1. a) What is physical layer? What are the functions of physical layer?

b) Difference between analog signal and digital signal.

c) What is transmission media and channel capacity.

2. a) Define switching and multiplexing

b) Difference between Serial and parallel transmission

c) Explain the process of analog-to-digital conversion.

3. a) Describe the different types of transmission media.

b) Difference between synchronous and asynchronous transmission

c) Explain the process of analog-to-analog conversion.

4. a) Describe different types of wireless transmission.

b) Difference between Frequency division Multiplexing and Time Division Multiplexing.

c) Write the applications of Multiplexer

5. a) What is circuit switching? Write the advantages and disadvantages of circuit switching.

b) Explain the technique message switching

c) Difference between circuit switching and packet switching.

6. a) Difference between Circuit switching and message switching.

b) Write the advantages and disadvantages of

Packet switching

c) Describe about wavelength Division Multiplexing and code Division Multiplexing

7. a) What is Transport Layer? Write the functions of transport layer

b) Describe about End-to-End communication

c) Write the features of transmission control protocol.

8. a) What is UDP? Write the features of UDP.

b) Write the parameters of UDP header and applications of UDP.

9) Describe different types of timer which uses TCP to control and management various tasks.

Ans. to the Ques. NO. 1(a)

Physical layer is the lowest layer of the OSI reference model. It is responsible for sending bits from one computer to another. This layer is not concerned with the meaning of the bits and deals with the setup of physical connection to the network and with transmission and reception of signals.

Functions of physical layer:

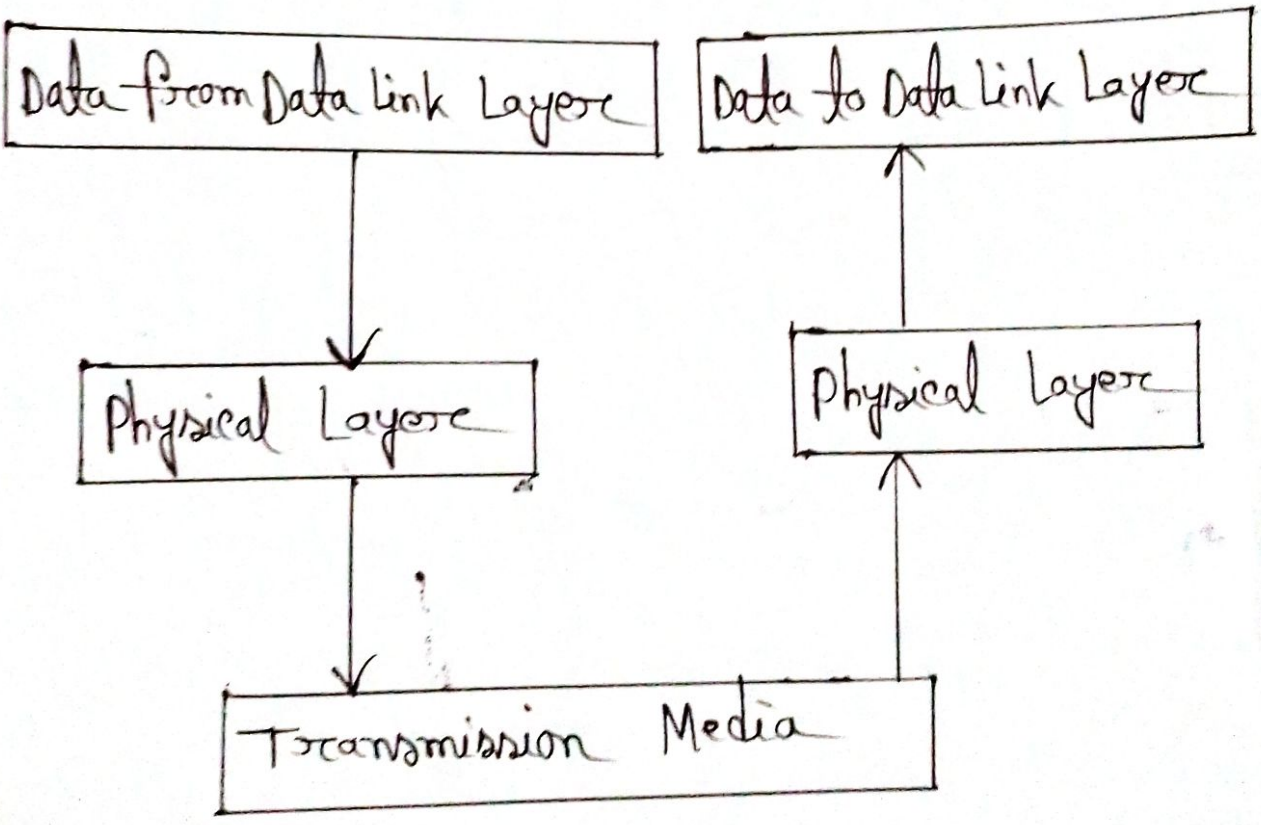
Following are the various functions performed by the physical layer of the OSI model

1. Representation of bits: Data in this layer consists of stream of bits. The bits must be encoded into signals for transmission.

