1. (a) Define physical layer? Write down the categories of signals?

(b) Define channel capacity? Write down the two forms of Transmission media?

(c) Define Multiplexing? Describe briefly about the transmission Impairment of physical layer?

(d) Define switching? Write down the categories of switching?

Ans. to the the ques: No-01 (a)

physical layer: physical layer in the OSI model plays the role of interacting with actual hardware and signaling mechanism. Signals are two categories:

i) **Digital signals:** Digital signals are discrete in nature and represent sequence of voltage pulses.

ii) **Analog signals:** Analog signals are in continuous wave form in nature and represented by continuous electromegnetic waves.

Ans. to the ques. No-01 (b)

Channel capacity: The speed of transmission of information is said to be the channel capacity. We count it as data rate in digital world.

The media over which the information between two computer systems is sent, called transmission media. Transmission media comes in two forms:

i) Guided Media: All comunication wires/cables are guided media, such as UTP, coaxial cables, and fiber optics.

ii) Unguided Media: Wireless or open air space is said to be unguided media, because there is no connectivity between the sender and receiver.

Ans. to the ques. No - 01(c)

Multiplexing: Multiplexing is a technique to mix and send multiple data streams over a single medium. this are two types.
i) multiplexer ii) De-multiplexer.
When signals travel through the medium they tend to deteriorate. This may have many reasons as given:

i) Attenuation: for the receiver to interpret the data accurately, the signal must be sufficiently strong.

ii) Dispersion: As signals travels through the media, it tends to spread and overlaps.

iii) Delay distortion: signals are sent over media with pre-defined speed and frequency.

iv) Noise: Random disturbance or fluctuation in analog or digital signal is said to be Noise in signal.

v) Impulse: This noise is introduced because of irregular disturbances such as lightening, electricity, short-circuit, or faulty components.

Ans. to the ques. No - 01 (d)

Switching: Switching is a mechanism by which data/information sent from source towards destination which are not directly connected. Networks have interconnecting devices, which receives data from directly connected sources, stores data, analyze it and then forwards to the next interconnecting device closest to

the destination.
Switching can be categorized as:

i) Circuit switching.
ii) Message switching.
iii) Packet switching.

2. (a) Define Digital-to-Digital Conversion? Write down the ways of Digital-to-Digital conversion?

(b) Define line coding? Write down the categories of line coding?

(c) Define Block coding? Write down the steps of Block coding?

(d) Define Analog-to-Digital Conversion? Write down the steps of PCM?

Ans. to the ques. No - 02(a)

Digital-to-Digital Conversion: This section explains how to convert digital data into digital signals.

It can be done in two ways,

i) line coding.

ii) Block coding.

For all communications, line coding is necessary whereas block coding is optional.

Ans. to the ques. No - 02(b)

Line coding: The process for converting digital data into digital signal is said to be line coding.

line coding are three types:

i) Uni-polar Encoding:

Uni-polar encoding schemes use signals voltage level to represent

data. In this case, to represent binary 1, high voltage is transmitted and to represent 0.

ii) polar encoding:

polar encoding scheme uses multiple voltage levels to represent binary values these are 4 types:

1. polar NRZ.
2. Return to Zero.
3. Manchester
4. Differential Manchester.

iii) Bipolar Encoding:

Bipolar encoding uses three voltage levels, positive, negative and zero. Zero voltage represents binary 0 and bit 1. is represented by altering positive and negative voltages.

Ans. to the ques. NO - 02 (c)

Block Coding: To ensure accuracy of the received data frame redundant bits are used. For example, in even-parity, one parity bit is added to make the count of 1s in the frame even. This way the original number of bits is increased. It is called Block coding. Block coding involves three steps:

i) Division.

ii) Substitution.

iii) Combination.

After block coding is done, it is line coded for transmission.

Ans. to the ques. No - 02(d)

Analog-to-Digital conversion: Microphones create analog voice and camera creates analog videos, which are treated is analog data. Analog data is a continuous stream of data in the wave from whereas digital data is discrete. To convert analog wave into digital data, we use pulse code Modulation (PCM).

