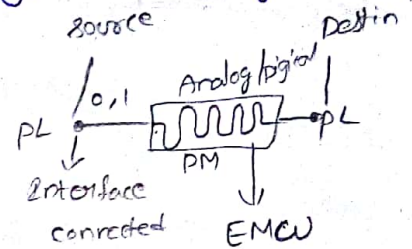
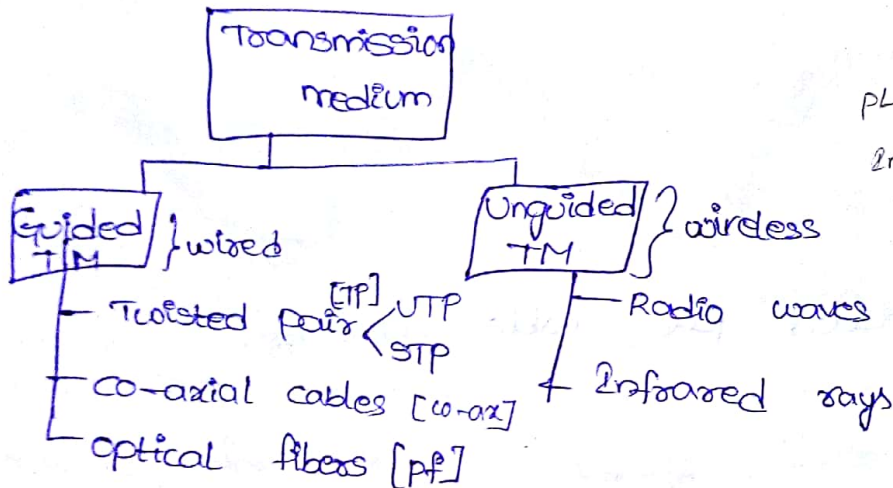


UNIT-2

Physical Layer

Transmission Medium / physical Medium / communication Medium:-

- * physical path b/w transmitter and receiver.
- * Repeaters or amplifiers may be used to extend the length of the medium.
- * Communication of electromagnetic wave is guided (or) unguided.



UTP - unshielded Twisted pair

STP - shielded Twisted pair

Digital Transmission Media Bit Rates:-

frequency is measured in terms of Hz

Digital Transmission (DTS) System	Bit rate	Observation _s
Telephone twisted pair	33.6 Kbps	4 kHz telephone channel.
Ethernet over twisted pair	10 Mbps	100 meters over unshielded twisted pair.
Fast ethernet over twisted pair	100 Mbps	100 meters using several arrangements of unshielded twisted pair
Cable modem	500 Kbps to 4 Mbps	shared CATV return channel.
ADSL over twisted pair (Asymmetric Digital Subscriber line)	64-640 Kbps in bound, 1.536-6.144 Mbps outbound.	uses higher frequency band and coexists with conventional analog telephone signal, which occupies 0-4 kHz band.
Radio LAN in 2.4 GHz band	2 Mbps	IEEE 802.11 wireless LAN.
Digital radio in 2.8 GHz band	1.5-45 Mbps	5 km multipoint radio link.

Optical fiber transmission system	2.4 - 9.6 Gbps	Transmission using one wavelength
optical " " "	1600 Gbps and higher	multiple simultaneous wavelengths using wavelength division multiplexing.

11/12/18

Twisted pair:-

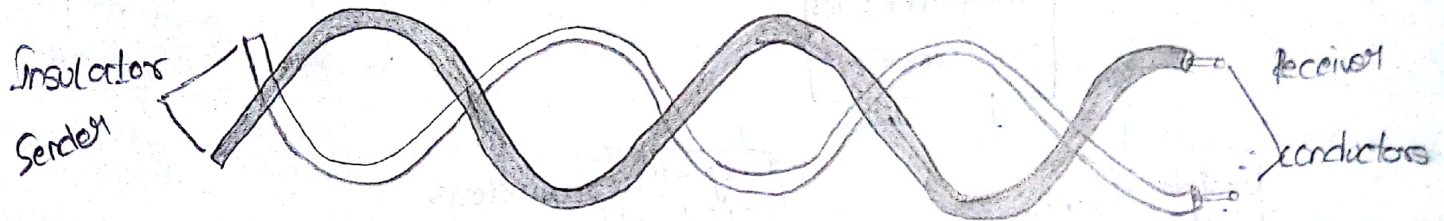


Fig:1 Twisted pair cable structure.

