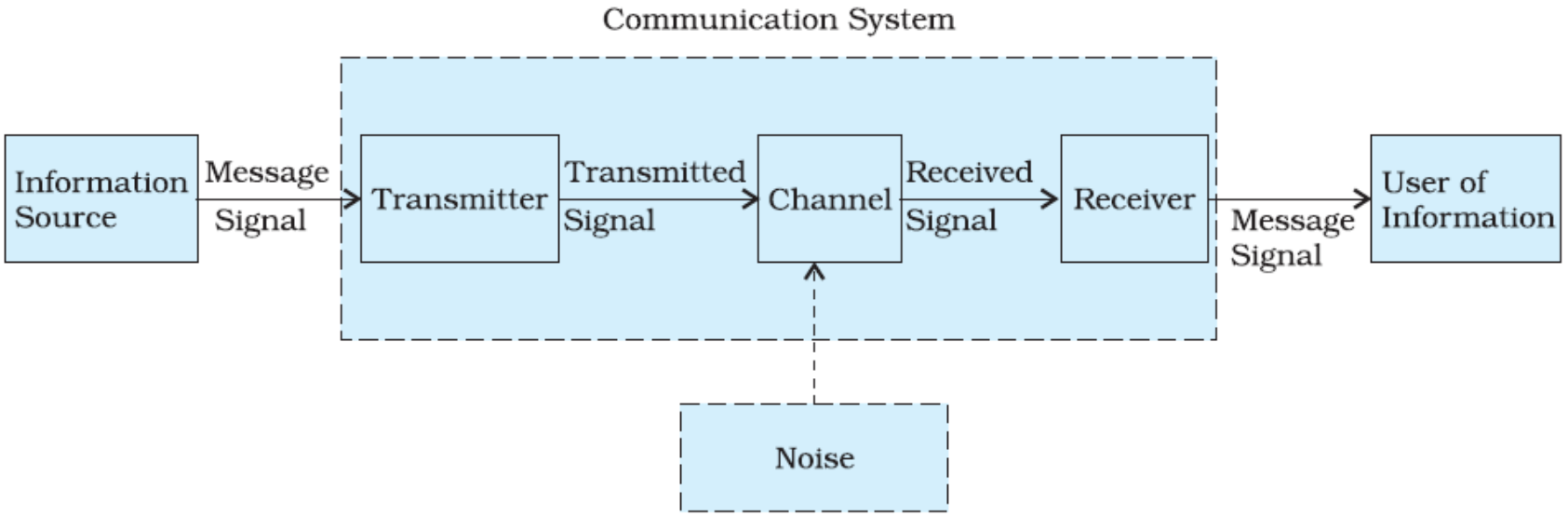
- Electronic communication refers to the faithful transfer of informationor message (available in the form of electrical voltage and current)from one point to another point.

- Transmitter, transmission channel and receiver are three basic unitsof a communication system.



Transducer: Any device that converts one form ofenergy into another can be termed as a transducer.

Signal: Information converted in electrical form and suitable for transmission is called a signal. Signals can be either analog or digital.

Noise: Noise refers to the unwanted signals that tend to disturb the transmission and processing of message signals in a communication system.

Transmitter: A transmitter processes the incoming message signal so as to make it suitable for transmission through a channel and subsequent reception.

Receiver: A receiver extracts the desired message signals from the received signals at the channel output.

Attenuation: The loss of strength of a signal while propagating through a medium is known as attenuation.

Amplification: It is the process of increasing the amplitude (and consequently the strength) of a signal using an electronic circuit called the amplifier.

Range: It is the largest distance between a source and a destination up to which the signal is received with sufficient strength.

Bandwidth: Bandwidth refers to the frequency range over which an equipment operates or the portion of the spectrum occupied by the signal.

Modulator: At the transmitter, information contained in the low frequency message signal is superimposed on a high frequency wave, which acts as a carrier of the information. This process is known as modulation. As will be explained later, there are several types of modulation, abbreviated as AM, FM and PM.

Demodulation: The process of retrieval of information from the carrier wave at the receiver is termed demodulation. This is the reverse process of modulation.

Repeater: A repeater is a combination of a receiver and a transmitter. A repeater, picks up the signal from the transmitter, amplifies and retransmits it to the receiver sometimes with a change in carrier frequency.

- Two important forms of communication system are: Analog and Digital. The information to be transmitted is generally in continuous waveform for the former while for the latter it has only discrete or quantised levels.

- Every message signal occupies a range of frequencies. The bandwidth of a message signal refers to the band of frequencies, which are necessary for satisfactory transmission of the information contained in the signal. Similarly, any practical communication system permits transmission of a range of frequencies only, which is referred to as the bandwidth of the system.

- Low frequencies cannot be transmitted to long distances. Therefore, they are superimposed on a high frequency carrier signal by a process known as modulation.

- In modulation, some characteristic of the carrier signal like amplitude, frequency or phase varies in accordance with the modulating or message signal. Correspondingly, they are called Amplitude Modulated (AM), Frequency Modulated (FM) or Phase Modulated (PM) waves.

- Pulse modulation could be classified as: Pulse Amplitude Modulation(PAM), Pulse Duration Modulation (PDM) or Pulse Width Modulation(PWM) and Pulse Position Modulation (PPM).

- For transmission over long distances, signals are radiated into spaceusing devices called antennas. The radiated signals propagate aselectromagnetic waves and the mode of propagation is influenced bythe presence of the earth and its atmosphere. Near the surface of theearth, electromagnetic waves propagate as surface waves. Surface wavepropagation is useful up to a few MHz frequencies.

- Long distance communication between two points on the earth isachieved through reflection of electromagnetic waves by ionosphere.Such waves are called sky waves. Sky wave propagation takes place upto frequency of about 30 MHz. Above this frequency, electromagneticwaves essentially propagate as space waves. Space waves are used forline-of-sight communication and satellite communication.

- If an antenna radiates electromagnetic waves from a height h_T, thenthe range d_T is given by

  $\sqrt{2Rh_T}$

  whereR is the radius of the earth.

- Amplitude modulated signal contains frequencies $(\omega_c - \omega_m)$, ω_c and $(\omega_c + \omega_m)$
- Amplitude modulated waves can be produced by application of the message signal and the carrier wave to a non-linear device, followed by a band pass filter.

- AM detection, which is the process of recovering the modulating signal from an AM waveform, is carried out using a rectifier and an envelope detector.

- A message signal of frequency 10 kHz and peak voltageof 10 volts is used to modulate a carrier of frequency 1 MHz and peakvoltage of 20 volts. Determine (a) modulation index, (b) the side bandsproduced.

  Solution

  (a) Modulation index =10/20 = 0.5

  (b) The side bands are at (1000+10 kHz)=1010 kHz and(1000 –10 kHz) = 990 kHz.

- A transmitting antenna at the top of a tower has a height32 m and the height of the receiving antenna is 50 m. What is themaximum distance between them for satisfactory communication inLOS mode? Given radius of earth 6.4 $\times 10^6$ m.

  Solution

  = $\sqrt{2} * 64 * 10^5 * 32 + \sqrt{2} * 64 * 10^5 * 50$

  $= 64 \times 10^2 \times \sqrt{10} + 8 \times 10^3 \times \sqrt{10}$ m

  $=144 \times 102 \times 10$ m = 45.5 km