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1.(a) What do you mean by physical layers? What is signal?

(b) Write the difference between digital signal and analog signal.

(c) Describe transmission impairment.

2.(a) Write about the different classes of noise.

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3.(a) What is switching? Categories of switching.

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(c) What is switching? Define circuit switching.

1.(a) What do you mean by physical layer? What is signal?

Ans: physical layer in the OSI model plays the role of interacting with actual hardware and signaling mechanism. Physical layer is the only layer of OSI network model which actually deals with the physical connectivity of two different stations. This layer defines the hardware equipment, cabling, wiring, frequencies, pulses used to represent binary signal etc. Physical layer provides its services to Data-link layer.

Signal: In electronics, a signal is an electric current or electromagnetic field used to convey data from one place to another. The simplest form of signal is a direct current that is switched on and off, that is principle by which the early telegraph worked. When data is sent over physical medium, it needs to be first converted into electromagnetic signals.

1.(b) Write the difference between digital signals and analog signal.

Ans: Difference between digital and analog signals

Digital Signal	Analog signal
1. Digital signals are discrete signals.	1. Analog signals are continuous signals.
2. A digital signal uses discrete values for representing the information.	2. Analog signal uses continuous values for representing the information.
3. Digital signal can't be affected by the noise during transmission.	3. Analog signal can be affected by the noise during the transmission.
4. Devices using digital signals are very flexible.	4. Devices which are using analog signals are less flexible.
5. Digital signals consume more bandwidth	5. Analog signals consumes more bandwidth
6. Digital signals have high cost.	6. Analog signals have low cost.
7. Digital signals are not portable.	7. Analog signals are portable.

L.(c) Describe transmission impairment.

Ans: When signals travel through the medium they tend to deteriorate. This may have many reasons as given:

Attenuation: For the receiver to interpret the data accurately, the signal must be sufficiently strong. When the signal passes through the medium, it tends to get weaker.

Dispersion: As signal travels through the media, it tends to spread and overlaps. The amount of dispersion depends upon the frequency used.

Delay distortion: Signals are sent over media with predefined speed and frequency. If the signal speed and frequency do not match, there are possibilities that signal reaches destination in arbitrary fashion. In digital media, this is very critical that is very some bits reach earlier than the previously sent ones.

Noise: Random disturbance or fluctuation in analog or digital signal is said to be noise in signal, which may distort the actual information being carried. Noise can be characterized in one of the following class:

- Thermal Noise
- Intermodulation
- Crosstalk
- Impulse

2.(a) write about the different classes of noise.

Ans: Noise is anything that interferes with the transmission of a signal. In telephone conversations, interference might be caused by static in the line, crosstalk from another line or background sounds. Noise can be characterized in one of the following class :

- **Thermal Noise:** Heat agitates the electronic conductors of a medium which may introduce noise in the media. Up to a certain level, thermal noise is unavoidable.
- **Intermodulation:** When multiple frequencies share a medium, their interference can cause noise in the medium.
- **Crosstalk:** This sort of noise happens when a foreign signal enters into the media. This is because signal in one medium affects the signal of second medium.
- **Impulse:** This noise is introduced because of irregular disturbances such as lightening, electricity.

is mostly affected by this sort of noise.

2.(b) What do you mean by transmission media?

What are forms of transmission media?

Ans! A transmission medium is something that can mediate the propagation of signals for the purpose of telecommunication. For example, data can modulate sound and a transmission medium for sounds may be air, but solids and liquids may also act as the transmission medium.

Transmission media comes in two forms:

Guided media: All communication wires/cables are guided media, such as UTP, coaxial cables, and fibre optics. In this media, the sender and receiver are directly connected and the information is sent through it.

Unguided media: Wireless or open air space is said to be unguided media, because there is no connectivity between the sender and receiver. Information is spread over the air, and anyone including the actual recipient may collect the information.

2.(c) What is channel capacity? What are the factors of channel capacity? What is multiplexing?