6. Topologies: Devices must be connected with the following topologies: Mesh, star, Ring, Bus.

7. Transmission modes: Physical layer defines the direction of transmission between two devices: Simplex, Half Duplex, Full Duplex

8. Deals with baseband and broadband transmission



Ans. to the ques. NO - 1 (b)

Difference between analog signal and digital signal.

Analog	Digital
1. An analog signal is a continuous wave that changes over a time period	1. A digital signal is a discreate wave that carries information in binary form.
2. Represented by sine waves	Represented by square waves
3. Human voice, natural sound, analog electronic devices are few examples	3. Computers, optical drives and other electronic devices
4. Continuous range of values	4. Discontinuous values
5. Records sound waves as they are	5. Converts into a binary waveform
6. Only be used in analog devices	6. Suited for digital electronics like computers, mobiles and more

Ans to the ques No - 1(c)

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

1. Guided Media: All communication wires/cables are guided media such as UTP, coaxial cables and fiber optics.

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

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

Bandwidth: The physical limitation of underlying media.

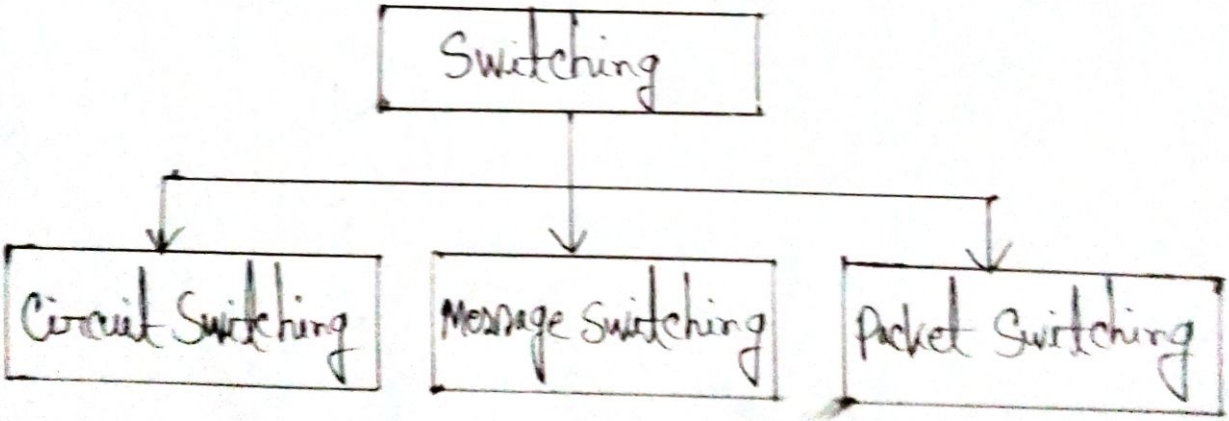
Error Rate: Incorrect reception of information because of noise

Encoding: The number of levels used for signaling

Ans. to the ques No - 2 (a)

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:



Multiplexing: Multiplexing is 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.

Ans. to the ques. No- 2(b)

Difference between Serial and parallel transmission

Serial	parallel
1. In Serial transmission data flows in bit direction	1. In parallel transmission data flows in multiple lines.
2 In serial transmission one bit transferred at one clock pulse	2 In parallel transmission eight bit transferred at one clock pulse.

3. Serial transmission is cost-efficient	3. Parallel transmission is not cost-effiecent
4. Serial transmission is slow in comparison of parallel transmission	4. Parallel transmission is fast in comparison of serial transmission.
5. Generally, Serial transmission is used for long distance.	5. Generally, parallel transmission is used for short distance
6. The circuit used in serial transmission is simple.	6. The circuit used in parallel transmission is relatively complex.
7. Its performance is comparatively lower as compared to parallel transmission.	7. On the other hand, parallel transmission is more efficient in performance.