PCM is one of the most commonly used method to convert analog data into digital form. It involves three steps:

i) sampling.

ii) Quantization.

iii) Encoding.

3. (a) Define Sampling? Write down the difference between Quantization and Encoding?

(b) Define Transmission Modes? What types of modes in transmission?

(c) Define parallel Transmission? Difference between parallel and serial transmission?

(d) Define serial transmission? Write down the categories of serial transmissions?

Ans. to the ques. No-03 (a)

Sampling: The analog signal is sampled every T interval. Most important factor in sampling is the

rate at which analog signal is sampled.

Difference between Quantization and Encoding:

Quantization: sampling yields discrete form of continuous analog signal. Every discrete pattern shows the amplitude of the analog signal at that distance.

Encoding:

In encoding, each approximated value is then converted into binary format.

11010110 10110100 ... 11010101

Quantization ⟹ Encoding

Ans. to the ques. No-03(b)

Transmission Modes:

The transmission mode decides how data is transmitted between two computers. The binary data in the form of 1s and 0s can be sent. There are two different modes:

i) parallel.
ii) serial.

Ans. to the ques. No-03(c)

Parallel transmission: The binary bits are organized in-to groups of fixed length. Both sender and receiver are connected in parallel with the equal number of data lines.

Difference between serial transmission and parallel transmission:

Serial transmission: In serial transmission, bits are sent one after another in a queue manner. Serial transmission requires only one communication channel.
Serial transmission can be either asynchronous or synchronous.

parallel transmission: computers distinguish between high order and low order data lines. The sender sends all the bits at once on all lines. Because the data lines are equal to the number of bits in a group or data frame, a complete group of bits is sent in one go.

Ans. to the ques. No-03(d)

Serial transmission: Bits are sent one after another in a queue manner. Serial transmission requires only one communication channel. There are two types of serial transmission:

i) Asynchronous Serial Transmission:

It is named so because there is no importance of timing. Data-bits have specific pattern and they help receiver recognize the start and end data bits.

ii) Synchronous Serial Transmission:

Timing in synchronous transmission has importance as there is no mechanism followed to recognize start and end data bits.

4(a) Define Digital-to-Analog conversion? Write down the three kinds of digital-to-analog conversions?

(b) Define Analog-to-Analog conversion? Write down the categories of Analog-to-Analog conversion?

(c) Define Transmission Media?

(d) Define twisted pair cable? Write down the types of twisted pair cable?

Ans. to the ques. No-04(a)

Digital-to-Analog Conversion: When data from one computer is sent to another via some analog carrier, it is first converted into analog signals. There are three kinds of digital-to-analog

conversions.

i) Amplitude shift keying: In this conversion technique, the amplitude of analog carrier signal is modified to reflect binary data.

ii) Frequency shift keying: In this conversion technique, the frequency of the analog carrier signal is modified to reflect binary data.

iii) phase shift keying: In this conversion scheme, the phase of the original carrier signal is altered to reflect the binary data.

iv) Quadrature phase shift keying.

Ans. to the ques. No - 4 (b)

Analog-to-Analog Conversion:

Analog-to signals are modified to represent analog data. This conversion is also known as Analog Modulation. Analog to Analog conversion can be done in three ways:

i) Amplitude Modulation: In this modulation, the amplitude of the carrier signal is modified to reflect the analog data.

ii) Frequency Modulation.

iii) phase Modulation: In the modulation technique, the phase of carrier signal is modulated in order to reflect the change in voltage.

Ans. to the ques. No - 04(c)

Transmission Media: At convenient way to transfer data from one computer to another, even before the birth of networking, was to save it on some storage media and transfer physical from one station to another.

The WAN links may not support such high speed. Even if they do, the cost too high to afford.

In these cases, data makeup is stored onto magnetic tapes or magnetic discs. and then shifted physically at remote places

Ans. to the ques. No - 04 (d)

Twisted pair cable: A twisted pair cable is made of two plastic insulated copper wires twisted together to form a single media. Out of these two wires, only one carries actual signal and another is used for ground reference.