Ans: The speed of transmission of information is said to be the channel capacity. We count it as data rate in digital world. It depends on numerous factors such as:

Bandwidth: The physical limitation of underlying medium

Error-rate: Incorrect perception of information because of noise.

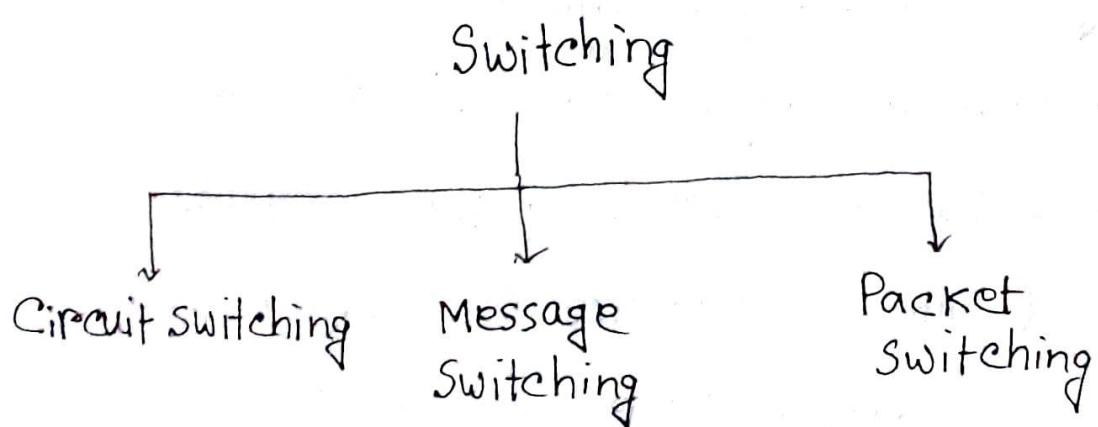
Encoding: The number of levels used for signaling.

Multiplexing: Multiplexing is a technique to mix and send multiple data streams over a single medium. This technique requires system hardware called multiplexer for multiplexing the streams and sending them on a medium, and de-multiplexer which takes information from the medium and distributes to different destinations.

3.(a) what is switching? Categories of switching.

Ans: 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 :



3.(b) What does digital transmission mean? What do you mean by digital conversion?

Ans: Data transmission, digital transmission, etc.
digital communication is the transfer of data from one point to another. Data transmitted may be digital messages originating from a data source such as a computer or a keyboard. It may also be an analog signal, such as a phone call or a video signal.

Digital to digital encoding is the representation of digital information by a digital signal. When binary 1s and 0s generated by the computer are translated into a sequence of voltage pulses that can be propagated over a wire, this process is known as digital-to-digital encoding.

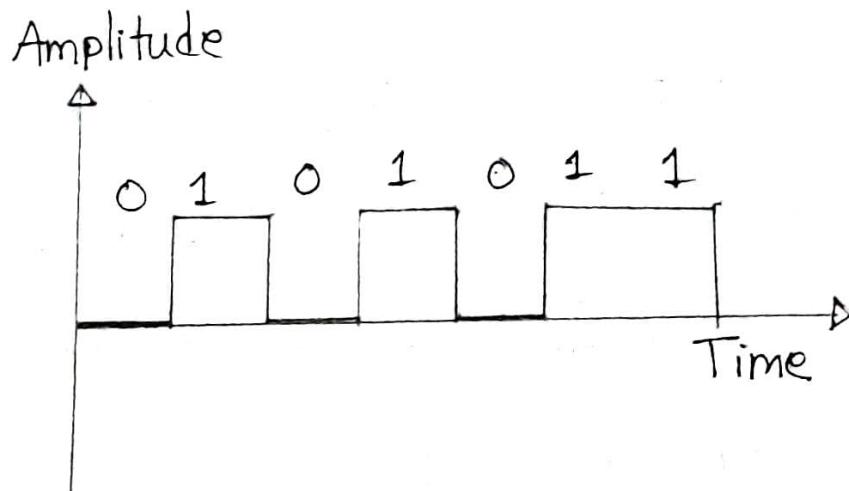
Digital to digital encoding is divided into three

categories. These are:

1. Unipolar encoding
2. Polar encoding
3. Bipolar encoding.

3.(c) Describe unipolar encoding.

