Computer & Communication

Q1 What is Primary Communication Model? Draw its basic block diagram and explain each component.   [2007, 2008, 2009, 2010, 2011, 2013, 2019]

Ans: – A model can be defined as a visual presentation that identifies, classifies and describes various parts of a communication system.

One of the earliest models of communication that introduced was Claude Shannon's Model. This was introduced in 1948. This laid the foundation for the different communication models that we have today.

Components of Communication Model

1) **Sender (Transmitter)**: – Anyone or anything that initiates the message.
2) **Receiver**: – Anyone or anything that receives the message.
3) **Message**: – Piece of information.
4) **Medium (Channel)**: – A path by which message is transmitted between sender and receiver.
5) **Acknowledgement**: – Confirmation of receipt of message by receiver, sent back to sender.
6) **Feedback**: – Response to the message from receiver.
7) **Noise**: – Anything that interferes with the transmission of message.

Shannon's Communication Model

Source → Transmitter → Channel → Receiver → Destination ; Noise → Channel

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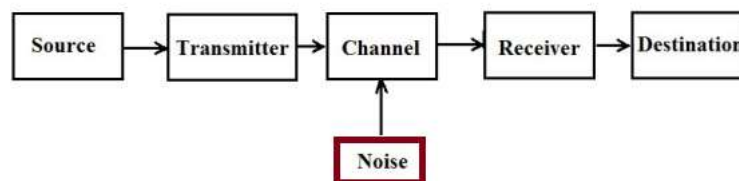
Q2 Explain Data Communication.   [2017]

Ans: – Exchange of information from one place to another place is called Communication. Communication is a Latin word which means 'to share'. It is the sharing of information between different individuals. It includes the sharing of ideas, concepts, imaginations, behaviours and written content.

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**Q3** Explain different types of Communication.   [2003, 2012, 2016]

Ans: – Communications are of following types –

1) **Written Communication**: – In the form of emails, letters, reports, memos and various other documents.
2) **Oral Communication**: – This is either face-to-face or over the phone/video conferencing etc.
3) **Non–Verbal Communication**: – It performs by using gestures or even simply body movements.

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Q4 What is Data Transmission? Explain its different types.

Ans: – It is the movement of data in the form of bits between two or more digital devices through physical medium.

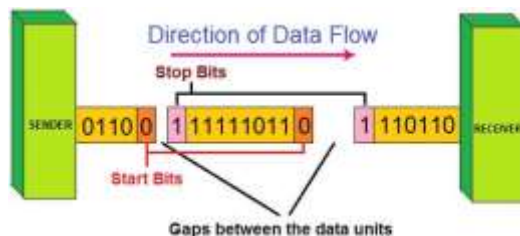Data Transmission divided into two parts –

Data Transmission → Serial Transmission, Parallel Transmission ; Serial Transmission → Synchronous, Asynchronous
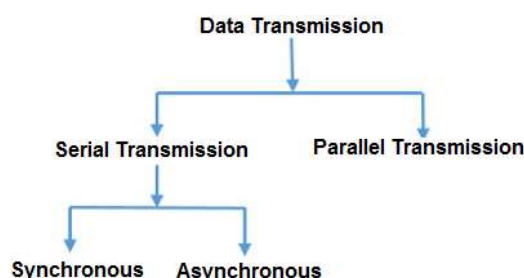
1) **Serial Transmission:** – When data is sent or received using serial data transmission, the data bits are organized in a specific order, since they can only be sent one after another. It a reliable data transmission method because a data bit is only sent if the previous data bit has already been received.
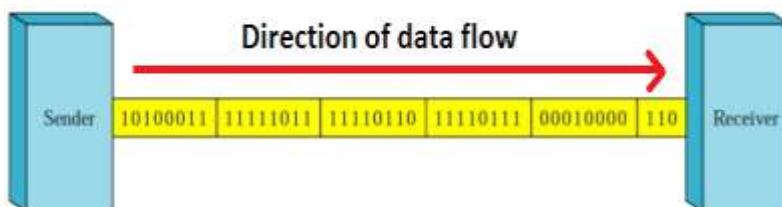

Serial Transmission of 8-bit Data
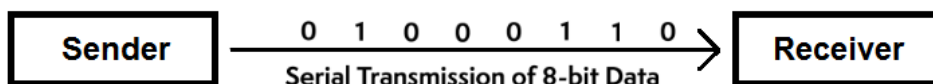
Serial Transmission also divided into two parts –

a) **Asynchronous Serial Transmission:** – Data bits can be sent at any point in time. Stop bits and start bits are used between data-bytes to synchronize the transmitter and receiver. The time between sending and receiving data bits is not constant, so gaps are used to provide time between transmissions.


