# **Communication System**

### Transmitter

(a) It process and encode the information and make it suitable for transmission.

(b) The message signal for communication can be analog signals or digital signals.

(c) An analog signal can be converted suitably into a digital signal and vice-versa.

(d) An analog signal is that in which current or voltage value varies continuously with time.

#### Communication channel

The medium through which information propagate from transmitter to receiver is called communication channel.

#### Receiver

It receives and decode the signal.

#### Analog signal

A signal in which current or voltage changes its magnitude continuously with time, is called an analog signal.

#### Digital signal

A signal in which current or voltage have only two values, is called a digital signal. An analog signal can be converted suitable into a digital signal and vice-versa.

# Modulation

The process of superimposing the audio signal over a high frequency carrier wave is called modulation.



(a) Energy carried by low frequency audio waves (20 Hz to 20000 Hz) is very small.

(b) For efficient radiation and reception of signal, the transmitting and receiving antennas should be very high approximately 5000 m.

(c) The frequency range of audio signal is so small that overlapping of signals create a confusion.

# Amplitude Modulation

In this type of modulation in which the amplitude of a high frequency carrier wave is varied in accordance with some characteristic of the modulating signal.

Band width required for amplitude modulation = twice the frequency of the modulating signal.

# • Frequency modulation

In this type of modulation, the frequency of high frequency carrier wave is varied in accordance to instantaneous frequency of modulating signal.

### Pulse modulation

In this type of modulation, the continuous waveforms are sampled at regular intervals. Information is transmitted only at the sampling times.

### Demodulation

The process of separating of audio signal from modulated signal is called demodulation.

#### Antenna

An antenna converts electrical energy into electromagnetic waves at transmitting end and pick up transmitted signal at receiving end and converts electromagnetic waves into electrical signal.

#### Modem

The term modem is contraction of the term modulator and demodulator. Modem is a device which can modulate as well as demodulate the signal. It connect one computer to another through ordinary telephone lines.

### • Fax (Facsimile telegraph)

The electronic reproduction of a document at a distant place is called FAX.



The radio waves are the electromagnetic waves of frequency ranging from 500 kHz to about 1000 MHz. These waves are used in the field of radio communication.

# Ground wave or surface wave propagation

It is suitable for low and medium frequency upto 2 MHz. It is used for local broad casting.

### • Sky wave propagation

It is suitable for radiowaves of frequency between 2 MHz to 30 MHz. It is used for long distance radio communication.

# (a) Critical frequency

The highest frequency of radio wave that can be reflected back by the ionosphere is called critical frequency.

Critical frequency,  $f_c = 9 (N_{max})^{1/2}$ Here,  $N_{max} =$  number density of electrons/meter<sup>3</sup>

(b) Skip distance

The minimum distance from the transmitter at which a sky wave of a frequency but not more than critical frequency, is sent back to the earth.

Skip distance  $(D_{skip}) = 2h (f_{max}/f_c)^2 - 1$ 

Here h is height of reflecting layer of atmosphere.

 $f_{\mbox{\tiny max}}$  is maximum frequency of electromagnetic waves and  $f_{\mbox{\tiny c}}$  is critical frequency.

# (d) Fading

The variation in the strength of a signal at receiver due to interference of waves, is called fading.

# • Space wave propagation

It is suitable for 30 MHz to 300 Mhz. It is used in television communication and radar communication. It is also called line of sight communication.

Range is limited due to curvature of earth. If h be the height of the transmitting antenna, then signal can be received up to a maximum distance

d = √2Rh

If the height of transmitting and receiving antennas be  $h_{\tau}$  and  $h_{\scriptscriptstyle R}$  respectively. The effective range will

 $d = \sqrt{2Rh_{T}} + \sqrt{2Rh_{R}}$ 

Microwaves are electromagnetic wave of frequency 1 to 300 GHz, greater than those of TV signals. The wavelength of microwaves is of the order of a few mm.

Microwave communication is used in radar to locate the flying objects in space.

These waves can be transmitted as beam signals in a particular direction, much better than radio wave.

There is no diffraction of microwave around corners of an obstacle which happens to lie along its passage.

### Satellite communication

It is carried out between a transmitter and a receiver through a satellite. A geostationary satellite is utilized for this purpose, whose time period is 24 hours.

# Geo-synchronous orbit

The orbit in which the geo-satellite above revolves around the earth is known as geo-synchronous orbit.

#### Remote sensing

It is a technique of observing or measuring the characteristics of the object at a distance. A polar satellite is utilized for this purpose.

Distance upto which a signal can be obtained from an antenna is given by

d = √2hR

Here, h is height of antenna and R is radius of earth.

### • LED and Diode laser

(a) Light emitting diode (LED) and diode laser are preferred sources for optical communication.

(b) Each produces light of suitable power required in optical communication. Diode laser provides light which is monochromatic and coherent

(c) LED provides almost monochromatic light. This suitable for small distance transmission.

# Line communication

Transmission lines are used to interconnect points separated from each other. Line communication may be in the form of electrical signal or optical signal.

# Optical fibers

An optical fiber is a long thread consisting of a central core of glass or plastic of uniform refractive index.

# • Types of optical fiber

Single mode step index fiber

Multi mode step index fiber

Multi mode graded index fiber