Ans: Unipolar encoding schemes use single voltage level to represent data. In this case, to represent binary 1, high voltage is transmitted and to represent 0, no voltage is transmitted. It is also called Unipolar-Non-return-to-zero. Because there is no rest condition. i.e it either represents 1 or 0.



Ans: Synchronous serial communication describes a serial communication protocol in which data is sent in a continuous stream at constant rate.

Timing in synchronous transmission has importance as there is no mechanism followed to recognize start and end data bits. There is no pattern or prefix/suffix method. Data bits are sent in burst mode without maintaining gap between bytes (8 bits).

Single burst of data bits may contain a number of bytes. Therefore, timing becomes very important. It is up to the receiver to recognize and separate bits into bytes. The advantage of synchronous transmission is high speed and it has no overhead of extra header and footer bits as in asynchronous transmission.

4.(a) What is block coding?

Ans: 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 is represented by slash notation, mB/nB . Means, m -bit block is substituted with n -bit block where $n > m$. Block Coding involves three steps:

- Division
- Substitution
- Combination

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

4.(b) What do you mean by Analog-to-Digital conversion?

Ans: Microphones create analog voice and cameras creates analog videos, which are treated as analog data. To transmit this analog data over digital signals we need analog to digital conversion.

Analog data is a continuous stream of data in the wave form 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:

- Sampling
- Quantization
- Encoding

4.(c) What do you mean by transmission mode?

Ans: Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. The transmission mode decides how data is transmitted between two computers. The binary data in the form of 1s and 0s can be sent in two different modes: Parallel and Serial.

Parallel transmission: The binary bits are organized into groups of fixed length. Both sender and receiver are connected in parallel with the equal number of data lines. Both computers distinguish between high order and low order data lines.

Serial transmission: In serial transmission, bits are sent one after another in a queue manner. Serial transmission requires only one communication channel.

4.(d) Write the difference between parallel and serial transmission.

Ans: Differences between parallel and serial transmission are given below:

Factor	Serial	Parallel
1. Number of bits transmitted at one clock pulse	1. One bit	n bits
2. No of lines required to transmit n bits	One line	n lines
3. Speed of data transfer	Slow	Fast
4. Cost of transmission	Low as one line is required	Higher as n lines are required
5. Application	Long distance communication between two computers	Short distance communication like computer to printer.

5.(a) What is Digital-to-Analog conversion?

Ans: When data from one computer is sent to another via some analog carrier, it is first converted into analog signals. Analog signals are modified to reflect digital data.

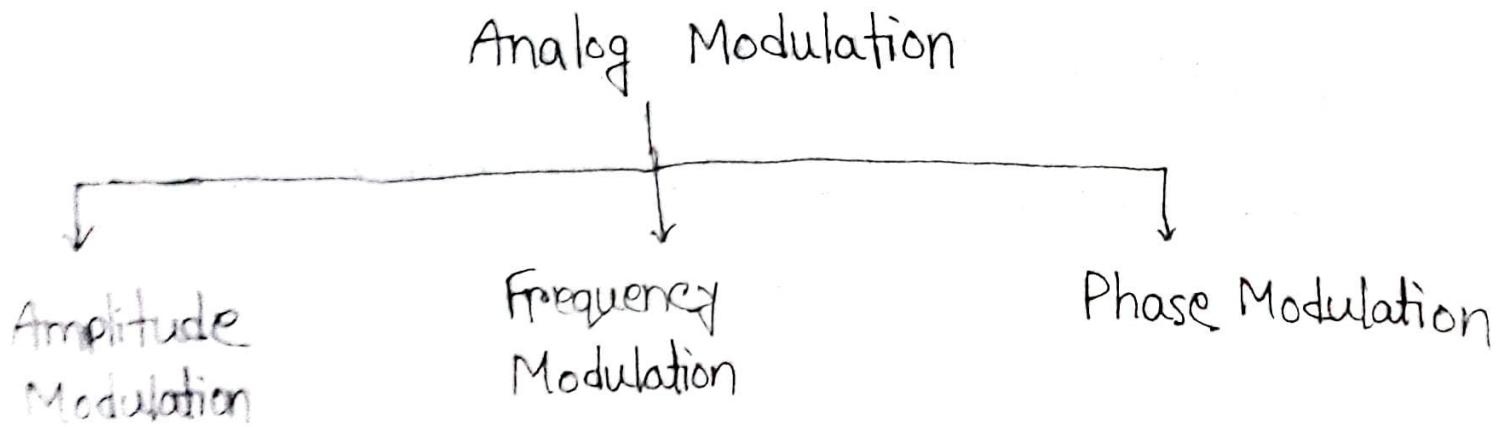
There are three kinds of digital-to-analog conversion.