There are two types of twisted pair cables:

i) Shielded Twisted pair (STP) cable.

ii) Unshielded Twisted pair (UTP) cable.

STP cables comes with twisted wire pair covered in metal foil. UTP has seven categories, each suitable for specific use. UTP cables are connected by RJ45 connectors.

5. (a) Define Coaxial cable? Write down the categories of coaxial cable?

(b) Define power lines? How many types in PLC?

(c) Explain, Fiber optic provides the highest mode of speed.

(d) Define wireless transmission? Describe the importance of wireless transmission?

Ans. to the ques. No-05 (a)

Coaxial cable: Coaxial cable has two wires of copper. The core wire lies in the center and it is made of solid conductor. The core is enclosed in an insulating sheath. The second wire is

wrapped around over the sheath and that too in turn encased by insulator sheath.

There are three categories of coax cables:

i) RG-59 (cable TV)
ii) RG-58 (Thin Ethernet)
iii) RG-11 (Thic Ethernet)

Ans. to the ques. No-05(b)

Power lines: power line communication (PLC) is layer-1 (physical layer) technology which uses power cables to transmit data signals. power lines are widely deployed, PLC can make all powered devices controlled and monitored. PLC works in half-duplex.

There are two types of PLC:

i) Narrow band PLC.

ii) Broad band PLC.

Ans. to the ques. No-5(C)

Fiber optics works on the properties of light. When light ray hits at critical angle it tends to refracts at 90 degree. This property has been used in fiber optic. The core of fiber optic cable is made of high quality glass or plastic. Fiber optic provides the highest mode of speed. It comes in two modes, one is single mode fiber and second is multimode fiber. single mode fiber can carry a single ray of light

whereas multimode is capable of carrying multiple beams of light.

Ans. to the ques. No - 05 (d)

Wireless transmission: It is a form of unguided media. Wireless communication involves no physical link established between two or more devices.

Communicating wirelessly, wireless signals are spread over in the air and are received and interpreted by appropriate antennas.

When an antena is attached to electrical circuit of a computer or wireless device, it converts the digital data into wireless signals and spread all over within its frequency range.

6(a) Define Radio transmission? Difference between Radio transmission and Microwave transmission?

(b) Define Infrared Transmission? Describe the importance of Light Transmission?

(c) Define Multiplexing? Write down the categories of multiplexing?

(d) Define Light transmission. Difference between Infrared transmission and light transmission?

Ans. to the ques. No-6(a)

Radio transmission: Radio frequency is easier to generate and because of its large wavelength it can penetrate through walls and

structure alike.

Difference between Radio and microweb transmission:

Radio transmission: Radio waves can have wavelength from 1 mm – 100,000 km. and wave frequency ranging from 3Hz to 300 GHz. Radio frequencies are sub-divided into six bands.

microwave transmission: Microwave antennas concentrate the waves making a beam of it. As shown in picture above, multiple antennas can be aligned to reach farther. Microwave can have wavelength ranging from 1mm - 1 meter and frequency ranging from 300 MHz to 300 GHz.

Ans. to the ques. No - 06 (b)

Infrared transmission: Infrared wave lies in between visible light spectrum and microwaves. It has wavelength of 700 - nm to 1 - mm and frequency ranges from 300 GHz to 430 THz. Highest most electromagnetic spectrum which can be used for data transmission is light or optical signaling. This is achieved by means of LASER. Laser works as Tx (transmitter) and photo - detectors works as Rx (receiver). Laser is safe for data transmission as it is very difficult to tap 1mm wide laser.

Ans. to the ques. No - 6 (c)

Multiplexing: It is a technique by which different analog and digital streams of transmission can be simultaneously processed over a shared link.
there are three types of multiplexing.

i) Frequency Division Multiplexing.
ii) Time Division Multiplexing
iii) Wavelength Division Multiplexing.

