CHAPTER 4
DATA COMMUNICATION

SHORT AND LONG QUESTIONS

Q.1 Define data communication.

Ans: Data Communication:

Data communication is the transmission of data between two points. A data communication system is a collection of hardware and software arranged to communicate information from one location to another.

Q.2 Define data, data transmission, analog signals and digital signals

Ans: Basic Terms of Data Communication:

The following terms are associated with data communication.

- Data
- Data transmission
- Analog signal
- Digital signal

Data:

Data means any types of raw facts and figures which can be provided as input to the computer for processing. Data can be in the form of text, sound, graphics, image or video.

Data transmission:

Data transmission means sending information from one place to other using computer networks and data communination systems. In computer technology, it means sending streams of bits or bytes from one place to another using copper wire, Fibre optics, satellite communication, etc.

Analog and Digital Signals:

A signal is a variation of physical quantity with time. The physical quantity can be temperature, pressure, rate of heart beat, etc. An electrical signal is a change in voltage or current with time.

Electrical signals can be divided into two main types, analog and digital signals.

Analog signals are continuous. They vary continuously within a range. Analog transmission uses signals that are exactly the same as sound waves.

- Digital signals consist of binary digit 0 and 1 to represent information. These signals are transmitted by a series of "ON" and "OFF" signals by pulses of electricity or light. The "ON" signal represents binary 1 and "OFF" signal binary 0.

Q.3 Define transmission media.

Ans: Transmission Media:

Transmission media provide the means by which data travels from source to destination. In other words, it is the pathway for transmitting data.

Q.4 Describe types of transmission media.

Ans: Types of Transmission Media:

There are two types of transmission media, Guided Media and Unguided Media.

Guided Media:

Guided media uses cabling system that guides the data signals along a specific path. Different types of guided media are twisted pair, coaxial cable and Fibre optic cable.

Unguided Media:

Unguided media signals travel through open space and nothing guides them along any specific path.

Point To Ponder

Why do satellites stay in orbit and never fall on the earth?

Ans: This is the law of inertia. The force of gravity acts upon a high speed satellite to deviate its trajectory from a straight-line inertial path. Indeed, a satellite is accelerating towards the Earth due to the force of gravity. Finally, a satellite does fall towards the Earth; only it never falls into the Earth.

Q.5 Define amplification.

Ans: Amplification:

Amplification refers to strengthening of signal to solve the problem of attenuation in data transmission.

Amplifier:

An amplifier is a device used in data communication that receives weak signals, amplifies it and then retransmits.

Q.6 List the communication devices.

Ans: Communication Devices:

A communication device is hardware that is used for transmission of information from one place to another between computers and other devices.

The following communication devices are commonly used in computer networks in data communication systems.

- Dial-up Modem
- Network Interface Card
- Router
- Switch/Access Point

For Your Information

The first dial-up modem was built in 1962. It had a speed of 300 bits per second

Do You Know?

Wireless network card provides an easy way to create a wireless network but it is slow and less reliable than wired network card.

Q.7 List the data transmission terminologies.

Ans: Communication Terminologies:

Communication Terminologies refers to terms or words that are related with data transmission or characteristics of communication channel.

Data Transmission Terminologies:

The following terms are used to determine the data transmission capabilities of a transmission media such as telephone line, coaxial cable, etc.

- Data rate
- Baud rate
- Bandwidth
- Signal to Noise Ratio

Q.8 Describe Signal-to-Noise Ratio.

Ans: Signal-to-Noise Ratio:

Signal-to-noise ratio is the ratio of signal power to the noise power that causes errors in data transmission. In other words, it means the ratio of useful data transmission to errors caused by noise over a transmission medium.

The measurement of Signal-to-noise ratio defines the data transmission quality of a communication medium.

If a transmission line has Signal-to-noise ratio higher than **1:1** that means more signal transmission than noise.

Q.9 Use appropriate formulae to determine the characteristics of a communication channel

OR

Describe the Characteristics of Communication Channel.

Ans: Characteristics of Communication Channel:

The maximum number of bits that can be transmitted over a communication line is a characteristic of transmission media. If more bits per second are transmitted than the line is capable of, some information will be lost due to transmission errors.

The baud rate can be calculated as:

$$Baud\ rate = Number\ of\ signal\ changes\ per\ second$$

The baud rate and data transmission rate measured as bits per seconds are not always the same.

For example, the Baud rate of a transmission line that uses modem is 28 kbps. If the electrical signal has two states to represent binary digits 0 and 1, then the Baud rate and data rate are the same.

If the electrical signal has four states to represent 00, 01, 10 and 11 as mentioned earlier, then Baud rate and data rate will not be the same.

Data rate will be calculated as:

$$Data\ rate = 2 \times Baud\ rate = 2 \times 28 = 56\ kbps$$

KEY POINTS

- Data communication refers to transmission of information from one location to another using copper wires, Fibre optics, satellites, etc.
- A data communication system is a collection of hardware and software arranged to communicate information from one location to another.
- Analog signals are continuous. They vary continuously within a range. Analog transmission uses signals that are exactly the same as sound waves.
- Digital signals consist of binary digit 0 and 1 to represent information. These signals are transmitted by a series of "ON" and "OFF" signals by pulses of

electricity or light. The "ON" signal represents binary 1 and "OFF" signal binary 0.

- Transmission medium is the physical pathway over which message is transmitted from sender to receiver.
- Protocol is a set of rules between two communication devices that govern the process of data communication.
- In asynchronous transmission, time interval between each character is not the same. Each character is transmitted with additional start and stop bits.
- In synchronous transmission, time interval between each character is always the same. It does not require start or stop bits.
- Guided media uses cabling system that guides the data signals along a specific path.
- Unguided media signals travel through open space and nothing guides them along any specific path.
- Radio waves are electromagnetic waves that are propagated by antennas.
- Satellite is an object that is placed in an orbit around the earth and revolves around it with speed that is same as the rotational speed of earth for communication.
- Attenuation is signal fall off with distance in guided or unguided media.
- Distortion refers to signal change in shape or form as it travels through communication lines.
- Cross talk refers to undesired signals that enter the path of the transmitted signal due to electromagnetic radiation.
- A Network Interface Card (NIC) is used to connect computers together to create computer network and make communication between computers possible.
- A router is a communication device used to connect computers together in different networks.
- A switch is used for connecting computers together in wired local area network whereas access point connects computers in wireless local area network.

EXERCISE

Q1. Select the best answer for the following MCQs.

i. In which type of data transmission start/stop bits are used?

A. Synchronous transmission B. Asynchronous transmission
C. Satellite transmission D. Microwave transmission

ii. In which of the following transmission, the time interval between the characters is always the same?

A. Synchronous transmission B. Asynchronous transmission
C. Satellite transmission D. Microwave transmission

iii. Which of the following transmission media uses light waves for transmitting information?

A. Coaxial cable B. Twisted pair cable

Chapter 1

Transmission Media

- Transmission media is anything that can carry signals or data.
- Transmission media is a physical pathway over which message is travelling from one place to another.
- Transmission media is the medium through which information is transmitted from one place to another.
- In electronic transmission, two physical isolated metal channels is not enough to carry information from one place to another because the signal will be lost in the surrounding environment. Therefore, a third wire is needed to provide a return path for the signal.
- Transmission media is the medium that carries the data signals while it is being sent from one place to another.
- Transmission media is the medium through which information is transmitted from one place to another