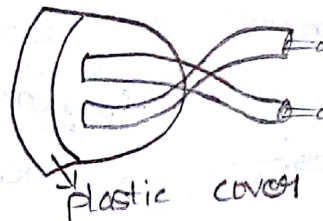


Fig:1(a):- Unshielded Twisted pair (UTP)

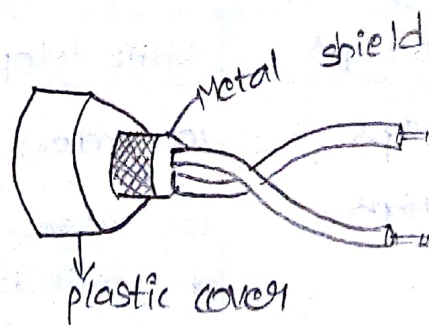


Fig:1(b):- shielded Twisted pair (STP)

* A Twisted pair is provides a physical path between transmit and receiver to carry signals physically.

* A Twisted pair is generally unshielded twisted pair.

* A Twisted pair cable is consisting two copper wires;

* one copper wire is using for signal transformation from sender to receiver where as another copper wire is used for the purpose of ground Reference.

* Basically a twisted pair one end is attached with insulator and other end is connected to conductor. Most frequently used twisted pair is unshielded twisted pair (UTP) in telephone lines and ethernet LAN. for voice and video signals transformation.

* Shielded twisted pair is another type of twisted pair which is designed by IBM and most specifically used in satellite communication where as STP connectors are more expensive than UTP connector.

* The examples for "RJ-45 Female" these are UTP connectors
"RJ-45 Male"

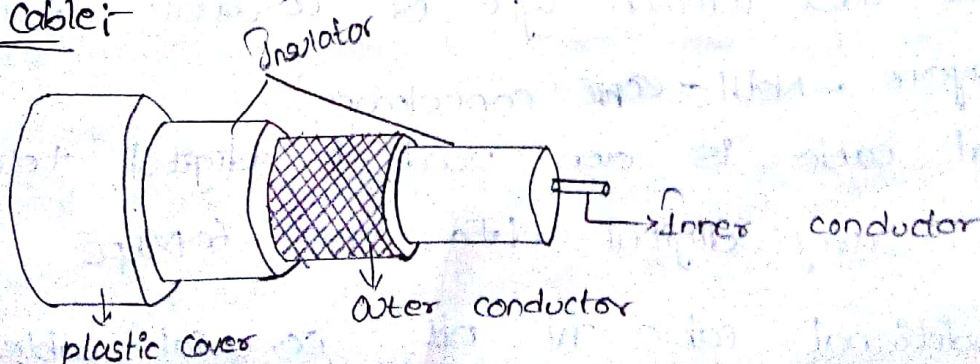
* In STP transmission medium the Insulator of copper conductor covered by metal shield which is protected by plastic cover.

* In STP Metal shield (or) Metal foil (or) braided cover is protects signals without effecting noise &

* The twisted pair cables are twisted together to implement efficient communication path b/w transmitter & Receiver if the two wires of twisted pair are connected parallelly then there will be created noise and cross talks.

13/12/18

Co-axial Cable:-



type of

* Co-axial cable is a specified transmission medium which is able to provide physical path between transmitter & receiver.

* Co-axial cable is consisting a copper conductor internally and out covered by another copper conductor which are insulated with plastic cover.