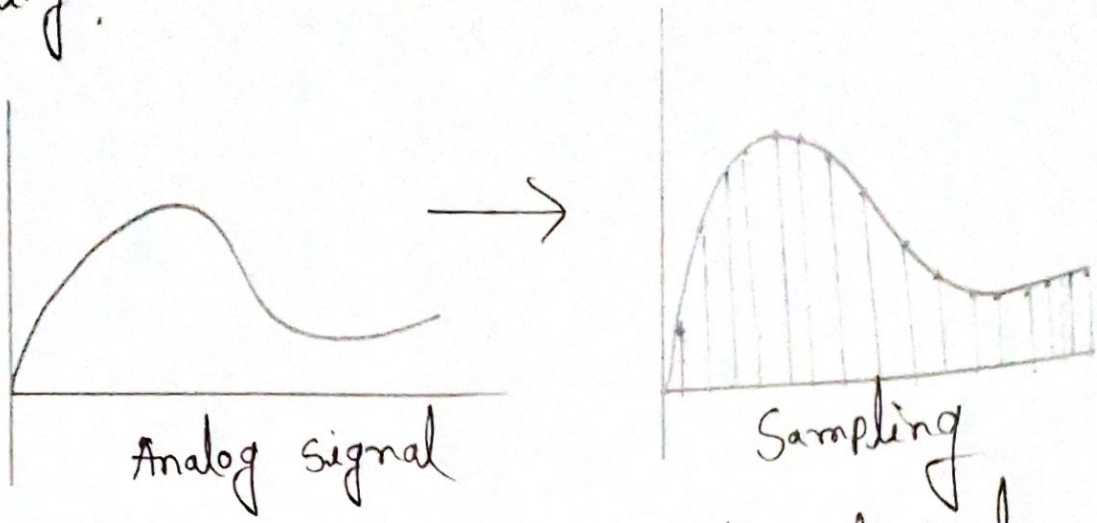
Ans. to the ques. NO-2(c)

Analog to Digital conversion:

Microphones create analog voice and camera creates analog videos, which are treated is 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 PCM. PCM is one of the most commonly used method to convert analog data into digital form. It involves three steps:

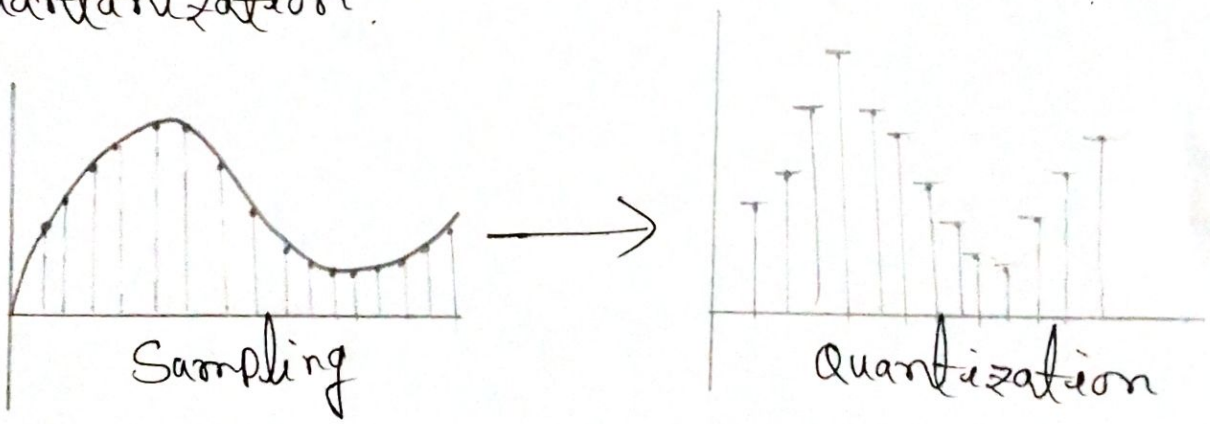
1) Sampling
2) Quantization
3) Encoding

Sampling:



The analog signal is sampled every T interval. Most important factor in sampling is the rate at which analog signal is sampled. According to Nyquist theorem, the sampling rate must be at least two times of the highest frequency of the signal