   The advantage of using the asynchronous method is that no synchronization is required between the transmitter and receiver devices.

b) **Synchronous Serial Transmission:** – Data bits are transmitted as a continuous stream in time a master clock. Start bits, Stop bits, and gaps are not used. This means that data moves faster. It is more expensive than asynchronous method.

2) **Parallel Transmission:** – When data is sent using parallel data transmission, multiple data bits are transmitted over multiple channels at the same time. This means that data can be sent much faster than using serial transmission methods.

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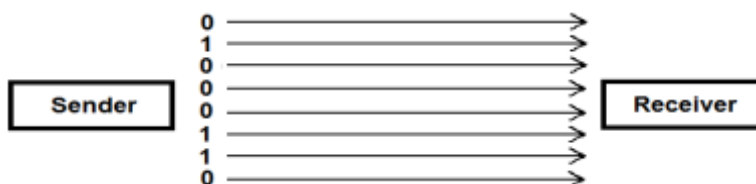
Q5   What is the difference between Data Communication and Data Transmission?

Ans: – Exchange of information in both directions (Sender to Receiver and Receiver to Sender) called Data Communication. It depends on Duplex Mode.

   Transfer of information in single direction (Sender to Receiver) called Data Transmission. It depends on Simplex Mode.

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Q6   What is Tele–Communication?

Ans: – Telecommunications refers to the exchange of information by electronic and electrical signals (called carrier waves) over a significant distance. It is a vast range of information–transmitting technologies such as mobile phones, land lines and broadcast networks.

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[2]

Q7   What is Transmission Medium? Explain its different types.   [2006, 2011]

Ans: –   In data communication terminology, a Transmission Medium is a physical path between the transmitter (sender) and the receiver. It is the channel through which data is sent from one place to another.

Transmission Media (medium) is broadly classified into the following types –
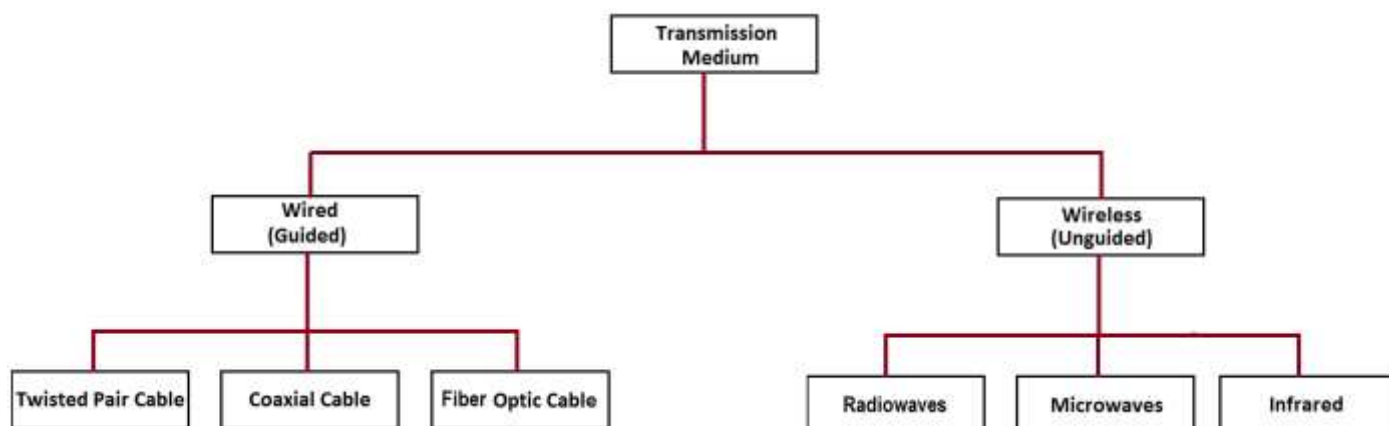
1) **Guided Medium**: – It is also referred to as Wired or Bounded Transmission Medium. In which signals being transmitted in a narrow pathway by using physical links like Twisted Pair Cable, Coaxial Cable and Fiber Optic Cable.