* These co-axial cables are designed to transport signals via analog telephone n/t which could carry 10,000 voice signals at a time.

* Co-axial cables are categorised into two types depending on capacity.

	category	Impedance	use
Type-1 →	RG-59	75 Ω	cable TV
Type-2 →	RG-58	50 Ω	Thin Ethernet
	RG-11	50 Ω	Thick Ethernet.

* As specified in the above table these are co-axial cables classified into two types 1. 75 Ω

2. 50 Ω

* RG is expanded as Radio Government.

* connect co-axial cable devices we need co-axial cable converters. The most common type of co-axial cable connector is BNC. (Bayone - Neill - ~~con~~ Concelman)

* co-axial cable is even used in digital telephone n/t and i carry digital data upto 60Mbps

* In traditional cable TV n/t co-axial cables are

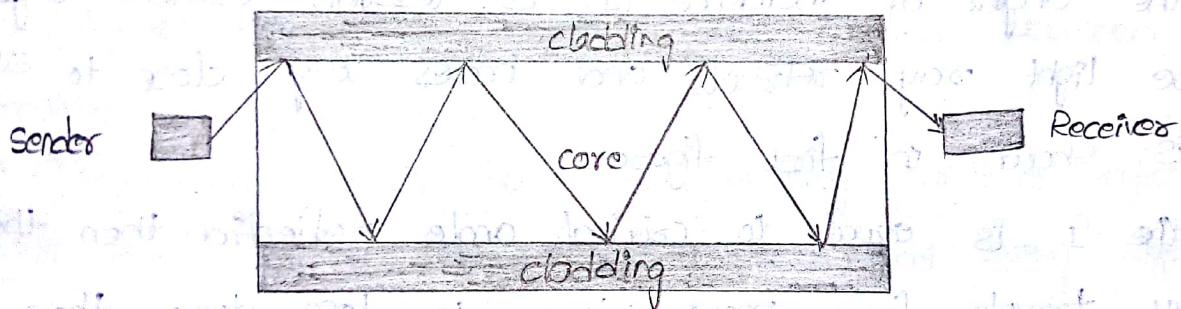
used but however in metropolitan cities co-axial cables are replaced by fiber optic lines because of high speed data transfer.

* The another common application of co-axial cable is used in ethernet.

* Thin ethernet is supporting for digital transmission of data using 10 base 2 by RG-58; 50Ω co-axial cable, this can transmits the data at 10Mbps with a range of 185 mts.

* The Thick ethernet is supporting for digital transmission of data using 10 base 5 by RG-11; 50Ω co-axial cable and this can transmits the data at 10Mbps with a range of 500mts

Fiber optic cables:-



* In the types of transmission medium of co-axial cable, twisted pair cable accepts and transports the signals in the form of electric current where as in optical fiber cables accepts and transports the signal in the form of light signal.

* An optical fiber cable is connected between the two physical layers of source and destination systems which can provides the physical path to carry the data in the form of light waves.

* An optical fiber cable is made of glass (or) plastic which can be able to explore through various aspects of light. To understand the transmission medium of optical

fiber we need to understand first the light wave propagation mode and the incidence of critical angles.

* The optical fiber cable is consisting the outer cover of cladding material and internally through the core the light waves are propagated internally using different propagation modes of core material.

* Optical fiber cables projects light ray, which can travel at different density through the core by changing the ray directions in the below three figures there is explain how light ray direction changes from more dense to less dense of substance.

* If the angle of incidence (i) is less than critical angle then the light ray refracts and moves very close to surface which is shown in first figure.