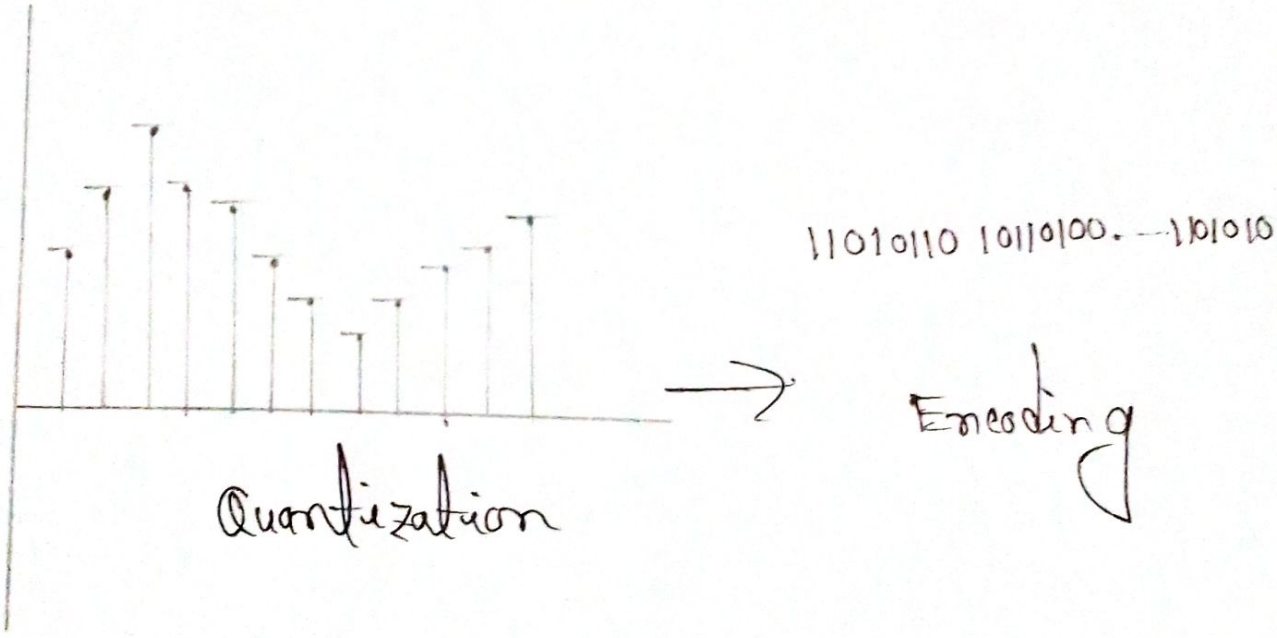
Quantanization:



Sampling yields discrete form of continuous analog signal. Every discrete pattern shows the amplitude of

the analog signal at that instance the quantization is done between the maximum amplitude value and the minimum amplitude value. Quantization is approximation of the instantaneous analog value

Encoding:



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

Ans. to the ques. No-3 (a)

There are three major types of transmission Media:

1) Twisted pair cable: It consists of 2 separately insulated conductor wires wound about each other. Generally several such pairs are bundled together in a protective sheath. They are the most widely used transmission media. Twisted pair is of 2 types:

① Unshielded Twisted pair (UTP): This type of cable has the ability to block external interference. It is used for telephonic applications.

② Shielded Twisted pair (STP): This type of cable consists of a special jacket to block external interference. It is used in fast-data-rate Ethernet and in voice and data channels of tel lines.

ii) Coaxial cable: It has an outer plastic covering containing 2 parallel conductors each having a separate insulted protection cover. The coaxial cable transmits information in two modes: Baseband mode and Broadband mode. Cable TVs and analog television networks widely use coaxial cables.

iii) Optical Fibre cable: It uses the concept of reflection of light through a core made up of glass or plastic. The core is surrounded by a less dense glass or plastic covering called the cladding. It is used for the transmission of large volumes of data. This cable can be unidirectional or bidirectional. The WDM supports 2 modes, namely unidirectional and bidirectional mode.

Ans. to the ques. No-3(b)

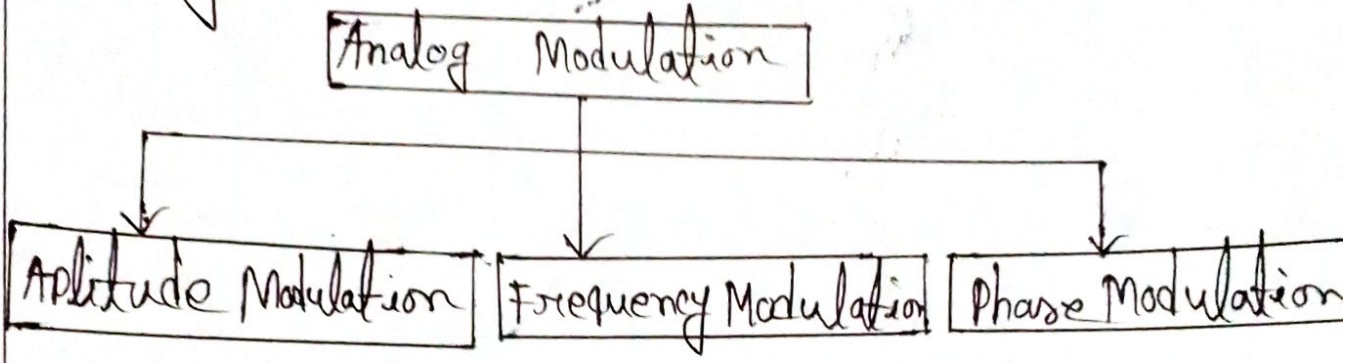
Difference between Synchronous and Asynchronous transmission:

Synchronous	Asynchronous
1. In synchronous transmission Data is sent in form of blocks or frames.	1. In asynchronous transmission Data is sent in form of byte or character
2. Synchronous transmission is fast.	2. Asynchronous transmission is slow
3. Synchronous transmission is costly	3. Asynchronous transmission is economical
4. Time interval of transmission is constant.	4. Time interval of transmission is not constant
5. There is no gap present between data	5. There is gap present between data
6. It is easy to design synchronous transmission	6. The asynchronous transmission is complex in nature and design

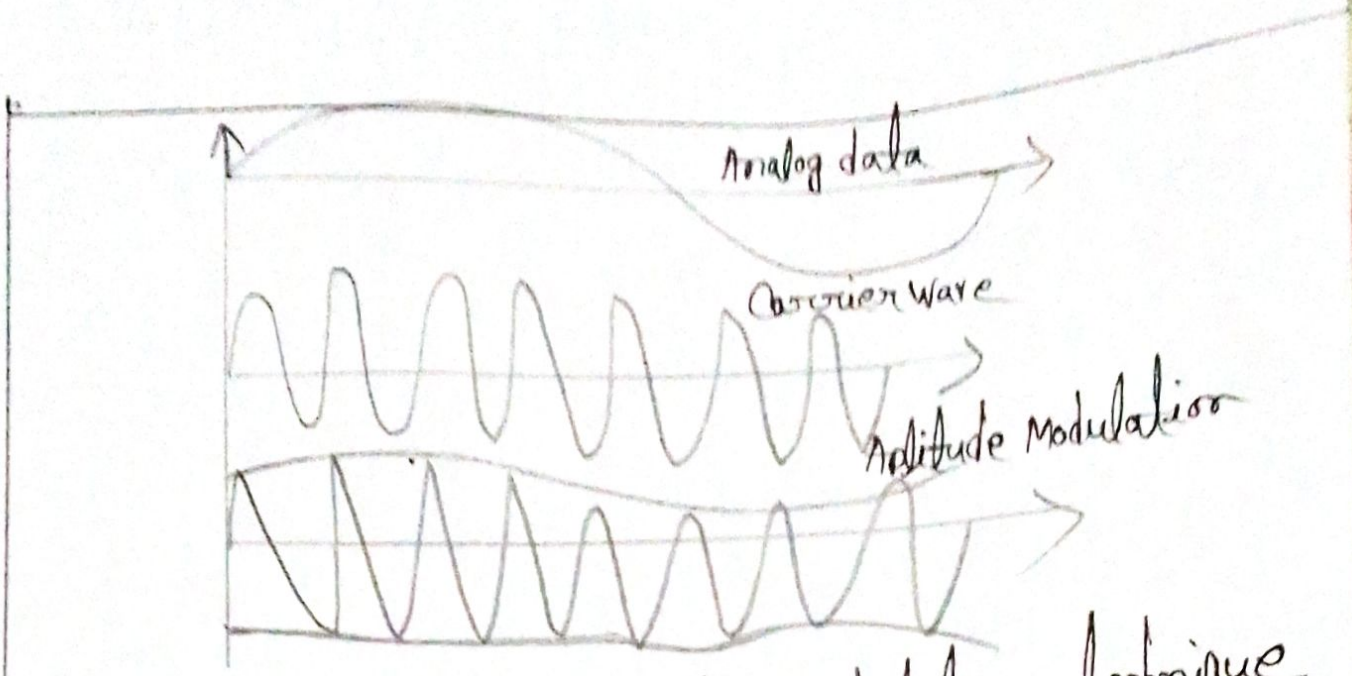
Ans to the ques. No 3 (c)