   Twisted–Pair and Coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current. Optical Fiber is a cable that accepts and transports signals in the form of light.

   i) **Twisted Pair Cable**: – This cable consists of two insulated copper wires twisted around each other. This cable is the most commonly used and is cheaper than others. It is light weight, cheap, can be installed easily and they support many different types of network. Twisted Pair Cables are of two types – Unshielded and Shielded Twisted Pair Cable

Unshielded Twisted Cable

Shielded Twisted Cable
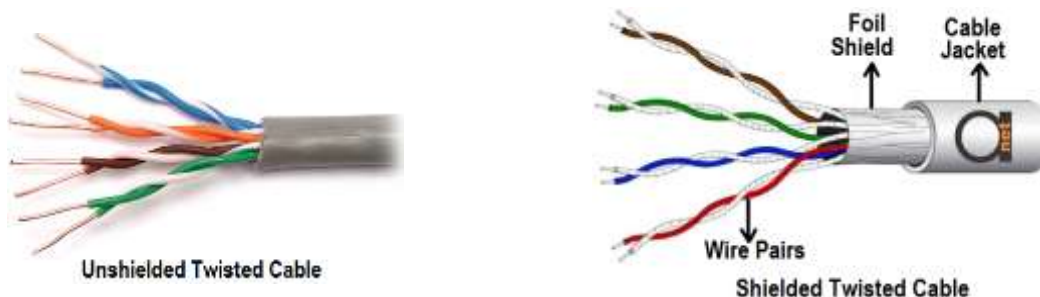
   ii) **Coaxial Cable**: – It contains two conductors that are parallel to each other. Copper is used in this as center conductor which can be a solid wire. These are more expensive than Twisted Pair Cables but perform better.

   It is used in long distance telephone lines. It transmits digital signals at a very high rate of 10 Mbps. It supports much higher noise immunity.
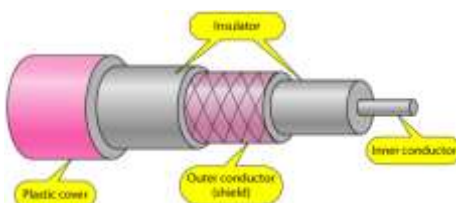
   iii) **Fiber Optic Cable**: – These cables are made up of plastic or glass and are about as thin as human hair. Optical cables are used to transfer data signals in the form of light signals up to hundreds of miles. Optic fibers are used to connect servers.

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These cables are highly durable and offer excellent performance but are expensive. These cables are not affected by any outer interference.

2) **Unguided Medium**: – It is also referred to as Wireless or Unbounded Transmission Medium. Data transfer in the form of electromagnetic waves. These media are not bounded by physical geography.

Nowadays wireless communication is becoming popular. Wireless LANs are being installed in office and college campuses. Unguided medium also divided into following sub–categories –

i) **Radio waves**: – Electromagnetic waves ranging in frequencies between 3 KHz and 1 GHz are normally called radio waves.

Radio waves are omnidirectional (send out signals in all directions). When an antenna transmits radio waves, they are propagated in all directions. This means that the sending and receiving antennas do not have to be aligned.

Application of Radio waves: –

a) The omnidirectional characteristics of radio waves make them useful for multicasting in which there is one sender but many receivers.

b) AM and FM radio, television, cordless phones and paging are some examples which uses Radiowaves.

ii) **Microwaves**: – Electromagnetic waves having frequencies between 1 GHz and 300 GHz are called Microwaves. Microwaves are unidirectional. When an antenna transmits microwaves, then sending and receiving antennas need to be aligned.

There are 2 types of Microwave Transmission –

a) **Terrestrial Microwave**: – Terrestrial Microwave Towers are used for communication over a large geographical area. In this communication, transmission is done between its towers from which microwave signals forward and receives. When microwave signals are transmitted from a tower, due to earth's curvature, they do not reach upto receiving tower. This type of problem is called **Line of Sight Problem**.

b) **Satellite Microwave**: – These are positioned 36000 Km above the equator with an orbit speed that exactly matches the rotation speed of the earth. A satellite is an amplifier or repeater that receives information from one location on the earth, repeats the data and sends it to one or more receiving location on the earth.

iii) **Infrared**: – It is also an unguided communication medium. It uses a red light to transmit information. The common application of is in television with a remote control.

Infrared waves are unreliable for communication outside a building as the sun rays may interfere with the infrared waves.

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Q8 Explain advantages and disadvantages of wired communication and wireless communication systems. [2007, 2012]

Ans: – **Wired Communication System**

Advantages: –

1) The network offer higher data rate and hence fast transfer of information.
2) It is simple to configure.
3) Cables offer higher bandwidth.
4) Insulation used to protect against interference (disturbances).

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5) The wired connection is more secure unless someone breaks the connection.
6) It offers higher reliability and better quality of service.

Disadvantages: –
1) Wired connection does not provide mobility during usage.
2) Installation of wired network is very difficult.
3) It is difficult to troubleshoot in faulty situation.
4) It requires more time to install.
5) It requires devices such as amplifiers, regenerators, repeaters, hubs and switches in order to extend the coverage distance.