- Amplitude Shift Keying: In this conversion technique, the amplitude of analog carrier signal is modified to reflect binary data. When binary data represents digit 1, the amplitude is held, otherwise it is set to 0.
- Frequency Shift Keying: In this conversation technique, the frequency of the analog carrier signal is modified to reflect binary data. This technique uses two frequencies, f_1 and f_2 . For example f_1 , is chosen to represent binary digit 1 and the other one is used to represent binary digit 0.

• Phase Shift Keying: In this conversion scheme, the phase of the original carrier signal is altered to reflect the binary data. When a new binary symbol is encountered the phase of the signal is altered. Amplitude and frequency of the original carrier signal is kept intact.

5.(b) Write about Analog-to-Analog conversion.

Ans: Analog signals are modified to represent analog data. This conversion is also known as Analog Modulation. Analog modulation is required when band pass is used. Analog-to-analog conversion can be done in three ways:



Amplitude Modulation: In this modulation, the amplitude of the carrier signal is modified to reflect the analog data. Amplitude modulation is implemented by means of a multiplier. The amplitude of modulating signal is multiplied by the amplitude of carrier frequency.

Frequency Modulation: In this modulation technique, the frequency of the carrier signal is modified to reflect the change in the voltage levels of the modulating signal.

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

Phase modulation is practically similar to Frequency Modulation, but in phase modulation frequency of the carrier signal is not increased.

5.(c) What do you mean by Bandpass and Low-pass?

Ans: Band Pass: The filters are used to filter and pass frequencies of interest. A bandpass is a band of frequencies which can pass the filter.

Lowpass: Lowpass is a filter that passes low frequency signals.

6.(a) What is transmission media?

Ans: A transmission medium is something that can mediate the propagation of signals for the purpose of telecommunication.

Signals are typically imposed on a wave of some kind suitable for the chosen medium. For example, data can modulate sound and a transmission medium for sounds may be air, but solids and liquids may also act as the transmission medium. Vacuum or air constitutes a good transmission medium for electromagnetic waves such as light and radio waves. While material substance is not required for electromagnetic waves to propagate, such waves are usually affected by the transmission media they pass through, for instance by absorption or by reflection or refraction at the interfaces between media.

6.(b) Write about twisted pair cable.

Ans: A twisted pair cable is made of two plastic insulated copper wires twisted together to form a single media. Out of ~~two~~ these two wires, only ~~only~~ one carries actual signal and another is used for ground reference. The twists between wires are helpful in reducing noise and crosstalk.

There are two types of twisted pair cables:

- Shielded Twisted Pair(STP) cables.
- Unshielded Twisted Pair(UTP) cable.

STP cables comes with twisted wire pair covered in metal foil. This makes it more indifferent to noise and crosstalk.

UTP has seven categories, each suitable for specific use. In computer networks, Cat-5, Cat-5e,

and cat6 cables are mostly used. UTP cables are connected by RJ45 connectors.

6.(c) What do you mean by PLC?

Ans: PLC means Power Line Communication. Power

Line Communication (PLC) is Layer-1 technology which uses power cables to transmit data signals. In PLC, modulated data is sent over the cables. The receiver on the other end de-modulates and interprets the data.

