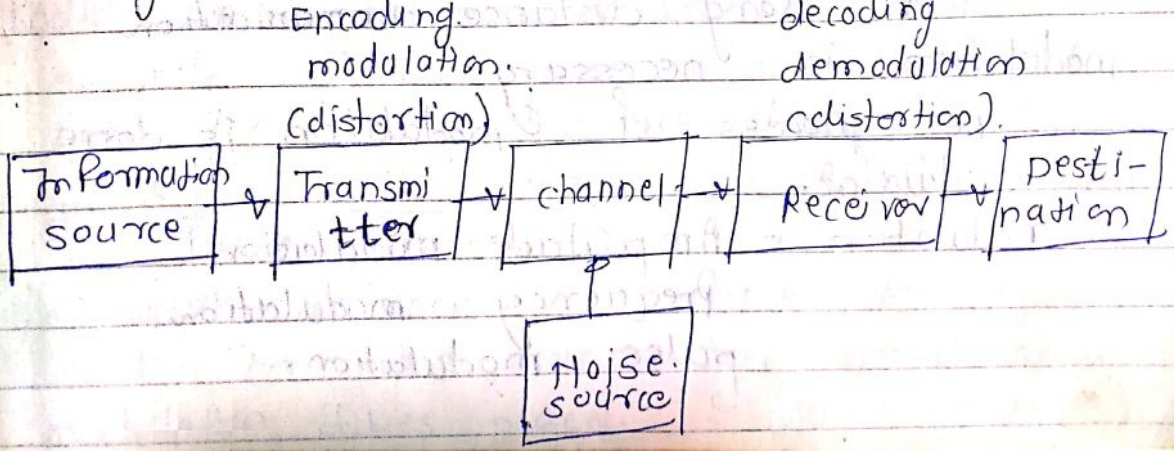
Electronic means of communication is widely used for communication of voice, music, picture and computer data. (1)

Communication - The term communication refers to the sending, receiving and processing of information (at a distance) by electric means.
The branch of engineering which deals with the comm^{n} system is known as-
Communication Engineering.

Communication System -
Here physical message such as sound, words, pictures etc is converted into electrical signal and then transmitted by transmitting antenna.

The Receiver converts the electrical signal back to the physical signal.
Electrical signal from transmitter is conveyed to the Rx^{r} through transmission channel.

Basic Block diagram of communication system



Information - communication system exists to communicate a message. This message comes from the information source.

The amount of information contained in any given message is measured in bits or dits.

The set of or total number of messages consists of individual messages which may be distinguished from one another.

These may be words, groups of words, code symbol or any other prearranged units.

(Information is defined as the choice of one message out of a finite set of messages :)

Transmitter - The message that comes from the information source is not electrical in nature, ie sound, picture signal.

At transmitter first physical variations are converted into electrical variation by using transducer ie microphone, camera tube.

For long distance communication modulation is necessary

The process of modulation is done in modulator.

modulation - Amplitude modulation.
Frequency modulation.
pulse modulation.

Channel frequency range.
space - Limitless.
optical fiber - upto Terahertz (300 to 3000TH2).
satellite link - 1 to 100 GH2.
coaxial cable - upto 100MH2.
Telephone cable - upto 30KH2 (with amp at few km)
modulation Telephone may be upto 3KHz wire - High level or low level.
type microwave link - GH2 (using dish antenna)

channel → The term channel is the frequency range allocated to particular service for transmission such as broadcasting channel. (television channel)
channel - is the medium which carries signal from one place to other place

Telecommunication Engineering is divided into two types depending on the transmission channel used:
i) Line Communication.
ii) Radio Communication

Line communication - In this medium of transmission is pair of conductors called transmission line. In this each transmission line can normally convey one message at a time. This transmission media is known as line channel. The installation & maintenance of a transmission line is very costly & complex. (telephone communication)
Line comm^n - wires, coaxial cable, optical fiber cable, ~~microwave link~~,

Radio Communication - In radio comm^n, signals from sources are transmitted through open space by electromagnetic waves called radio waves
These waves are transmitted through antenna in the open space.
→ In the transmitter process of modulation takes place. So each signal
e.g - air (openspace), microwave link, satellite link

30Hz - 300Hz ELF
extremely ~~high~~ low freq

gets seperate frequency channel and avoids interference.