Ans. to the ques. No - 6 (d)

Light transmission: Highest most electromagnetic spectrum which can be used for data transmission is light or optical signaling.

Difference between Infrared and Light transmission;

Infrared transmission: Infrared wave lies in between visible light spectrum and microwaves. It has wavelength of 700-nm to 1-mm and frequency ranges from 300 GHz to 430 THz.

Light transmission: Because of frequency light uses, it tends to travel strictly in straight line, Hence, the senders and receivers must be in the line-of-sight. Because laser transmission is unidirectional, at both ends of communication the laser the photo-detector needs to be installed

7. (a) Define Network switching ? Write down the categories of network switching ?

(b) Define circuit switching ? Write down the phases of circuit switching ?

(c) Define Message switching ? Describe the drawbacks of message switching?

(d) Define packet switching ? Explain, the importance of packet switching?

Ans. to the ques. No - 07 (a)

Network switching : Switching is process of forward packets coming in from one port to a port leading towards the destination. Switching can be

divided into two major categories:

i) Connectionless.

ii) Connection oriented.

Ans. to the ques. No. 7(b)

Circuit switching: when two nodes communicate with each other over a dedicated communication path, it is called circuit switching. Circuits can be permanent or temporary. Applications which use circuit switching may have to go through three phases:

i) Establish a circuit.

ii) Transfer the data.

iii) Disconnect the circuit

Ans. to the ques. No. - 7. (c)

Message switching: This technique was somewhere in middle of circuit switching and packet switching. Message switching has the following drawbacks:

i) Every switch in transit in path needs enough storage to accommodate entire message.

ii) Message switching was not a solution for streaming media and real-time applications.

iii) Because of store-and-forward technique and waits included until resources are available.

Ans. to the ques. No-7(d)

Packet switching: shortcomings of message switching gave birth to an idea of packet switching. The entire message is broken down into smaller chunks called packets. it enhances packet switching line efficiency as packets from multiple applications can be multiplexed over the carrier. packet switching enables the user to differentiate data streams based on priorities. packets are stored and forwarded according to their priority to provide quality of service.

8.(a) Define Transport Layer? Write down two main transport layer protocols?

(b) Define TCP? Describe the length of TCP header?

(c) Define congestion control? Explain the timer management of TCP?

(d) Define UDP? Write down the applications of UDP?

Ans. to the ques. No - 08(a)

Transport Layer: Next layer in OSI model is recognized as transport layer. This layer communicates with its peer transport layer of the remote host.

The two main transport layer protocols are:

i) Transmission control protocol.

ii) User Datagram protocol.

Ans. to the ques. No - 8 (b)

TCP: TCP is one of the most important protocols of Internet protocols suite. It is most widely used protocol for data transmission in communication network such as Internet.

The length of TCP header is minimum 20 bytes long and maximum 60 bytes.

i) Source port (16-bits)

ii) Destination port (16-bits)
iii) Sequence Number (32-bits)
iv) Acknowledgement number (32-bits)
v) Data offset (4-bits)
vi) Reserved (3-bits)
vii) Flags (1-bit each)
viii) window size.
ix) checksum.
x) Urgent pointer.
xi) options.

Ans. to the ques. No-08(c)

Congestion control: When large amount of data is fed to system which is not capable of handling it, congestion occurs.

Tcp uses different types of timer to control and management various task.

i) keep-alive timer:

- this timer is used to check the integrity and validity of a connection.

ii) Retransmission timer:

- this timer maintains stateful session of data sent.

iii) persist timer:

- TCP session can be paused by either host by sending window size 0.

iv) Timed-wait:

- Timed out can be maximum of 240 seconds.

Ans. to the ques. No - 8 (d)

UDP : UDP is simplest transport layer communication protocol available of the TCP/IP protocol suite.

Here are few applications where UDP is used to transmit data :

i) Domain Name Services.

ii) Simple Network Management protocol.

iii) Trivial File Transfer protocol.

iv) Routing Information protocol.

v) Kerberos.