Lecture 01: Introduction

It is the process of conveying or transferring message from one point to another. It is started with wire telegraphy in 1940.

Generally communication is of two types:

i) Communication within line of sight
ii) Communication beyond line of sight between point to point.

If two points are beyond line of sight then branch of communication engineering come into picture.

Elements of Communication System or Block Diagram of Communication System:

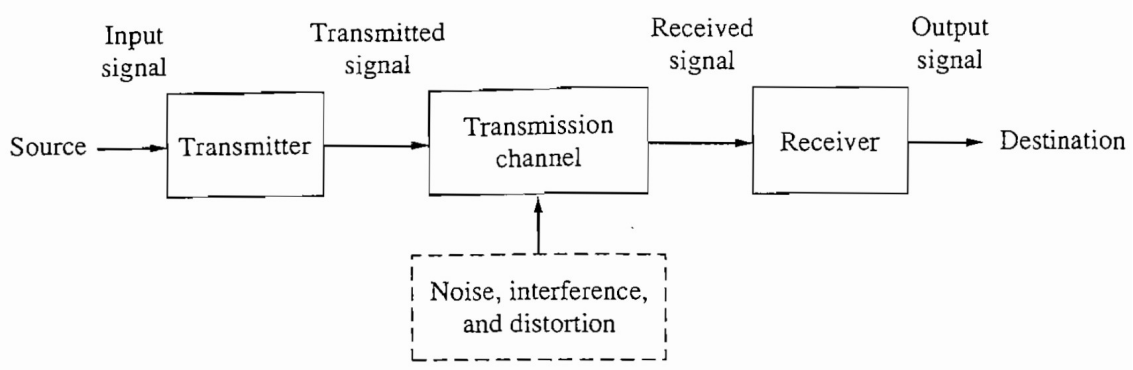

Fig.1 Block diagram of Communication System

1. **Source & Destination:** The message produced by the information source is not electrical in nature, but it may be a voice signal, a picture signal, etc. So an input transducer is required to convert original message signal into a time varying electrical signal. These signals are called ***baseband signals or modulating signals***.

At the destination another transducer is required to convert electrical signal into appropriate message signal.

2. **Transmitter:** The transmitter comprising electrical and electronic components converts message signal into a suitable form for propagating over communication medium. This is often achieved by modulating the carrier signal which may be an electromagnetic wave. This wave is often referred as ***modulated signal***.

Modulation types:

i) On the basis of power requirement: a) Low level modulation b) High level modulation.

ii) On the basis of carrier wave: a) Continuous wave modulation b) Pulse Modulation.