Analog-to-Analog Conversion

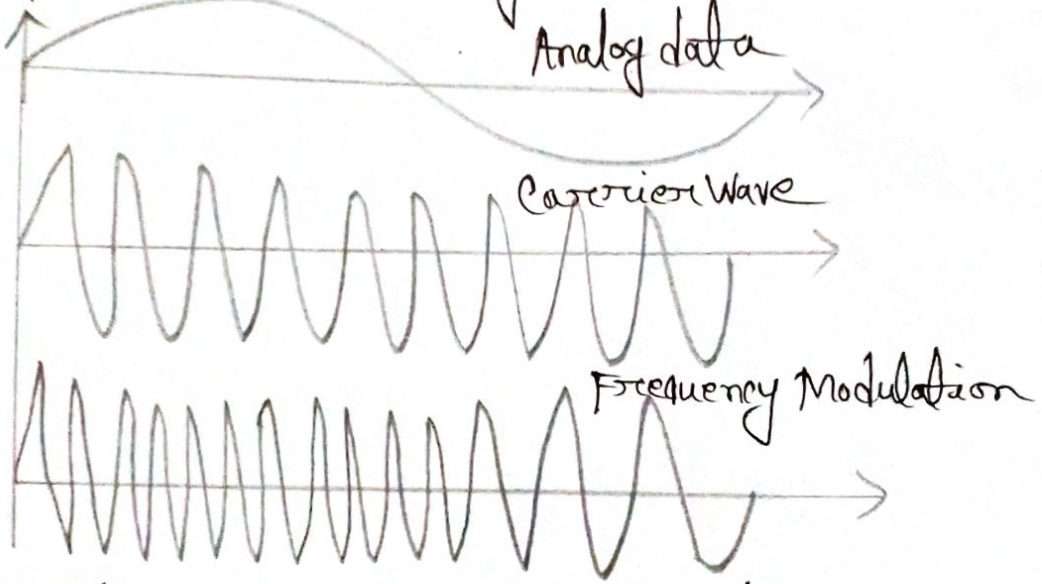
Analog signals are modified to represent analog data. This conversion is also known as Analog Modulation. Analog modulation is required when bandpass is used. Analog to analog conversion can be done in 3 ways.



Aplitude Modulation: In this modulation, the amplitude of the carrier signal is modified to reflect the analog data. Aplitude modulation is implemented by means of a multiplier. The frequency and phase of carrier signal remain unchanged.



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.

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

Wireless transmission is a form of unguided media. There are many kinds of wireless transmission

Radio transmission: Radio frequency is easier to generate and because of large wavelength it can penetrate through walls and structures alike. Radiowaves can have wavelength from 1mm - 100,000km and have frequency ranging from 3Hz to 300GHz. Radio frequencies are sub divided into 6 bands.

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 and receiver must be aligned to strictly in line of sight. Microwaves can have wavelength ranging from

1mm - 1meter and frequency ranging from 300 MHz to 300 GHz

Infrared Transmission: Infrared wave lines 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. Infrared wave is used for very short range communication purposes such as television and it's remote

Light Transmission: Highest most electromagnetic spectrum which can be used for data transmission is light or optical signaling this is achieved by means of LASER Laser work as Tx (transmitter) and photo-detector work as Rx (receiver).

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

Difference between FDM and TDM:

Basis	FDM	TDM
1. Definition	1. A technique that allows transmission of multiple signals using different frequency slots over a common link.	A technique that permits the flow of multiple data signal over a communication link in different time domain
Stands for	Frequency Division Multiplexing	Time Division Multiplexing
multiplexing techniq	Analog	Digital
Synchronization	Not needed	Necessary
Circuit orientation	Complex	comparatively simple
Cross talk	Exist	Does not Exist
Propagation delay	Not sensitive	Sensitive
Efficiency	Less efficient	More efficient
cost	High	comparatively low

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

The applications of Multiplexer:

1. Communication System - A Multiplexer is used in communication systems, which has a transmission system and also a communication network. A multiplexer is used to increase the efficiency of the communication system by allowing the transmission of data such as audio and video data from different channels.

2. Computer Memory - A multiplexer is used in computer memory to keep us a vast amount of memory in the computers and also to decrease the number of copper lines to connect the memory to other parts of the computer.

3. Telephone Network: A multiplexer is used in telephone networks to integrate the multiple audio signals on a single line of transmission.

Ans to the ques. No-5(a)

Circuit switching: when a dedicated path is established for data transmission between sender and receiver, it is called circuit switching

Advantages of circuit switching:

1) Once path is set up, the only delay is in data transmission speed.
2) No problem of congestion or garbled message.

