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Ans to the Q no-(1)

(a) There are mainly five components of a data communication system:-

(1) Massage:- A data communication system's most valuable asset is the massage, which refers to data or information, and can be various formats like text, audio, or vedio.

(2) Sender:- In data communication system, a senders, such as a computers, a mobile, or workstations, plays a crucial role in transferring messages from source to destination

(3) Reciever:- This is the final destination where the massage from the senders has been received by a device like a computer, telephone, mobile or workstation.

(4) Transmission Medium:- Transmission medium, a physical path used in data communications, acts as a bridge between senders and receivers, guiding or unguiding data or message via wires or unguided methods.

(5) Set of Rules:- (Protocal) - Data communication is governed by protocols, designed by communication system designers, which represents agreements between devices. Without a protocol, communication between devices is impossible, making the protocol essential for effective data communication.

(4) Advantage of Mesh Topology:-

Failure during a single device won't break the network.
There is no traffic problem as there is a dedicated point to point links for every computers.
Fault identification is straightforward.
It provides high privacy and security.
Adding new devices won't disrupt data transmission.
This topology has robust features to beat any situation.
A mesh doesn't have a centralized authority.

Disadvantage of Mesh Topology:-

It's costly as compared to the opposite network topologies i.e. Star, bus, point to point topology.
Installation is extremely difficult in Mesh.
Complex process.

Power requirement is higher as all the nodes will need to remain active all the time.

There is a high risk of redundant connections.

Maintenance needs are challenging with a mesh.

b) Microwave:- Microwave is a line-of-sight wireless communication technology that uses high frequency beams of radio waves to provide high speed wireless connections that can send and receive voice, video, and data information.

Microwave links are widely used for point to point communications because their small wavelength allows conveniently sized antennas to direct them in narrow beams which can be pointed directly at the receiving antenna. This allows nearby microwave equipment to use the same frequencies without interfering with each other, as lower frequency radio waves do.

Microwaves are a form of electromagnetic radiation with wavelengths ranging from 1 meter to 1 millimeter; with frequencies between 300 MHz (100 cm) and 300 GHz (0.1 cm).

Characteristics of Microwave:-

(v) Microwaves are unidirectional.

(vi) Microwave transmission involves line-of-sight (LOS) communication technology.

(vii) Affected greatly by environmental factors like rain fading.

(viii) Microwaves cannot penetrate through obstacles such as hills, buildings, and trees due to their high frequency.

(ix) Signals can be degraded during Solar proton events.

(x) Atmospheric disturbances such as rain and snow can scatter microwave signals.

(c) Disadvantage of LAN:-

Local Area Networks (LAN) are limited in distance, create information security issues, and require expensive installation and communication hardware. They are difficult to share data with outside sources, have limited scalability, and have a single point of failure. Regular maintainance and management are necessary for optimal performance but can be time consuming and costly.

Disadvantage of MAN:-

The large area of MAN makes it difficult to secure from hackers due to safety issues, the need for expensive fiber optic cables, and the need for skilled technicians and administrators, making it difficult to manage and secure data.

Disadvantage of WAN:-

WAN networks face more security issues than LAN and MAN due to merged technologies, leading to potential malicious attacks. Installation costs are high due to complex geographical coverage, requiring expensive routers and security solutions.

Ans to the Q no-(2)

(a) Periodic signal:-

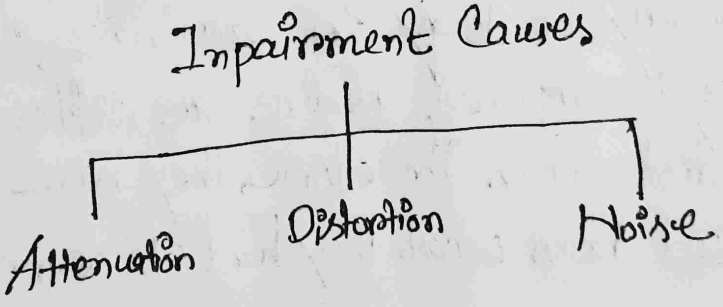
A periodic signal is a signal that repeats itself at regular intervals of time. A periodic signal can be represented as a sum of sinusoidal functions with frequencies that are integer multiples of the fundamental frequency of the signal.

Non-Periodic signals-

A non-periodic signal is a signal that does not repeat itself at regular intervals. This means that it does not have a fundamental frequency and its frequency spectrum is generally not composed of discrete frequencies.

b) Transmissions Impairment:-

In communication system, analog signals travel through transmission media, which tends to deteriorate the quality of analog signal, which means that the signal at the beginning of the medium is not the same as the signal at the end of the medium. The imperfection causes signal impairment. Here are the causes of the impairment.



Attenuation is the loss of energy in a signal, resulting in a decrease in strength with distance. Amplifiers are used to amplify the attenuated signal, compensating for this loss. Attenuation is measured in decibals (dB) and

can be expressed in terms of powers or voltage.

$$\text{Attenuation (dB)} = 10 \log_{10}(P_2/P_1)$$

P1 is the power at sending end and P2 is the power at receiving end.

Somewhere the decibel is also define in terms of voltage instead of power. In this case because powers is proportional to the square of the voltage the formula is

$$\text{Attenuation (dB)} = 20 \log_{10}(V_2/V_1)$$

Distortion means changes in the form or shape of the signal. This is generally seen in composite signals made up with different frequencies. Each frequency component has its own propagation speed travelling through a medium. And thats why it delay in comming at the final destination. Every component arrive at different time which leads to distortion. Therefore, they have different phases at receivers and from what they had at senders end.

Noise, a random or unwanted signal, can corrupt the original signal. It can be induced, crosstalk, thermal or impulse noise. Induced noise comes from motors and appliances, thermal noise from electron movement, crosstalk

from wires, and impulse noise from lightning or powers lines.

(4) A signal travels through an amplifier, and its power is increased 10 times. This means that

$$P_2 = 10P_1.$$

In this case the amplification can be calculated as

$$10 \log_{10} \frac{P_2}{P_1} = 10 \log_{10} \frac{10P_1}{P_1}$$

$$= 10 \log_{10} 10 = 10(1) = 10 dB.$$