Wireless Communication System

Advantages: –
1) Wireless frequency penetrates the walls therefore wireless networks are easy to install anywhere.
2) Wireless networks are easy to install and easy to maintain compare to messy wired networks.
3) The great benefit of wireless communication is mobility of usage.
4) The wireless communication devices are available at very low cost.
5) Wireless network planning is very easy compare to wired network.

Disadvantages: –
1) Wireless signals can be easily hacked.
2) Wireless networks require careful radio frequency planning at the beginning of installation.
3) Wireless networks also have an increased chance of jamming and interference.
4) While wireless networks offer great flexibility in offices where we can work from anywhere, but it becomes difficult to manage the employees.
5) Setting up a wireless network can sometimes be difficult for people who are not experienced with computers.

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Q9   Prepare comparison table of different types of communication medium.   [2011]
Ans: –

SN	Guided Medium	Unguided Medium
1	Physical medium required for data communication.	Physical medium not required for data communication.
2	It is also known as Wired or Bounded medium.	It is also known as Wireless or Unbounded medium.
3	It provides direction for data communication.	It does not provide direction for data communication.
4	Data communication covers limited distance.	Data communication covers unlimited distance.
5	Not possibility of 'Line of Sight Problem'.	Possibility of 'Line of Sight Problem'.
	Ex: – Twisted Pair Cable, Coaxial Cable, Fiber Optic Cable	Ex: – Radiowave, Microwave, Infrared, Wi–Fi

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Q10   What is the function of Fiber Optic Cable? Mention its advantages.   [2020]
Ans: –   Fiber Optic Cables are used to transfer data signals in the form of light signals up to hundreds of miles. These cables are made up of plastic or glass and are about as thin as human hair.

Advantages: – Advantages of fiber optic cable are as follows –
1) The optical fiber cables are cheaper to transport and easier to install than metal cables.
2) The optical fiber cables are very strong and flexible.
3) The optical fiber cables are lighter and smaller.

4) Optical fiber is well protected from external interference.
5) It has greater bandwidth.
6) Resistances to high temperature.
7) They can carry large amount of information in either digital or analog form.
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Q11   What is communication speed? How is it measured?
Or
What is data transmission rate?   [2020]
Or
Explain data communication unit.   [2019]
Ans: –   Communication speed is the amount of data bits that can be transmitted via a given communication channel in a given unit of time. It exactly shows that how much stuff that we can send through a connection.

In telecommunication and electronics, Bit Per Second (BPS) or Baud is a common unit to measure the speed of communication over a data channel.
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Q12   What is Bandwidth?   [2015, 2018, 2020]
Ans: –   The bandwidth of a signal is defined as the difference between the upper and lower frequencies of a signal generated.
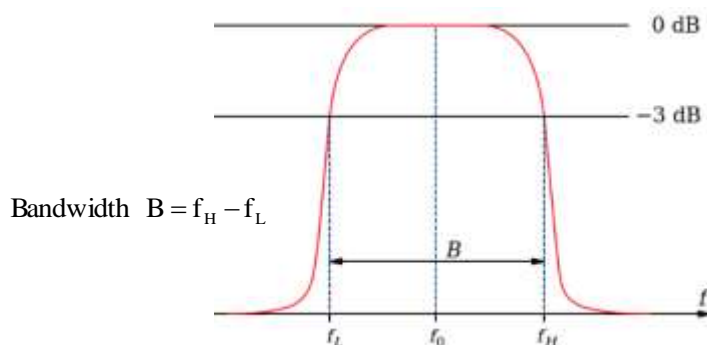
Bandwidth $B = f_H - f_L$

As seen from the above representation, Bandwidth (B) of the signal is equal to the difference between the higher frequency (fH) and the lower frequency (fL). Bandwidth is measured in kilohertz (KHz), megahertz (MHz), gigahertz (GHz), terahertz (THz).
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Q13   Explain the different types of Bandwidth.
Ans: –   The Data–Handling Capacity of media is referred to as its Bandwidth. Bandwidth is the range of frequencies that is available for the transmission of data. Types of bandwidth are –
1) **Narrow Band Line**: – These media communicate data with relatively slow speed. Ex. – Telegraph lines.
2) **Voice Band Line**: – These media are faster than narrow band. Ex. – Telephone lines.
3) **Broad Band Line**: – Also called Wide Band Line. These media transmit large volumes of data at a high speed via microwave, satellite, coaxial cable, and fiber optic cable.
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Q14   What is Transponder?   [2014]
Ans: –   A wireless communications device usually attached to an artificial satellite known as Transponder. A Transponder receives and transmits radio signals at a prescribed higher frequency range. Transponder also removes outer disturbances from the signal.
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Q15   Explain Data Transmission Modes or Data Communication Modes.   [2013]
Ans: –   Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. It is also called Communication Mode. These mode, directs the direction of flow of information.

