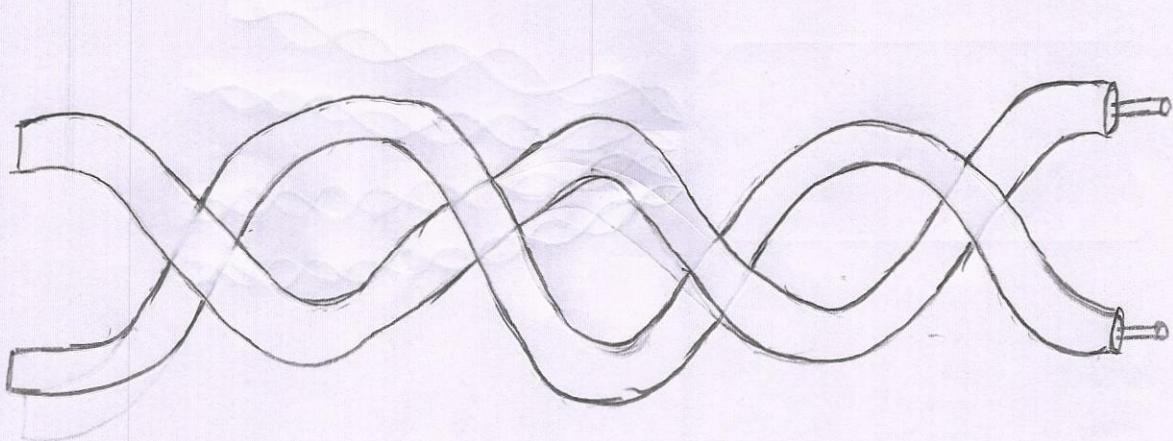
(1) Magnetic Media:

- In this, data is transported from one computer to another by writing the data onto magnetic tape or removable media. (e.g., recordable DVDs)
- Then physically transport the tape or disks to the destination machine, and read them back in again.

(2) Twisted pair:

- It is the simplest, oldest and low priced cable medium.

- It is made up of two insulated copper wires about 1mm thick, twisted around each other.



- Twisted pairs can be used for transmitting either analog or digital signals.
- The bandwidth depends on the thickness of the wire and the distance travelled.
- Two basic types of twisted-pair cable exist.

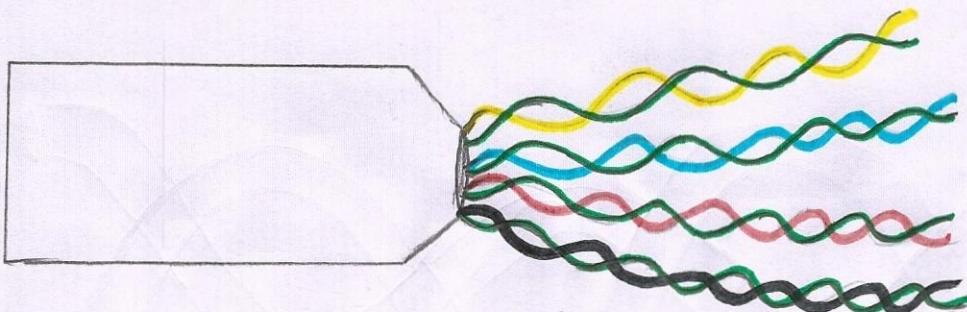
Unshielded Twisted Pair (UTP)

Shielded Twisted Pair (STP)

- Transmission links may be simplex or Half Duplex or Full Duplex in mode.

Unshielded Twisted pair :

- It is one of the most popular LAN cables.
- This cable consists of 4 twisted pairs of metal wires (ie., 8 wires in the cable).



