Mid Assessment | Fall - 2023

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CSE - 21st Batch | **Course Code:** CSE - 435

Course Title: Data Communication | **ID:** 2121210071

Answer to the Question no- 1

(a)

Data Communication System Components:
There are mainly five components of a data communication system:

1. Message
2. Sender
3. Receiver
4. Transmission Medium
5. Set of rules (Protocol)

All elements are described below:

1. **Message:**
   This is most useful asset of a data communication system. The message simply refers to data or piece of information which is to be communicated. A message could be in any form, it may be in form of a text file, an audio file, a video file, etc.

2. **Sender:**
   To transfer message from source to destination, someone must be there who will play role of a source. Sender plays part of a source in data communication system.

3. **Receiver:**
   It is destination where finally message sent by source has arrived. It is a device that receives message. Same as sender, receiver can also be in form of a computer, telephone mobile, workstation, etc.

4. **Transmission-Medium:**
   In entire process of data communication, there must be something which could act as a bridge between sender and receiver, transmission medium plays that part. It is physical path by which data or message travels from sender to receiver. Transmission medium could be guided (with wires) or unguided (without wires), for example, twisted pair cable, fiber optic cable, radio waves, microwaves, etc.

5. **Set of rules (Protocol):**
   In simple terms, the protocol is a set of rules that govern data communication. If two different devices are connected but there is no protocol among them, there would not be any kind of communication between those two devices. Thus the protocol is necessary for data communication to take place.

Advantages of Mesh Topology	Disadvantages 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 computer. • Fault identification is straightforward. • This topology provides multiple paths to succeed in the destination and tons of redundancy. • It provides high privacy and security. • Data transmission is more consistent because failure doesn't disrupt its processes. • Adding new devices won't disrupt data transmissions. • This topology has robust features to beat any situation. • A mesh doesn't have a centralized authority.	• It's costly as compared to the opposite network topologies i.e. star, bus, point to point topology. • Installation is extremely difficult in the mesh. • Power requirement is higher as all the nodes will need to remain active all the time and share the load. • Complex process. • The cost to implement mesh is above other selections. • There is a high risk of redundant connections. • Each node requires a further utility cost to think about. • Maintenance needs are challenging with a mesh.

(b)

Microwave

Microwaves are electromagnetic radiations, also known as microwave radiation. Microwaves have a frequency ranging between 300 MHz and 300 GHz. The wavelength of microwaves ranges from 1 mm to around 30 cm. Microwave radiations lie in between the radio waves and infrared radiations. Microwaves are short-wavelength radio waves having frequencies in the gigahertz (GHz) range. These microwaves are produced by dedicated vacuum tubes, known as klystrons, magnetrons, and Gunn diodes.

Characteristics of microwaves or microwave radiation are listed below-

- They are the radiations capable of radiating electromagnetic energy with shorter wavelengths.
- Microwaves are reflected by metal surfaces.
- The transmission of microwaves is affected by phenomena like refraction, diffraction, reflection, and interference.
- They can easily pass through glass and plastics, and hence are used in heating and cooking in an oven.
- They are easily attenuated within shorter distances.
- These radiations are not reflected by the Ionosphere.
- Microwave radiation can pass through the atmosphere. Hence, microwaves are used in the satellite communication sector to transmit information back and forth to the satellite. We can know why satellite dishes are made of metal since they reflect microwave radiation.
- Microwaves travel in a straight line and are reflected by the conducting surfaces.
- Microwave currents have the capacity to flow through a thin layer of a cable.

(c)

Disadvantages of LAN MAN & WAN

LAN	MAN	WAN
• Limited distance. • Information security issue created. • Installing LAN is expensive. • Data sharing via outside source. • Limited scalability. • Single point of failure.	• The problem of less security. • Wire required. • Technical assistance. • Difficult to manage.	• Security issue. • Installation cost. • Troubleshooting issues. • Maintenance issues.

Answer to the Question 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. The fundamental frequency of a periodic signal is the lowest frequency present in the signal.

Non-Periodic Signal:

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. Non-periodic signals can be continuous or discrete, and they can be either deterministic or random. Examples of non-periodic signals include white noise, impulses, and arbitrary waveforms.

(b)

Transmission Impairment

Transmission impairment occurs when the received signal is different from the transmitted signal. As we know, a signal can be transmitted as Analog signal or it can be transmitted as a digital signal.

In Analog signals due to transmission impairment the resulting received signal gets different amplitude or the shape. In the case of digitally transmitted signals at the receiver side we get changes in bits (0's or 1's).

Causes:

There are various causes of transmission impairments −

- Noise
- Distortion
- Attenuation

Let us understand them one by one.

Noise-

Noise is the major factor for the transmission distortion as any unwanted signal gets added to the transmitted signal by which the resulting transmitted signal gets modified and at the receiver side it is difficult to remove the unwanted noise signal. These noises are various kinds like shot noise, impulse noise, thermal noise etc.

Distortion-
This kind of distortion is mainly appearing in case of composite signals in which a composite signal has various frequency components in it and each frequency component has some time constraint which makes a complete signal.

Attenuation:
Attenuation is generally decreased in signal strength, by which the received signal will be difficult to receive at the receiver end. This attenuation happens due to the majority factor by environment as environment imposes a lot of resistance and the signal strength decreases as it tries to overcome the resistance imposed.

Q: A signal travels through an amplifier and its power is increased 10 times so calculate the amplification.

Answer:

The amplification in terms of power gain can be calculated using the formula:

Amplification = $10\times\log_{10}\ \boldsymbol{P}_{out}/\boldsymbol{P}_{in}$

Where-

$\boldsymbol{P}_{out}$ is the output power and $\boldsymbol{P}_{in}$ is the input power.

In this case, since the power is increased 10 times, the amplification factor would be 10.

Therefore, $\boldsymbol{P}_{out}$ is 10 times $\boldsymbol{P}_{in}$

Substituting this into the formula, we get:

Amplification = $10\times\log_{10}\frac{10\times\boldsymbol{P}in}{\boldsymbol{P}in}$

Simplifying this expression further:

Amplification = $10\times\log_{10}(10)$

Using a calculator, we find that $\log_{10}(10) = 1$.

Therefore:

Amplification = 10×1 =10

So, the amplification is 10 times or 10 in logarithmic scale (10 db).