There are two types of transmission modes –

Data Transmission Mode

Simplex   Duplex

Half-Duplex   Full-Duplex
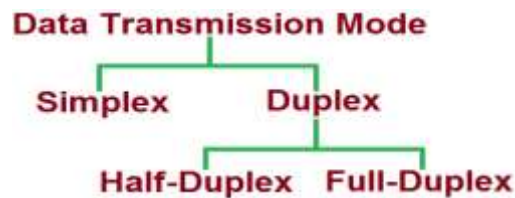
1) **Simplex Mode**: – In this type of transmission mode, data can be sent only in one direction i.e. communication is unidirectional. We cannot send a message back to the sender.
   Example: –
   a) Television broadcasting.
   b) Transmission of data from keyboard to CPU.
   c) Television and remote.
   d) Transmission of signal towards Pager.

DIRECTION OF DATA

KEYBOARD   COMPUTER

   Advantage: –
   a) Fast speed of transmission.
   b) Low cost of transmission.
   c) Transmission without collision.

   Disadvantage: –
   a) Not suitable for data processing applications.
   b) Receiver cannot send any type of response towards sender.

2) **Duplex Mode**: – Duplex data transmission means that data can be transmitted in both directions on a signal carrier. It is divided into two sub parts –
   i) **Half Duplex Mode**: – Half Duplex data transmission means that data can be transmitted in both directions on a signal carrier (medium), but not at the same time.
      Hence Half Duplex transmission implies a bidirectional line (one that can carry data in both directions) but data can be sent in only one direction at a time.
      Example: –
      a) Transmission of fax.
      b) Transmission of E–Mail on Internet.
      c) Data transmission through walkie–talkie.

Data transmission in both directions
but not at the same time

COMPUTER 1   COMPUTER 2
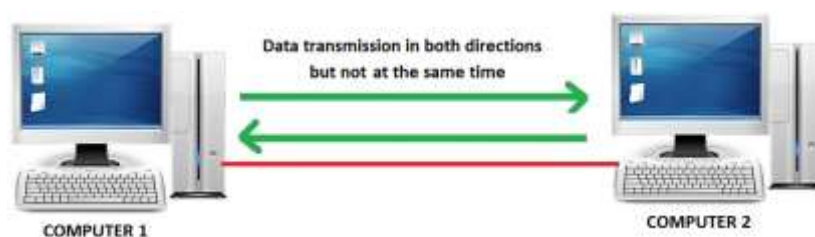
      Advantage: –
      a) More reliable as compared to Simplex Transmission.
      b) Fast as compared to Full Duplex.
      c) Suitable for small data processing applications.
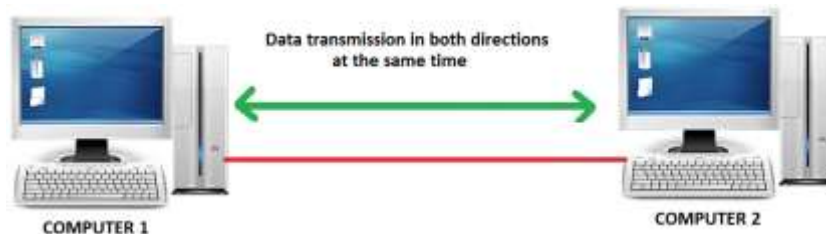   d) Economical as compared to Full Duplex.

Disadvantage: –
   a) Not suitable for large data processing applications.
   b) Transmission speed is slower as compared to Simplex.

ii) **Full Duplex Mode**: – In Full Duplex system we can send data in both the directions as it is bidirectional at the same time.

Example: –
   a) Telephone Network.
   b) Computer Network.
   c) Example of Highway.

Advantage: –
   a) More reliable as compared to Simplex and Half Duplex Transmission.
   b) Suitable for large data processing applications.
   c) There is no waiting state in this type of transmission.

Disadvantage: –
   a) Required traffic control.
   b) Possibility of collision.

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Q16   Compare Simplex and Duplex.   [2006]

Ans: –

SN	Simplex	Duplex
1	Communication is unidirectional.	Communication is two–directional.
2	A sender can send data but, cannot receive.	A sender can send as well as receive the data.
3	No possibility of data collision.	Possibility of data collision.
4	Not required traffic control	Required traffic control
	Ex:– Television, Remote, Speaker, Monitor, Keyboard etc.	Ex:– Fax Machine, E-Mail, Walkie–Talkie, Computer Network, Mobile Network etc.