- Each pair is twisted with a different number of twists per inch to eliminate interference from adjacent pairs and other electrical devices
- Each twisted pair consists of two metal conductors that are insulated separately with their own coloured plastic insulation.
- UTP cable relies on cancellation effect produced by twisted wire pairs to limit the signal degradation caused by electromagnetic interference and radio frequency interference.
- RJ-45 connector: UTP cable is installed using a RJ-45 connector. (Registered-Jack Connector). RJ-45 is an eight-wire connector used commonly to connect computers onto a LAN, esp ethernet.

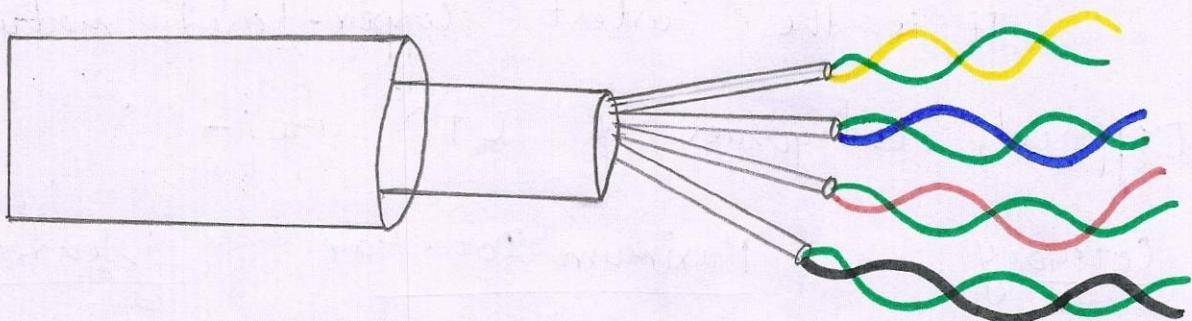
- UTP cables are suited for both data & voice transmissions commonly used in telephone systems.
 - they are also widely used in DSL lines, 10Base-T, 100Base-T LAN.
- Adv.:-
- It is the cheapest media
 - Easy to install and maintain
 - It occupies less space
 - It is the fastest copper-based medium today.

- Different categories of UTP are:-

<u>Category</u>	<u>Maximum Data Rate</u>	<u>Intended Use</u>
1	1 Mbps	Voice only
2	4 Mbps	4 Mbps Token Ring
3	16 Mbps	10 BaseT Ethernet
4	20 Mbps	16 Mbps Token Ring
5	100 Mbps (2-pair)	100 BaseT Ethernet
	1000 Mbps (4-pair)	1000BaseTX
5e	1000 Mbps (2-pair)	1000 BaseT
6	1000 Mbps (2-pair)	1000 BaseT & faster broadband applications
6a	10000 Mbps (2-pair)	Future standard that will provide for 10 Gbps Ethernet

Shielded Twisted Pair (STP)

- This cable has a metal foil or braided-mesh covering that occurs each pair of insulated conductors.
- The metal foil is used to prevent infiltration of electromagnetic noise.
- This shield also helps to eliminate crosstalk.