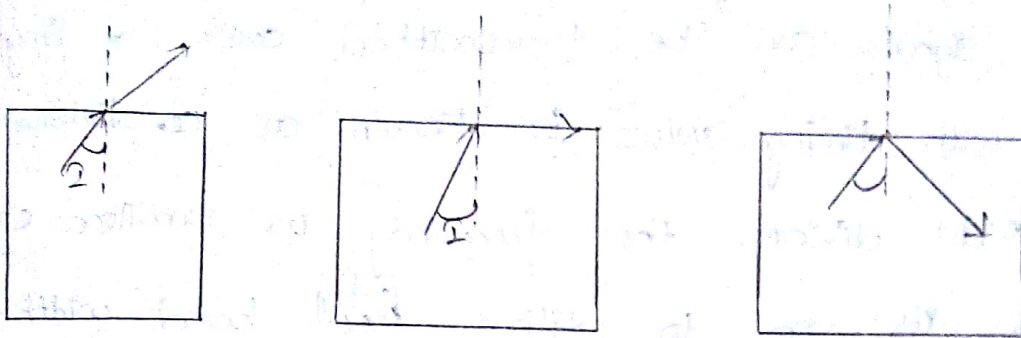
* If the i is equal to critical angle reflection then the light ray travels from more dense to less dense then the light ray bends along with the interface.

* If the i is greater than critical angle. Reflection then the light ray travels from more dense to less dense then the light ray travels towards critical angle with reflection.

* Generally a critical angle Reflection (CAR) is a property of substance and it can change depending on different substances.

* The light ray through optical fiber is propagated depending on the type of mode. The mode is may be single mode or multi mode through this mode only the beam of light

source can be travel. comparatively the all available guided transmission mediums the optical-fibers are capable of high data transfers for long distances.



Multiplexing:-

* Multiplexing is a technique which is applied on physical medium to share physical path among multiple nodes to utilize band width efficiently. Multiplexing technique is used by many different analog and digital streams to share physical medium between multiple computers.

* Multiplexing divides the high capacity medium logically and assigns the require frequencies to each and every system simultaneously. Multiplexing mechanism are used at the side of multiple senders who are try to send over a single medium can be implemented by a device known as multiplexer and the signals received by demultiplexers at the other end of physical medium by receivers.

* The physical medium sharing can be done based on following parameters.

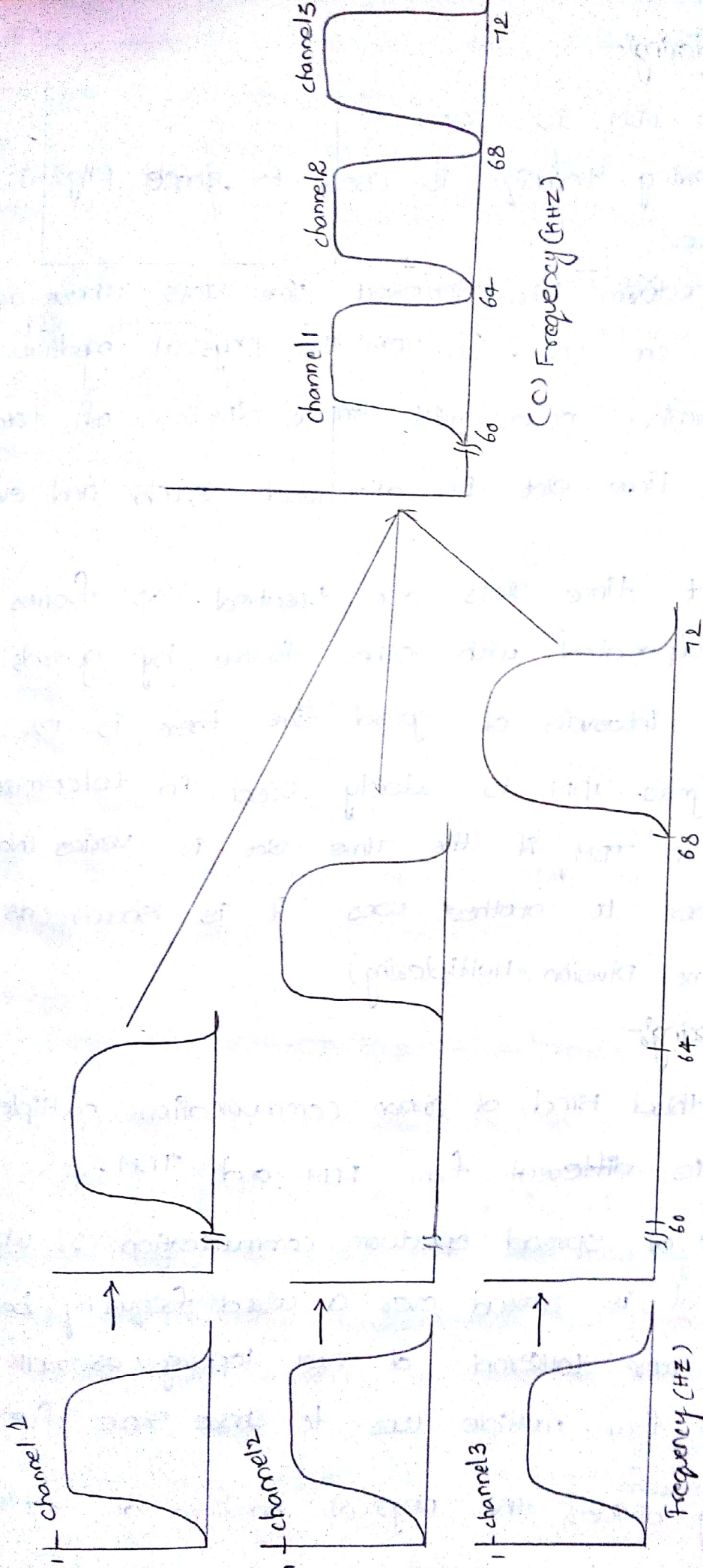
a. physical medium sharing is done based on frequencies among multiple users these known as frequency division multiplexing.