Because 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:

- Narrow band PLC
- Broad band PLC

Narrow band PLC provides lower data rates up to

100s of kbps, as they work at lower frequencies (3-5000 MHz). They can be spread over several kilometers.

Broadband PLC provides higher data rates up to 100s of Mbps and works at higher frequencies (1.8-250 MHz). They cannot be as much extended as narrowband PLC.

7.(a) What is wireless transmission?

Ans: Wireless transmission 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 antenna 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. The receptor on the other end receives these signals and converts them back to digital data.

7.(b) Define radio transmission and microwave transmission.

Ans: Radio frequency is easier to generate and

through walls and structures alike. Radio waves can have wavelength from 1 mm - 100,000 km and have frequency ranging from 3 Hz to 300 GHz. Radio frequencies are subdivided into six bands.

Radio waves at lower frequencies can travel through walls whereas higher RF can travel in straight line and bounce back. The power of low frequency waves decreases sharply as they cover long distances. High frequency radio waves have more power.

Microwave transmission: Electromagnetic waves above 100 MHz tend to travel in a straight line and signals over them can be sent by beaming those waves towards one particular station. Because microwaves travels in straight lines,

both sender and receiver must be aligned to be strictly in line-of-sight.

Microwave can have wavelength from 1mm-1 meters and frequency ranging from 300 MHz to 300 GHz.

Microwave antennas concentrate the waves making a beam of it. As shown in picture above, multiple antennas can be aligned to reach farther. Microwaves have higher frequencies and do not penetrate wall like obstacles.

Q.(c) What are the functions of transport layer?

Ans: All modules and procedures pertaining to transportation of data or data stream are categorized into transport layer. As all other layers, this layer communicates with its peer transport layer of the remote host.

Functions of transport layer are given below

- This layer is the first one which breaks the information data, supplied by application layer in to smaller units called segments. It numbers every bytes in the segment and maintains their accounting.
- This layer ensures that data must be received in the same sequence in which it was sent.
- This layer provides end to end delivery of data between hosts which may or may not belong to the same subnet.
- All server processes intend to communicate over the network are equipped with well-known Transport Service Access Points(TSAPs) also known as port numbers

8.(a) Write down the features of TCP?

Ans: Features of TCP are given below:

- TCP is reliable protocol. That is, the receiver always sends either positive or negative acknowledgement about the data packet to the sender, so that the sender always has bright clue about whether the data packet is reached the destination or it needs to resend it.
- TCP ensures that the data reaches intended destination in the same order it was sent.
- TCP provides error-checking and recovery mechanism.
- TCP provides end-to-end communication.
- TCP provides flow control and quality of service.
- TCP (Transmission Control Protocol) operates in Client/Server point-to-point mode.
- TCP provides full duplex communication.

roles of both receiver and sender.

8.(b) What do you mean by multiplexing?

Ans: The technique to combine two or more data streams in one session is called Multiplexing. When a TCP client initializes a connection with server, it always refers to a well-defined port number which indicates the application process.

The client itself uses a randomly generated port number from private port number pools.

Using TCP Multiplexing, a client can communicate with a number of different application processes in a single session. For example, a client requests a web page which in turn contains different types of data (HTTP, FTP) the TCP session timeout is increased and the session is kept open.

for longer time so that the three way handshake overhead can be avoided.

8.(c) What is switching? Define circuit switching.

Ans: Switching is process to forward packets coming in from one port to a port leading towards the destination. When data comes on a port it is called ingress, and when data leaves a port or goes out it is called egress. A communication system may include number of switches and nodes.

Circuit Switching: When two nodes communicate with each other over a dedicated communication path, it is called circuit switching. There is a need of pre-specified route from which data will travel and no other data is permitted. In circuit switching, to transfer the data circuit must be established so

that the data transfer can take place.

Circuits can be permanent or temporary.
Applications which use circuit switching may have
to go through three phases

- Establish a circuit
- Transfer the data.
- Disconnect the circuit