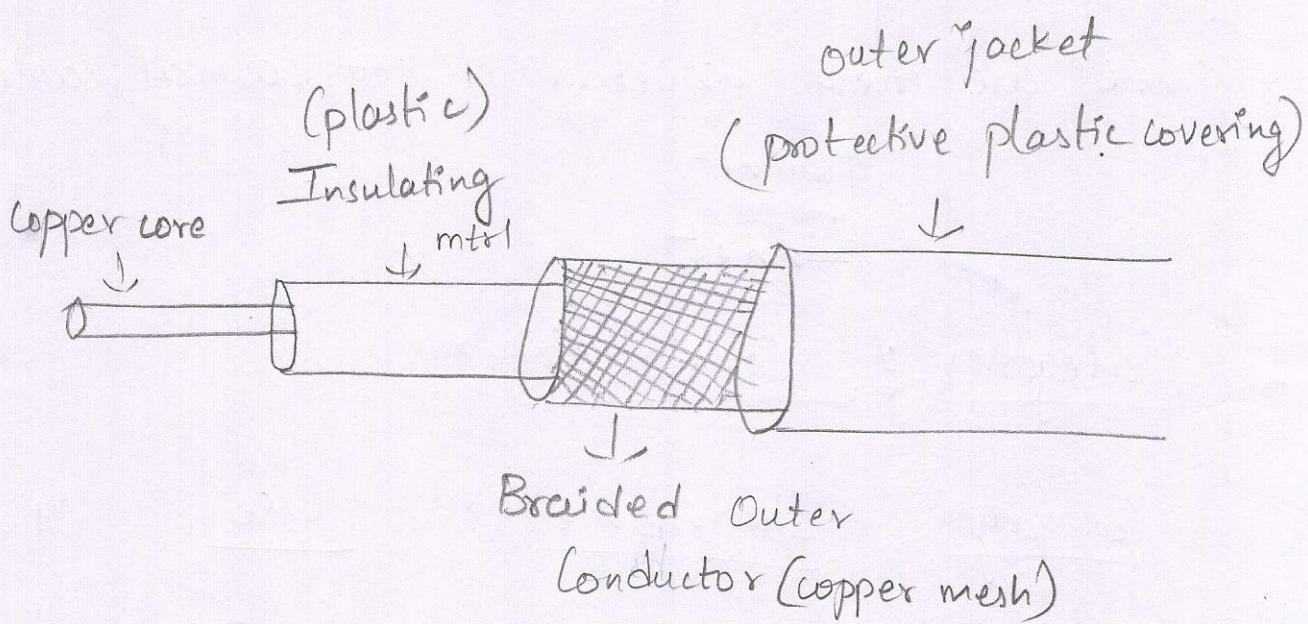


- STP reduces electrical noise both within the cable and from outside the cable.
- STP is suited for environments with electrical interference and also provides better performance at higher data rates.
- But the extra shielding makes STP cable quite bulky and more expensive than UTP cables.

Coaxial Cable

- It is one of the common transmission medium (called as coax) in current day data communication.

- They are relatively inexpensive, but most costly than UTP on a per-unit length.



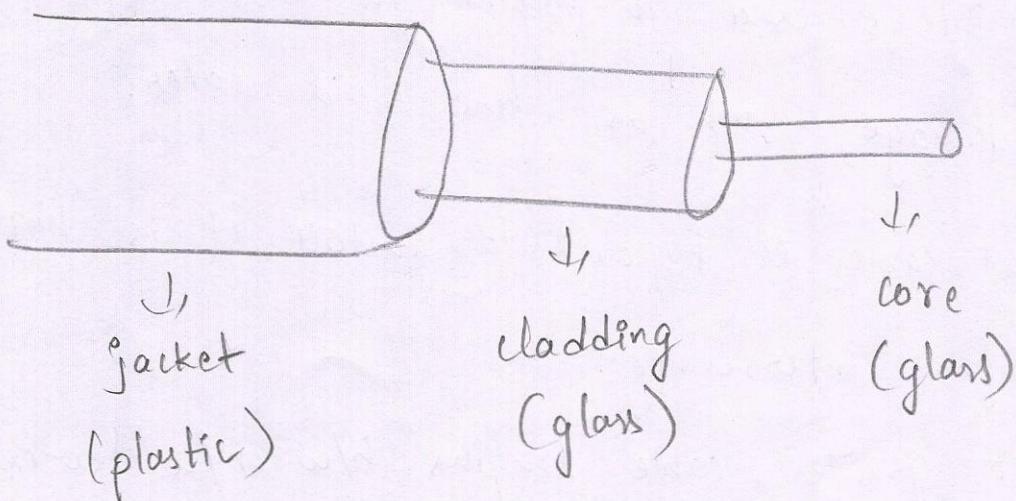
- A coaxial cable consists of four components:
 - ① A core copper wire, which serves as a primary channel.
 - ② An electric plastic insulator which surrounds the copper.
 - ③ A braided outer conductor which is a copper mesh, It is used to protect from electrical electromagnetic interference.
 - ④ The last layer is outer jacket which is protective plastic covering. It is used to protect the inner layers from physical damage such as fire and water.
- Although coaxial cable is difficult to install, it is highly resistant to signal interference.
- It can support greater cable lengths b/w w/w devices and greater bandwidth than twisted-pair cable.