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Q17   What is MODEM? Where is it used and why?   [2020]

Ans: –   MODEM stands for MOdulation DEModulation. MODEMS are of two types –
   1) Internal Modem (Fixed with computer)
   2) External Modem (Connect externally to computer).
       MODEM is an Input–Output device. It is used in computer network. It is a device that converts Digital Signal into Analog Signal and Analog Signal into Digital Signal.

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Q18   What is Modulation?   [2016]

Ans: –   Conversion of Digital Signal into Analog Signal called Modulation. It is performed by MODEM.

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Q19   What is Demodulation?   [2015]

Ans: –   Conversion of Analog Signal into Digital Signal called Demodulation. It is performed by MODEM.

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Q20   What is Modulation? Explain different types of Modulation.   [2015]

Ans: –   Modulation is the process of converting low–frequency information into high–frequency radio waves (called carrier wave).

Any signal to be transmitted consists of a number of varying frequencies and cannot be directly transmitted by the transmitter and is therefore super–imposed with a carrier signal before being transmitted. This is the 'Modulation' of the signal.

There are 3 basic types of Modulation –

1) **Amplitude Modulation:** – A type of modulation where the amplitude of the carrier signal is modulated (changed) in proportion to the message signal while the frequency and phase are kept constant.

2) **Frequency Modulation:** – A type of modulation where the frequency of the carrier signal is modulated (changed) in proportion to the message signal while the amplitude and phase are kept constant.

3) **Phase Modulation:** – A type of modulation where the phase of the carrier signal is modulated (changed) in proportion to the message signal while the amplitude and frequency are kept constant.

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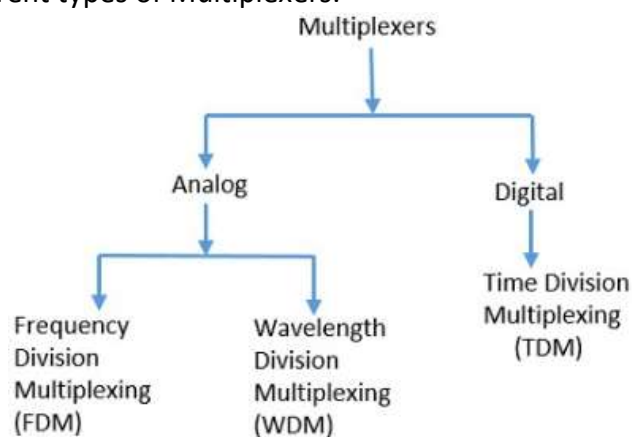
Q21   What is Multiplexing?

Or

What is Multiplexer?

Ans: –   Multiplexing is the process of combining multiple signals into one signal, over a shared medium. The device that does multiplexing can be called as a Multiplexer or MUX.

Wavelength Division Multiplexing (WDM)

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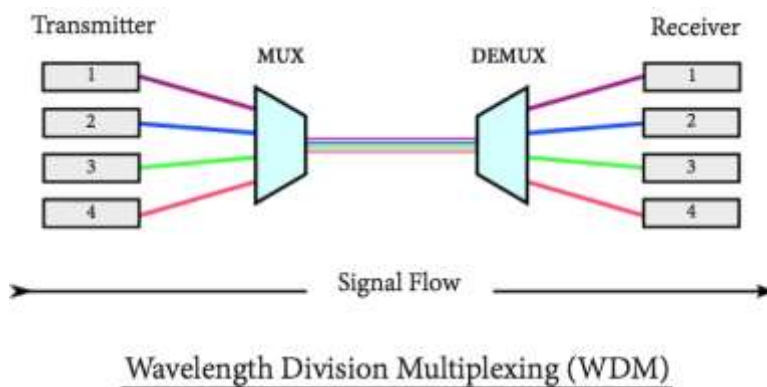
Q22   Name the different types of Multiplexers.

Ans: –

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Q23   What is Firewall? Write its uses.   [2020]

Ans: –   Firewall is a software program that prevents unauthorized access. We can implement a firewall in either hardware or software form. Firewall monitors all incoming and outgoing

traffic and examines each message and blocks those that do not meet the specified security criteria. A firewall is also useful for allowing remote access to a private network through secure logins.

Basically, firewalls need to be able to perform the following tasks –

1) Defend resources.
2) Validate access.
3) Manage and control network traffic.
4) Record and report on events.
5) Act as an intermediary.