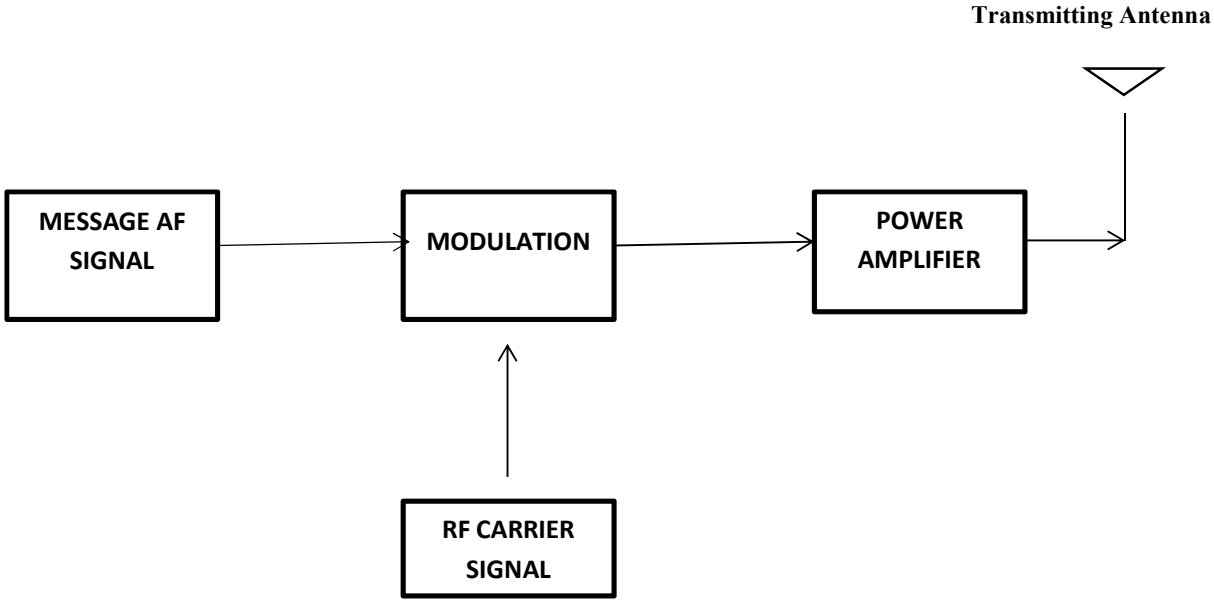

Fig.2 Modulation Process

After modulation, signal is amplified by a power amplifier, so that it can be easily transmitted to a considerable distance.

3. **Channel:** The transmitter and receiver are usually separated in space. The channel provides connection between the source and destination. The channel can be of many like coaxial cable, microwave links, radio wave links, or an optical fibre. Regardless of its type, channel degrades the transmitting signal in a number of ways which produces signal distortion. This occurs due to imperfect response of channel, undesirable electrical interference in channel, insufficient channel bandwidth, and contamination of signals due to noise.

4. **Receiver:** The main function of receiver is to extract message signal from degraded version of transmitted signal. The receiver has the task of operating on received signal so as to reconstruct the recognizable form of original signal and to deliver it to destination. Exact form of receiver can be decided by requirement. The decision of receiver is made on basis of i) modulation used ii) frequency range iii) display used and iv) destination.

At receiver side the reverse process of transmitter takes place, called ***demodulation***. Demodulation is avoided directly from RF received signal because at RF frequency demodulation process will be complex and costly. So first stage of receiver is to convert RF signal into a low frequency called 'Intermediate Frequency'. This is done with the help of mixer and local oscillator.

In the mixer, a locally generated RF signal (from L.O.) is mixed with received RF signal. Output of mixer is the difference between these two signals.

Now demodulation takes place as in fig.3 below depending on the type of modulation.

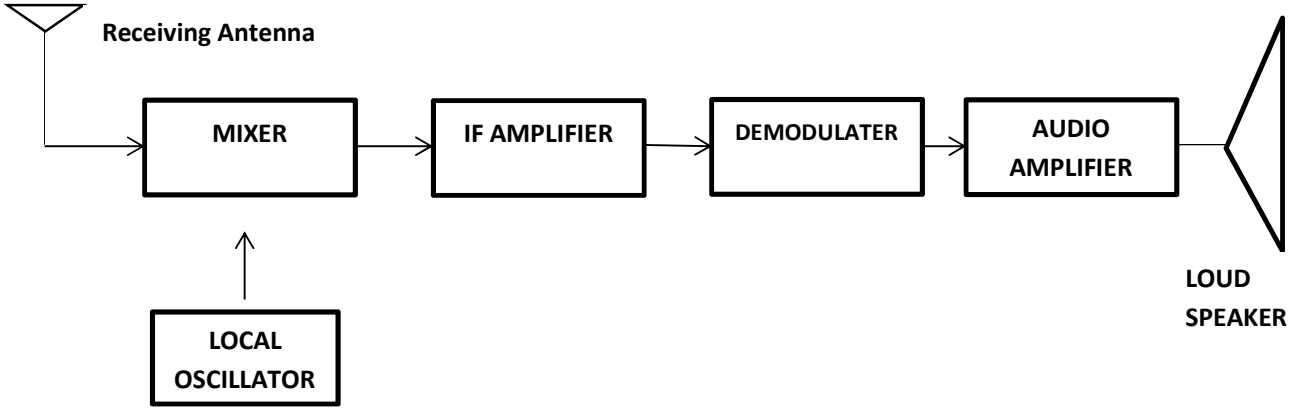

Fig.3 Receiver

Types of Communication Systems:

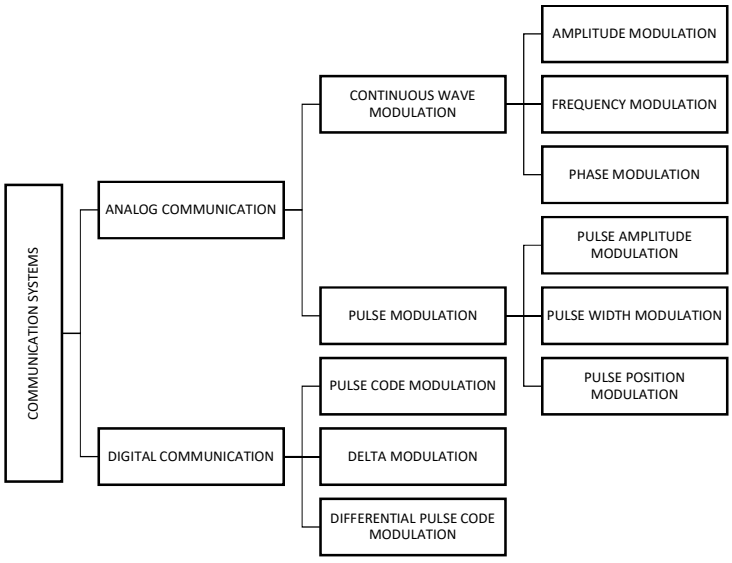

Fig.4 Types of Communication Systems

Communication engineering is further divided into two types depending on the transmission media: i) Line Communication & ii) Wireless or Radio Communication

Line Communication: In this, the medium of transmission is a pair of conductors called transmission lines. Each transmission line can normally convey only one message at a time and is known as a line channel.

Disadvantages: i) Installation and maintenance is costly.
ii) Transmission capability is limited.

Radio Communication: In this, the message is transmitted through the open space by electromagnetic waves called Radio waves. Here signals from various sources are transmitted through open space. This causes interference among various signals, and as such no useful message is received by receiver.

The problem of interference is solved by translating the message signal to different RF spectra. This is achieved by transmitter using the process called modulation. Each radio frequency spectrum behaves as a separate frequency channel and thus avoids interference. The receiver selects desired radio frequency and produces the useful message by another process called demodulation.

Basic Modes of Communication: There are two basic modes of communication.

i) **Broadcasting**: This involves the use of a single powerful transmitter and numerous receivers that are relatively inexpensive to build. Here information bearing signals flow only in one direction.

ii) **Point-to-Point Communication**: in which communication process takes place over a link between a single transmitter and receiver. In this case, there is usually a bidirectional flow of information bearing signals, which requires the use of transmitter and receiver at each end of the link.

Frequency Spectrum:

Type of signal	Frequency Range	Applications
ELF	30 Hz-300 Hz	Power Transmission
VF	300 Hz-3KHz	Audio Applications
VLF	3KHz-30KHz	Submarine Communications, Navy, and Military Communications.

LF(Long Waves)	30KHz-300KHz	In Aeronautical and marine, navigations act as subcarriers.
MF(Medium Waves)	300KHz-3MHz	AM radio broadcast, Marine and aeronautical communications.
HF(Short Waves)	3MHz-30MHz	Short wave transmission, Amateur and CB communication.
VHF	30MHz-300MHz	TV and FM broadcasting
UHF(Micro Waves)	300MHz-3GHz	UHF TV channels, Cellular phones, Military applications
SHF	3GHz-30GHz	Satellite and RADAR communications
EHF	30GHz-300GHz	Satellites and specialized RADARs
Infrared	---	TV remote control, weapon guidance systems
Visible Light	---	---
X-rays, gamma rays, cosmic rays, etc.	---	---

Bandwidths of typical signals:

Type of the signal	Range of frequency in Hz	Bandwidth in Hz
Voice signal for telephony	300-3400	3100
Music signal	20-15000	14980
TV signals(picture)	0-5MHz	5MHz