- Coaxial cables are capable of transmitting data at a fast rate of 10Mbps.
- There are two varieties of coaxial cable:
 - thicknet
 - thinnet
- Categories of Coaxial Cable

<u>Category</u>	<u>Impedance</u>	<u>Use</u>
RG - 59	75Ω	Cable TV
RG - 58	50Ω	Thin Ethernet
RG - 11	50Ω	Thick Ethernet

- The most common type of connector is BNC connector.

Fiber-optic cable:



- Optical fiber consists of thin glass fibers that can carry information in the form of visible light.
- It consists of very narrow strand of glass or plastic called the core.
- Around the core is a layer of dense glass or plastic called the cladding, whose refractive index is less than that of the core.
- The outer most layer of the cable is known as jacket, which shields the cladding & the core from moisture, crushing & abrasion.
- Optical fibers transmit a beam of light by means of total internal reflection.
- When a light beam from a source enters the core, the core refracts the light & guides the light along its path.
- The cladding reflects the light back into the core & prevents it from escaping through the medium.
- Fiber optic cable support two modes of propagating light, they are:-

Multimode: In this mode, many beams from a light source traverse along multiple paths & at multiple angles.

Single mode : The beams propagate almost horizontally.

- LED or LASER acts as the source converting electric pulse to light pulses & photodiode acts as receiver doing vice versa.
- Fiber optic cable uses 3 types of connectors. They are:-
 - SC (Subscriber Connector) : It is used to connect cable TV.
 - ST (Straight Tip) - It is used to connect n/w devices
 - MT-RJ (Mechanical Transfer- Registered Jack) —
It is used for n/w applications.

Twisted-pair cable

- Transmission of signals takes place in the electrical form over the metallic (copper wires) conducting wires.

- In this medium, the noise immunity is low.

- Twisted pair cable can be affected due to external magnetic field.

Coaxial cable

- Transmission of signals takes place in the electrical form over the inner conductor of the cable (copper core).

- Coaxial having higher noise immunity than twisted pair cable.

- Coaxial cable is less affected due to external magnetic field.

Optical fiber

- Signal transmission takes place in an optical form over a glass fiber.