* The physical medium capacity is divided based on the timing values where as each and every time slot is assigned to a specific system is known as time division multiplexing.

* Multiple data signals can be transmitted over a single frequency along with timing values is known as code division multiplexing. FDM divides the frequency in smaller channels but CDMA allow its users to utilize ~~free~~^{full} band width at all timing slot.

Frequency Division Multiplexing:

* Frequency division multiplexing is a pure analog technology which is introduced and use to the first generation of communication. FDM carries and divides the spectrum in two logical channels and allocates specific frequency each and every user independently and can provide exclusive access to the users. All channels are divided depending on frequency and 'binaries' can be transmitted without overlapping with each other. Channels are separated by guard bands. Guard band is a frequency which is not used by either channel; which can be logically separates each and every user channel frequency without interfering by others.



(c) Frequency (kHz)

Time Division Multiplexing:-

- * An alternative to FDM is TDM.
- * TDM is a multiplexing technique used to share physical medium among computers.
- * TDM divides spectrum into different time slots where each is assigned to one user. In TDM the physical medium is shared among various nodes with logical division of total time and a fixed time slot is allocated each and every system.
- * In TDM different time slots are treated as frames so each frame is separated with other frames by guards because of small intervals of guard time there is no overlapping b/w signals. TDM is widely used in telephone and cellular N/T. In TDM if the time slot varies (not fixed) from one user to another user it is known as STDM (Statistical Time Division Multiplexing).

Code-Division Multiplexing:-

- * CDM means a third kind of communication multiplexing mechanism. It is different from FDM and TDM.
- * CDM is a form of spread spectrum communication in which a narrow band signal is spread over a wider frequency band. This can make it more tolerant of over lapping, as well as allows multiple signals from multiple users to share some frequency bands.
- * CDM is basically divides the physical medium at required time slot frequency band accessibility.

*CDM allows to transfer each station over the entire frequency spectrum at all the time.

*In CDM multiple stations can transfer signals and utilize full band width at any allocated time slots.

*CDM is able to extract desired signal effectively than TDM & FDM.

*CDM is used by cable n/t and satellite communication n/t.