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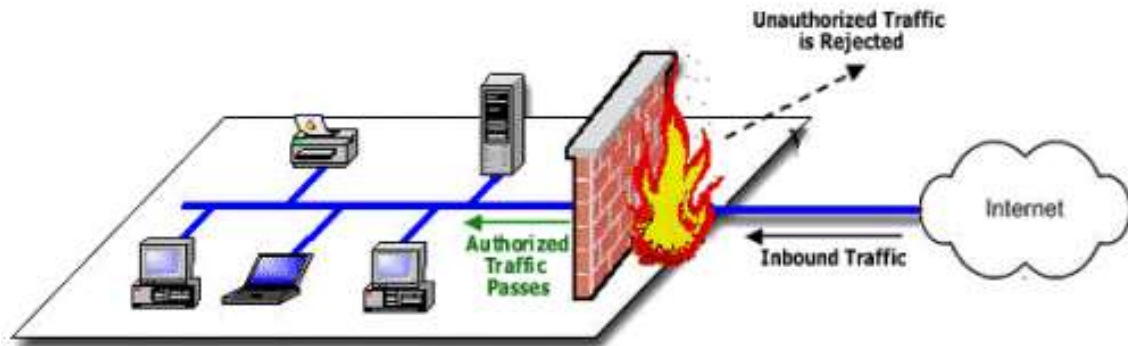
Q24   What is OSI Model?

Ans: –   OSI (Open Systems Interconnection) is reference model for how applications can communicate a network. It is a logical layout that defines network communication used by computer to interconnection with other computers. The OSI Model was developed by the International Organization for Standardization (ISO) in 1978.

The model is broken into seven subcomponents or layers –

1) **Physical Layer:** – The Physical layer is also called as the Layer–1. Here are the basic functionalities of the Physical Layer –
   i)   Responsible for electrical signals, light signal, radio signals etc.
   ii)   Hardware layer of the OSI layer
   iii) Devices like repeater, hub, cables, Ethernet work on this layer

2) **Data Link Layer:** – The data link layer is also called as the Layer–2 of the OSI model. Here are the basic functionalities of the Data Link Layer –
   i)   Responsible for encoding and decoding of the electrical signals into bits.
   ii)   Manages data errors from the physical layer.
   iii) Converts electrical signals into frames.
   iv)   Devices like Switch work at this layer

3) **Network Layer:** – The Network layer is also called as the Layer–3 of the OSI model. Here are the basic functionalities of the Network Layer –
   i)   Switching and routing technologies work here.
   ii)   Creates logical paths between two hosts across the World Wide Web called as virtual circuits.
   iii) Routes the data packet to destination.
   iv)   Internetworking, error handling, congestion control and packet sequencing work at this layer.
   v)   Different network protocols like TCP/IP, IPX, AppleTalk work at this layer.
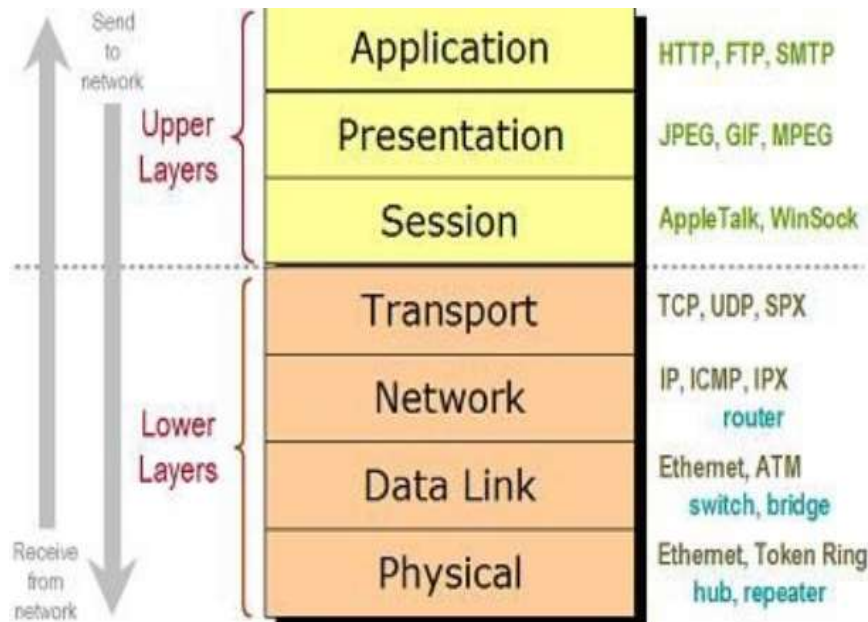
4) **Transport Layer:** – The Transport layer is also called as the Layer–4 of the OSI model. Here are the basic functionalities of the Transport Layer –
   i)   Responsible for the transparent transfer of data between end systems.
   ii) Responsible for end-to-end error recovery and flow control.
   iii) Responsible for complete data transfer.