- Optical fiber has highest

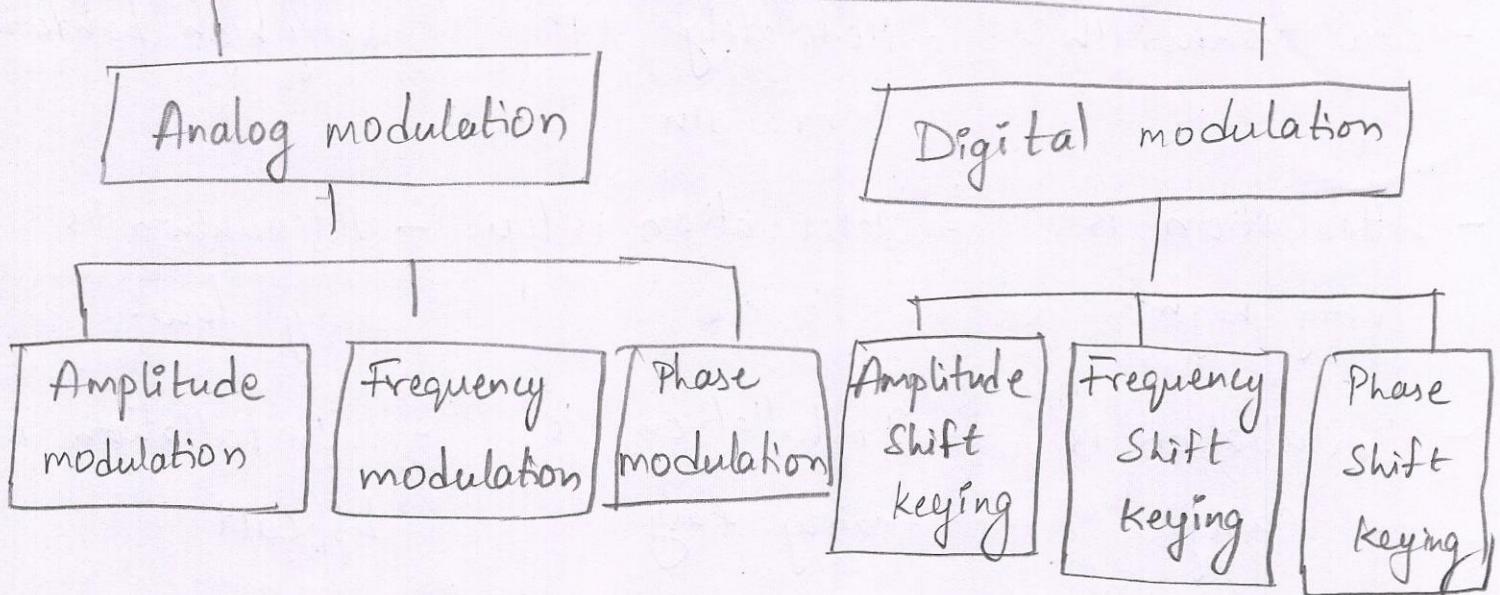
- Not affected by the external magnetic field.

- cheapest medium	- Moderate expensive	- Expensive
- Low Bandwidth	- Moderately high bandwidth	- Very high bandwidth
- Attenuation is very high.	- Attenuation is low	- Attenuation is very low.
- Installation is easy	- Installation is fairly easy.	- Installation is difficult.

Digital Modulation and Multiplexing:

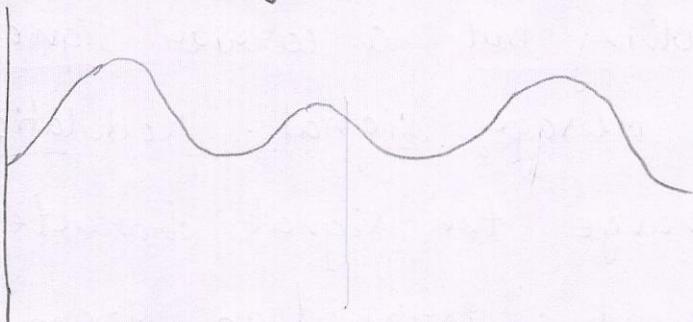
- Modulation :- It is nothing but, a carrier signal varies in accordance with the message signal. Modulation technique is used to change the signal characteristics.
- It is a process of encoding information from a message source in a way that is suitable for transmission. This is achieved by altering the characteristics of a wave.
 - In the modulation process, a parameter of the carrier wave is varied in accordance with the modulating signal.
 - The receiver demodulates the received modulated signal & gets the original information signal back.
 - Modulation is of two types :—