Disadvantages of Circuit switching:

1) Long set up time is required
2) A request token must travel to the receiver than then acknowledged before any transmission can happen

3) Line may be held up for a long time
4) Inefficient use of communication channel
5) More bandwidth is required

Ans to the ques No - 5 (b)

Message switching - This technique was somewhere in middle of circuit switching and packet switching. In message switching, the whole message is treated as data unit and is switching / transferred in its entirety. A switch working on message switching, first receives the whole message and buffers it until there are resources available to transfer it to the next hop. If the next hop is having enough resource to accomodate large size message,

the message is stored and switch waits. This technique was considered substitute to circuit switching. As in circuit switching the whole path is blocked for two entities only. Message switching is replaced by packet switching.

Ans. to the ques. NO-5(c)

Difference between Circuit switching and Packet switching:

Circuit	Packet
1. In circuit switching there are 3 phases i) connection establishment ii) Data transfer iii) Connection released	1. In Packet switching directly data transfer takes place.

2. In circuit switching each data unit know the entire path address which is provided by the source	2. In packet switching each data unit just know the final destination address intermediate path is decided by the routers.
3. It was initially designed for voice transfer	3. It was initialy designed for data transfer
4. It is implemented at Physical layer	4. It is implemented at network layer
5. Its initial cost is low.	5. It demands high installation cost
6. The protocols for delivery are simpler	6. It requires complex protocols for delivery
7. Charging happens per minute	7. charging happens per packet
8. Each packet follows the same route	8. Each packet does not follow the same route
9. It does not store and forward transmission	9. It does store and forward transmission

Ans to the ques no - 6 (a)

Difference between circuit switching and message switching:

Circuit	Message
1. Circuit switching is done by setting a physical path between two systems.	1. In message switching, data is stored by one node then forward to another node to transfere data to another system
2. In circuit switching data is not stored	2. In message switching data is first stored then forwarded to the next node.
3. It needs dedicated physical path.	3. It does not need dedicated physical path
4. It is a geographical addressing	4. It is a heirarchical addressing
5. It is costly.	5. It is less costlier than circuit switching

6. Circuit switching routing is manual type routing	6. Message switching routing is not manual type routing
7. It reserves full bandwidth in advance	7. It does not reserve the entire bandwidth in advance
8. Charge depend on time and distance	8. Charge is based on the number of bytes and distance
9. No congestion occurs for per minute in circuit switching.	9. In message switching, no congestion or very less congestion occurs.

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

Advantages of packet switching:

1) Delay in delivery of packets is less since packets are sent as soon as they are available.

2) Switching devices don't require massive storage

3) Data delivery can continue even if some parts of the network faces link failure.

4) It allows simultaneous usage of the same channel by multiple users.

5) It ensures better bandwidth usage

Disadvantages of packet switching:

1) They are unsuitable for applications that cannot affor delays in communication like high quality voice calls.

2) Packet switching high installation costs

3) They require complex protocols for delivery

4) Network problems may introduce errors in packets, delay in delivery of packets or loss of packets.

Ans to the Ques. NO-6(c)

Wavelength Division Multiplexing: Light has different wavelength. In fiber optic mode, multiple optical carrier signals are multiplexed into an optical fiber by using different wavelength. This is an analog multiplexing technique and is done conceptually in the same manner as FDM but uses light as signals

Code Division Multiplexing: Multiple data signals can be transmitted over a single frequency by using Code Division Multiplexing FDM divides the frequency in smaller channels but CDM allows its users to full bandwidth and transmit signals all the time using a unite code. CDM uses orthogonal codes to spread signals.

Ans. to the Ques. No-7 (a)

Transport layer: In computer networking, the transport layer is a conceptual division of methods in the layered architecture of protocols in the network stack in the internet protocol suite and the OSI model.

Functions of Transport Layer:

1) This layer is the first one which breaks the information data, supplied by Application layer into smaller units called segments. It numbers every byte in the segment and maintains their accounting.

2) This layer ensures that data must be received in same sequence in which it was sent.