5) **Session Layer:** – The Session layer is also called as the Layer–5 of the OSI model. Here are the basic functionalities of the Session Layer –
   i)   Responsible for establishment, management and termination of connections between applications.
   ii) The session layer sets up, coordinates, and terminates conversations, exchanges, and dialogues between the applications at each end.

6) **Presentation Layer:** – The Presentation layer is also called as the Layer–6 of the OSI model. Here are the basic functionalities of the Presentation Layer –
   i)   Responsible for data representation on computer screen.
   ii) Encryption and decryption of the data.
   iii) Layer 6 Presentation examples include encryption, ASCII, EBCDIC, TIFF, GIF, PICT, JPEG, MPEG, MIDI.

7) **Application Layer:** – The Application layer is also called as the Layer–7 of the OSI model. Here are the basic functionalities of the Application Layer –
   i)   Application layer supports application, apps, and end-user processes.
   ii) Quality of service.
   iii) This layer is responsible for application services for file transfers, e-mail, and other network software services.
   iv) Protocols like Telnet, FTP, HTTP work on this layer.

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Q25   What is transmission impairment (signal loss) in Data Communication?

Ans: –   In the data communication system, analog and digital signals go through the transmission medium. Transmission media are not ideal. There are some imperfections in transmission mediums. So, the signals sent through the transmission medium are also not perfect. These imperfections cause transmission impairment. These impairments degrade the quality of the signals.

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It means that signals that are transmitted at the beginning of the medium are not the same as the signals that are received at the end of the medium.

Causes of Transmission Impairment

1) **Attenuation: –** Whenever a signal transmitted through a medium over long distances, it loses its quality and strength. It is called Signal Loss or Attenuation. A signal which is transmitted during Attenuation called Attenuated Signal.

   For amplifying Attenuated Signal, we use Amplifier which provides us original frequency enabled signal. Attenuation measured by DB (Decibels) and represented by a negative value because it represents loss. Example –12 DB
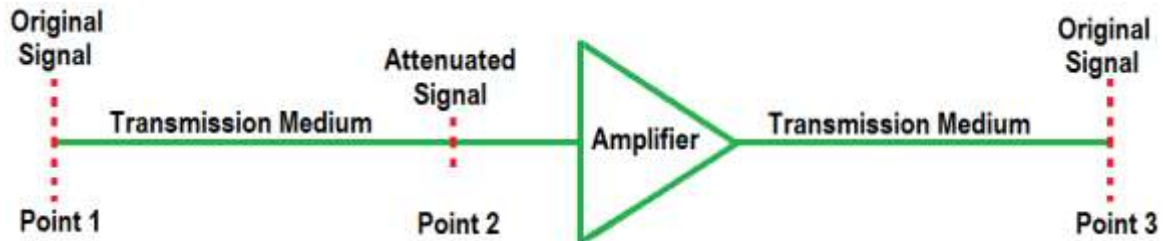
2) **Distortion: –** If a signal changes its form or shape, it is referred to as distortion. Signals made up of different frequencies. Therefore, different components have different delay in arriving at the final destination. So it provides Delay Distortion.
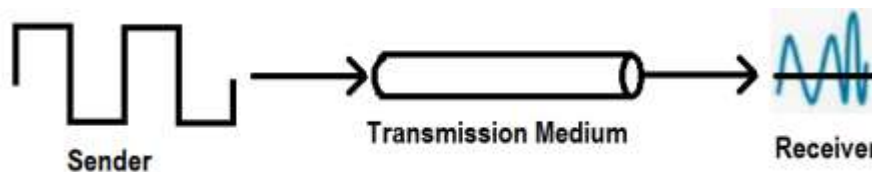
3) **Noise: –** There are some random or unwanted signals mix up with the original signal is called noise. Noises can corrupt the quality of original signals. Different types of Noises are –
   i) Induced Noise comes from sources such as motors and appliances.
   ii) Thermal Noise is movement of electrons in wire which creates an extra signal.
   iii) Crosstalk Noise is when one wire affects the other wire.
   iv) Impulse Noise is a signal with high energy that comes from lightning or power lines.

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Q26   Explain the following.

1) **Crosstalk: –** It is a type of interference (disturbance) caused by the electric or magnetic fields developed during transmission. Crosstalk affects the quality of signal during transmission.

2) **Transducer: –** A transducer is any device that converts any physical variable like force, movement etc to an electronic signal. For example, whenever we use our smartphone and select a value on its screen the processor of the phone converts the pressure on the screen due to our finger touch into a signal.

3) **Amplification: –** The process of increasing the amplitude of a signal is called "amplification". For example, whenever we speak on a mike, our voice is both amplified and audible at a farther distance. In this process, only the amplitude of the signal increases. There is no fundamental change to the original content of the signal.

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