modulation



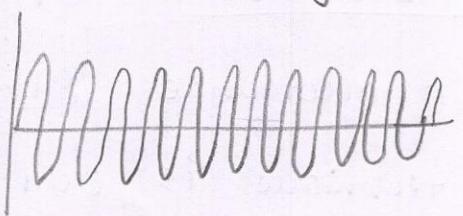
modulation process

input signal / message signal



modulating signal

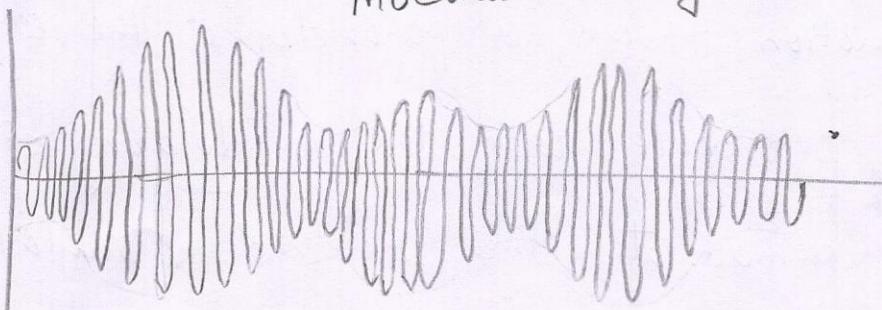
carrier signal



high frequency signal
[const phase
const amplitude]

