

Communication System

POINTS TO REMEMBER

1. The exchange of information between a sender and receiver is called communication. It is the act of transmission of information.
2. The arrangement of devices to transfer the information is called communication system.
3. Every communication system has three basic elements. 1) Transmitter 2) channel 3) Receiver

4. Information :

1. The information to be communicated may be written message (or) speech (or) some picture. The information is in the form of electric signal which is suitable for sending. This is of two types.

a) Analog voltage signal in which information is converted into continuous variations of voltage (or) current.

b) Digital voltage signal in which the information is converted into stepwise vibrations of current (or) voltage.

2. A device which converts one form of energy into another form is called transducer. Ex. Micro phone, speaker etc.

3. If the information is communicated between two points, the method is called point to point communication. Ex: Traditional telephone

4. If the information is passed to several points, it is called broad casting mode (or) wireless mode. Earth's atmosphere plays an important role in this communication.

5. Transmitter: Transmitter first converts the message into equivalent electrical variations. It is then called a signal. The signals in communication (speech, music etc) are at low frequency and can not be transmitted to longer distance. For long distance transmission, the signals are superimposed on a high frequency waves called carrier waves. This process is called modulation. The process of changing some character (amplitude, frequency (or) phase) of a carrier wave in accordance with the intensity of the signal is known as modulation. The basic modes of modulation are 1) Amplitude modulation (AM) 2) Frequency Modulation (FM) and 3) Phase Modulation (PM)

6. Antenna: 1) Antenna plays an important role in communication. The linear size of the antenna should be nearly $\frac{\lambda}{4}$. The distance up to which an antennae of higher 'h'

can cover on the surface of the earth $d = \sqrt{2Rh}$

2) The maximum distance between transmitting and receiving antennae is

$$d_{\max} = d_t + d_r = \sqrt{2Rh_t + 2Rh_r}$$

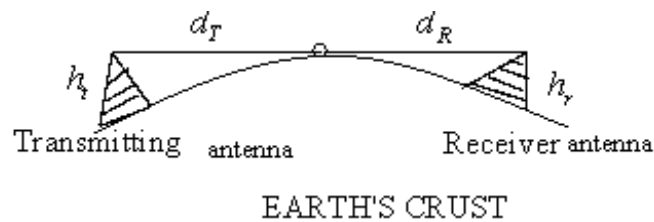
7. Channel: Earth's atmosphere has an important role in the transmission of modulated waves. There are three modes of propagation.

1) Ground wave propagation 2) Sky wave propagation 3) Space wave propagation

➤ World wide web (WWW) was invented by Tim-Berners-Lee .

very short distance. To radiate signals with high efficiency. Antennas should have a size comparable to the wavelength λ of the signal.

3. What are sky waves? Explain sky wave propagation, briefly.
 A. Long distance short wave communication is possible by ionosphere reflection. The lower frequency limit depends on the absorption in ionosphere, noise level at the receiver, since the losses in ionosphere decrease with frequency. The upper limit of frequency depends on the distance of transmission, height and electron density in the different layers ionosphere. Sky wave propagation is used in the frequency ranges from few MHz to about 30 MHz. EM waves with frequencies more than 30 MHz will escape through the ionosphere.
4. What is space wave communication? Explain.
 A. Electromagnetic waves of frequency above 30 MHz use space wave (or) direct wave propagation. This is used for line-of-sight (LOS) communication (radar) and satellite communication (mobile telephone). The maximum line-of-sight distance d_M between the transmitting and receiving antennas of height h_t and h_r respectively is,



$$d_{\max} = d_t + d_r = \sqrt{2Rh_t + 2Rh_r} \quad \text{Where R is radius of earth.}$$

Television broadcast, microwave links and satellite communication are examples of communication systems that use space wave mode of propagation.

5. What do you understand by modulation? Explain the need for modulation.
 A. **Modulation:** The signals in communication (speech, music etc) are at low frequency and can not be transmitted to longer distance. For long distance transmission, the signals are superimposed on a high frequency waves called carrier waves. This process is called modulation. The process of changing some character (amplitude, frequency (or) phase) of a carrier wave in accordance with the intensity of the signal is known as modulation.
- Modulation is of three types :
- i) **Amplitude Modulation :** In India amplitude modulation is used in radio broadcast – casting. The amplitude of the high frequency carrier wave is changed in accordance with the intensity of the signal, frequency being constant.
 - ii) **Frequency Modulation :** In T.V. transmission, frequency modulation is used for sound signal and amplitude modulation is used for picture signal. The frequency of the carrier wave is changed in accordance with the intensity of the signal, amplitude being same. In frequency modulation, power loss will be least and noise can be reduced.

Frequency modulation requires 7 to 8 times larger band width than for A.M. and frequency modulation is more expensive.

iii) **Phase Modulation** : Phase of the carrier wave changes in accordance with the modulating signal.

VERY SHORT ANSWER QUESTIONS

1. What are the basic blocks of a communication system?
A. Every communication system has three basic elements.
1) Transmitter 2) channel 3) Receiver
2. What is "World wide web" (WWW)?
A. WWW may be regarded as the mammoth encyclopedia of knowledge accessible to everyone round the clock throughout the year. Tim-Berners-Lee invented the World Wide web.
3. Mention the frequency range of speech signals.
A. In a communication system, the message signal can be voice, music, and picture or computer data. For speech signals, the adequate frequency range is between 300 Hz and 3100 Hz. Speech signals requires a bandwidth of 2800 Hz.
4. What is sky wave propagation?
A. Long distance short wave communication is possible by ionosphere reflection. Sky wave propagation is used in the frequency ranges from few MHz to about 30 MHz. EM waves with frequencies more than 30 MHz will escape through the ionosphere.
5. Mention the various parts of the ionosphere?
A. The ionosphere is so called because of the presence of large number of ions or charged particles. It extends from a height of nearly 65 km to about 400 km above the earth's surface. The ionosphere is further subdivided into several layers. They are troposphere, stratosphere, mesosphere, thermosphere etc.
6. Define modulation. Why is it necessary? (March 2010 ,June2010, March 2009)
A. **Modulation**: The signals in communication (speech, music etc) are at low frequency and can not be transmitted to longer distance. For long distance transmission, the signals are superimposed on a high frequency waves called carrier waves. This process is called modulation.
7. Mention the basic methods of modulation. (March 2009)

- A. The basic modes of modulation are
- 1) Amplitude modulation (AM)
 - 2) Frequency Modulation (FM) and
 - 3) Phase Modulation (PM)
8. Which type of communication is employed in Mobile Phones?
- A. In mobile phones, point-to-point communication mode is employed. In point-to-point communication mode, communication takes place over a link between a transmitter and a receiver.

ASSESS YOURSELF

1. What should be the band width of frequencies required for the transmission of pictures using video signals?

A. 4.2MHz.
2. What is the maximum number of TV signals that can be transmitted along a co-axial cable?

A. Number of channels = $\frac{\text{Available bandwidth of the medium}}{\text{Bandwidth of signal}} = \frac{750\text{MHz}}{6\text{MHz}} = 125$
3. What is the maximum number of TV signals that can be transmitted along a co-axial fibre?

A. Number of channels = $\frac{\text{Available bandwidth of the medium}}{\text{Bandwidth of signal}} = \frac{100 \times 10^3 \text{MHz}}{6\text{MHz}} = 16667$
4. What are the different modes of propagation of radio waves?

A. There are three modes of propagation.

 - 1) Ground wave propagation
 - 2) Sky wave propagation
 - 3) Space wave propagation