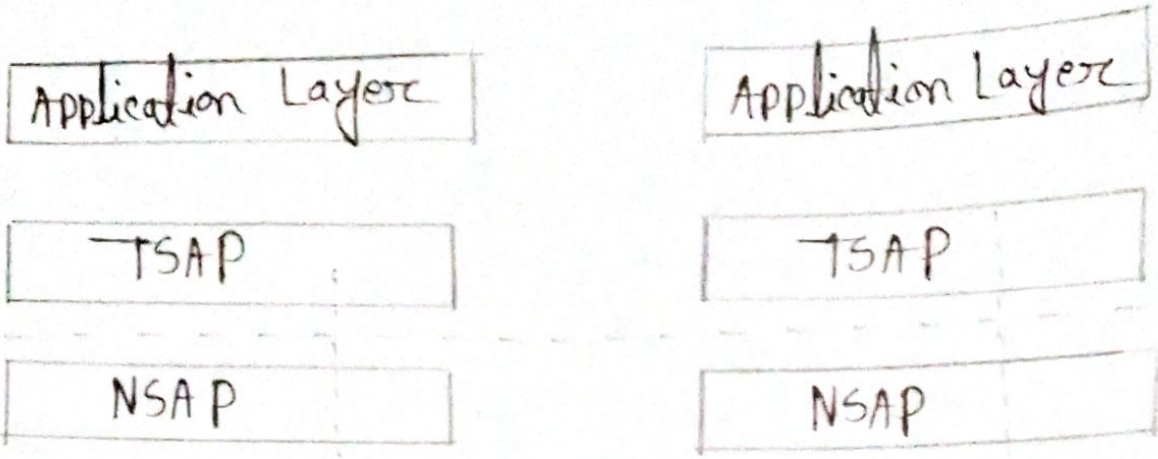
3) This layer provides end-to-end delivery of data between hosts which may or may not belong to the same subnet.

4) All server process intend to communicate over the network are equipped with well known transport Service Access Points (TSAPs) also known as port numbers.

Ans to the ques NO-7(b)

End-to-End communication.

A process or host identifies its peer host on remote network by means of TSAPs, also known as port numbers. TSAPs are very well defined and a process which is trying to communicate with its peer knows in advance



For example, when a DHCP client wants to communicate with remote DHCP servers, it always requests on port number 67. When a DNS client wants to communicate with remote DNS server, it always requests on port number 53 (UDP).

The two main Transport Layer protocols are:

1. Transmission control protocol: It provides reliable communication between two hosts.
2. User Datagram protocol: It provides unreliable communication between two hosts.

Ans to the ques. No- 7(c)

The Transmission control protocol (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.

Features of Transmission control protocol:

1) TCP is reliable protocol. That is, the receiver always sends either positive or negative acknowledgement about the data packet to the sender

2) TCP ensures that the data reaches intended destination in the same order it was sent.

3) TCP is connection oriented. TCP requires that connection between two remote points be established before sending actual data.

4) TCP provides error checking and recovery mechanism.

5) TCP provides end-to-end communication.

6) TCP provides flow control and quality of service

7) TCP operates in client/server point-to-point mode

8) TCP provides full duplex server, i.e it can perform roles of both receiver and sender

Ans to the ques No 8(a)

UDP stands for User Datagram protocol. UDP is the simplest Transport Layer communication protocol available of the TCP/IP protocol suite.

Features of UDP :

1) UDP is used when acknowledgement of data does not hold any significance
2) UDP is good protocol for data flowing in one direction
3) UDP is simple and suitable for query based communications.
4) UDP is not connection oriented.
5) UDP does not provide congestion and control mechanism
6) UDP does not guarantee ordered delivery of data

7) UDP is stateless

8) UDP is suitable protocol for streaming applications such as VoIP, multimedia streaming

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

UDP header contains four parameters:

Source port — This 16 bit information is used to identify the source port of the packet.

Destination port — This 16 bits information, is used to identify application level service on destination machine.

Length — Length field specifies the entire length of UDP packet. It is 16-bits field and minimum value is 8 byte, i.e. the size of UDP header itself.

Checksum — This field stores the checksum value generated by the sender before sending.

Applications of UDP :

i) Domain Name services
ii) Simple Network Management protocol
iii) Trivial File Transfer Protocol
iv) Routing Information Protocol
v) Kerberos

Here UDP is used to transmit data.

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

TCP uses different types of timers to control and management various tasks :

keep alive timer :

(i) This timer is used to check the integrity and validity of a connection.

(ii) When keep alive time expires, the host sends a probe to check if the connection still exists.

Retransmission Timer :

(i) This timer maintains stateful session of data sent

(ii) If the acknowledgement of send data does not receive with the retransmission time, the data segment is sent again

Persist timer :

(i) TCP session can be paused by either host by sending window size 0

(ii) To resume the session a host needs to send Window Size with some larger value

Timed-wait :

(i) After releasing a connection either of the hosts waits for a Timed-Wait time to terminate the connection complete

(ii) Timed-out can be a maximum of 240 second

It defines the type of encoding ie how 0's and 1's are changed to signal

2. Data Rate: This layer defines the rate of transmission which is the number of bits per second.

3. Synchronization: It deals with the synchronization of the transmitter and receiver. The sender and receiver are synchronized at bit level.

4. Interface: The physical layer defines the transmission interface between devices and transmission medium.

5. Line configuration: This layer connect devices with the medium: Point to point configuration and Multipoint configuration