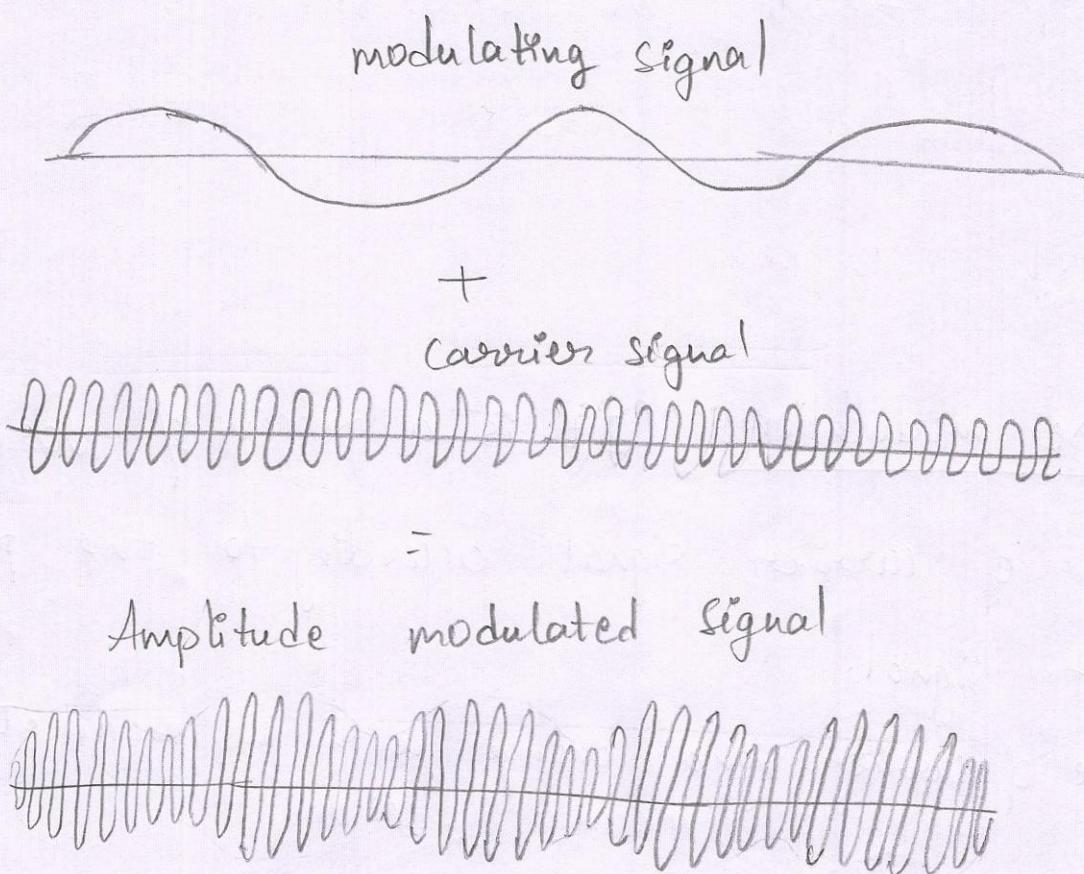
=

modulated signal



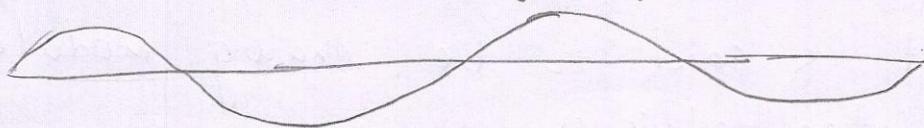
Output Signal

- ① Analog modulation : If Analog signal is used as carrier signal , it is said to be Analog modulation.
- Analog modulation techniques:
- ② Amplitude modulation : It is a process of varying amplitude of carrier signal accordingly with the amplitude of input signal.



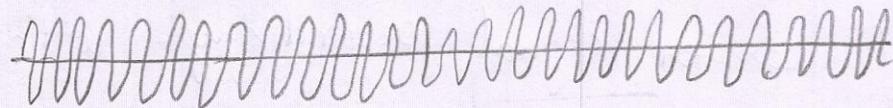
- ③ Frequency Modulation : It is a process of varying frequency of carrier signal according to the frequency of the input signal .
- frequency of carrier signal changes with modulating signal

modulating signal



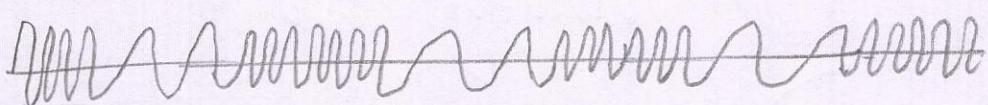
+

carrier signal



=

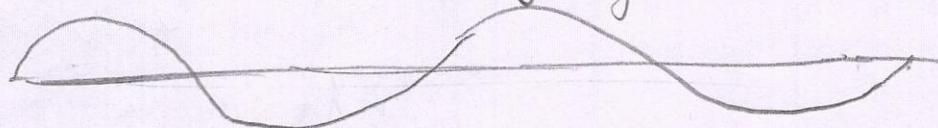
Frequency modulated signal



⑤ Phase modulation: It is a process of varying phase of carrier signal according to the phase of input signal.

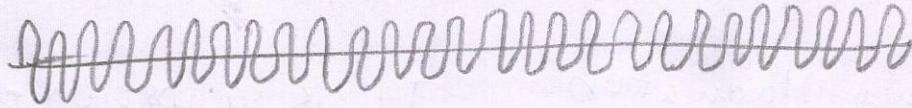
- phase of carrier signal changes with the modulating signal.

modulating signal



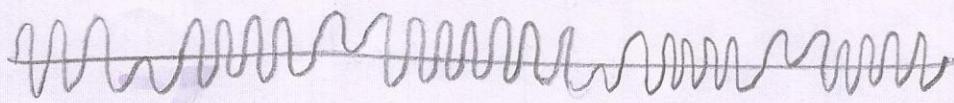
+

carrier signal



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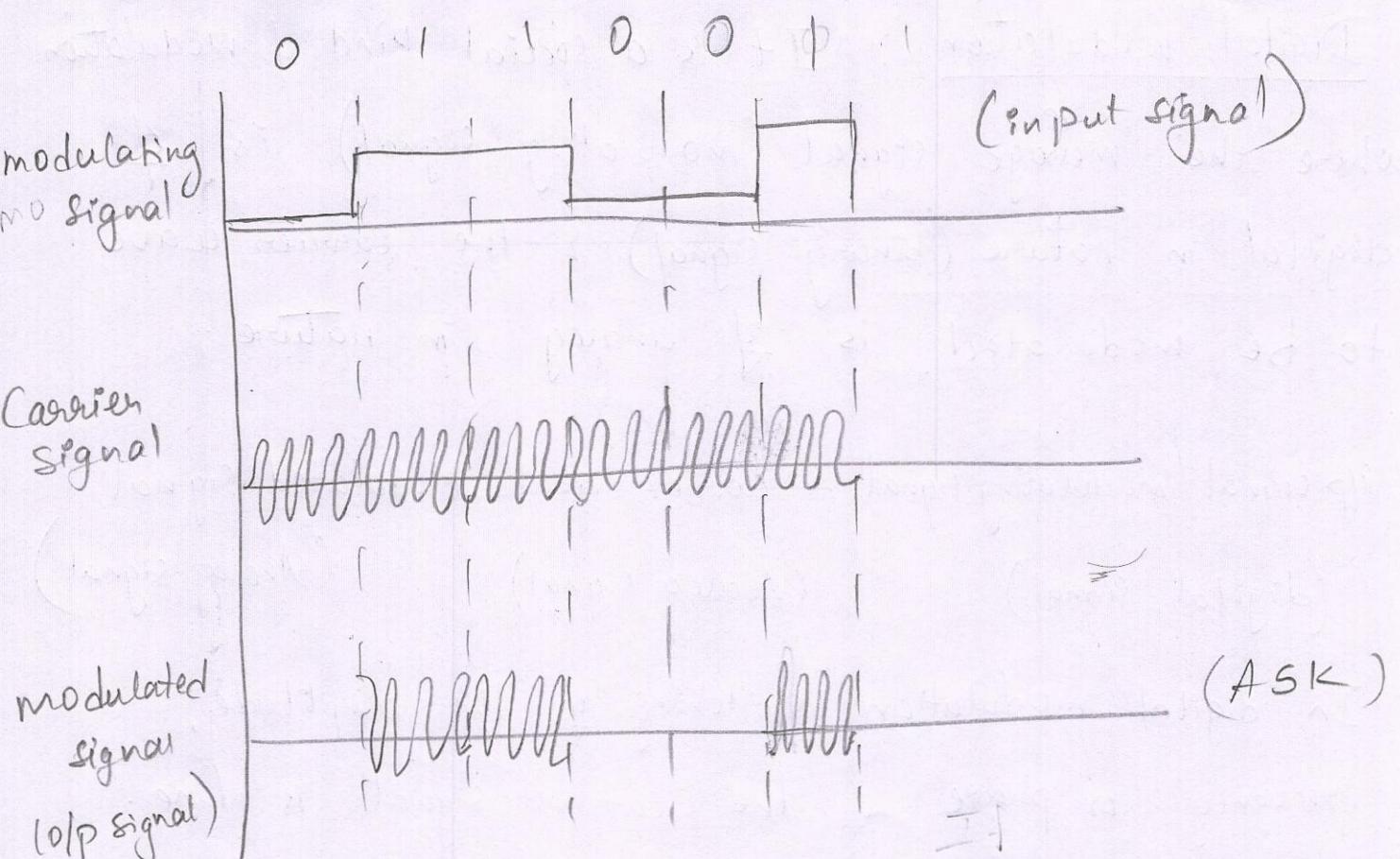
Phase modulated signal



② Digital modulation : It is a special kind of modulation where the message signal (modulating signal) is of digital in nature (binary signal) & the carrier wave to be modulated is of analog in nature.

- In digital modulation, switching of the amplitude, frequency or phase of the carrier signal is done.
 - Digital modulation techniques:
 - ASK
 - PSK
 - FSK
 - ASK, PSK, FSK are analogous to AM, PM, FM resp.
 - The only difference is that the modulating signal is digital in ASK, PSK, FSK & analog in AM, PM, FM.

a) Amplitude shift keying: In ASK, the amplitude of the carrier wave is changed according to the digital input signal (modulating signal).



If i/p data = 0 \rightarrow No amplitude in o/p signal
 data = 1 \rightarrow amplitude of carrier wave is propagated.

⑤ Frequency Shift Keying :- In FSK, the frequency of the carrier wave is changed according to the digital i/p signal (modulating signal).