Entire radio frequency range is classified into several bands

0.3 to 3.4 KHz - voice freq

Name of band	Freq range	short name
1) very low freq	10~~3~~KHz - 30KHz	VLF
2) Low freq	30KHz - 300KHz	LF
3) Medium freq	300KHz - 3MHz	MF
4) High freq	3 MHz - 30MHz	HF
5) Very high freq	30MHz - 300MHz	VHF
6) Ultra high freq and microwaves	~~Above~~ 300MHz - 3000MHz (3GHz)	UHF
7) Super high freq (satellite)	3 GHz to 30GHz	SHF
8) Extremely high freq (micro wave + satellite)	30GHz to 300GHz	EHF
	10^3 - 10^7 GHz Infrared, and ultraviolet	

microwave 3GHz - 100GHz. ?
3×10^3 MHz

Receiver - It consists of tuned cats do pick up the transmitted signal.

Demodulator demodulates the modulated signal and converts it to il sends to loadspeaker which converts demodulated electrical signals into sound signal.

microwave
3GHz - 100GHz
(above microwave
300mHz ✓

Music = 20Hz - 15KHz.

Noise - Noise is the unwanted energy present in the transmission system due to any reason. such as tending to interfere with proper and easy reception and reproduction of wanted signal.

1) Insufficient channel bandwidth
2) Random variations in the channel characteristics.
3) External interference
4) Manmade noise, atmospheric noise

Modulation → The information is known as modulating signal.

Carrier → The signal which carries this information called carrier signal.

The carrier is high freq sine wave. Some chts of the carrier signal is varied in accordance with instantaneous value of the modulating signal

Such a sine wave may be represented by eqn

~~E = e sin~~

$$e = E \sin(\omega t + \phi)$$

where e is instantaneous value of the sine wave called carrier

E is its max^m amplitude.
ω is the angular velocity or angular freq.
ϕ is phase relation with respect to some reference

Any of these 3 chts ~~are~~ or parameter of carrier may be varied by the modulating signal which results in.
Amplitude modulation (A.M)
Frequency modulation (F.M)
phase modulation (P.M).

Need For modulation -

1) Audio freq range is from 20Hz to 20KHz These modulating signals are transmitted as it is without modulation. The signals from various sources get mixed with it. It is highly impossible to seperate original information signal from the other signal.

2) The length of Rx^r and Tx^r antenna is $\frac{1}{4}$ of the wavelength of freq of modulating signal (Information signal).

suppose we want to transmit signal of 15KHz

The length of antenna?

$$f = c/\lambda$$

$$\lambda = \frac{c}{f}$$

$$= \frac{3\times10^8}{15\times10^3}$$

$$= \frac{10^5}{5}$$

$$\lambda = 2\times10^4 \text{ m.}$$

$$\text{length of antenna} = \frac{\lambda}{4} = \frac{2\times10^4}{4}$$

$$= 5\times10^3$$

$$= 5000 \text{ m}$$

A vertical antenna of this 5000m (16,000 feet) is just unthinkable.

So in order to seperate the various signals, it is necessary to translate them into different portions of electromagnetic spectrum.

In modulation signal have been translated to higher freq range using high freq carrier.

A tuned ckt is provided in the front end of Rx^r to select the desired section of spectarum and the unwanted signal are rejected.

Uses of Electronic Communication.

1. Broadcast Radio
2. Television.
3. Telephone
4. Navigational Aids.
5. Computer data Transmission.
6. Radar
7. Telegraph & Teleprinter.

Need for modn

(3) Transmission of more than one message simultaneously over a channel is known as multiplexing

If we transmit these messages directly without modulation, over a single channel. (may be pair of wires.

called transmission lines or free space) they will interfere with each other.

This can be avoided by multiplexing techniques. i) Time division multiplexing
ii) Frequency division multiplexing

i) T.D.M uses pulse modulation.
ii) F.D.M uses continuous (or analog) modulation

This multiplexing helps in transmitting number of messages simultaneously, over a single channel.
So the i) number of channels needed will be less.
ii) Cost of installation and maintenance of more channels reduces.

AM	MW	515 to 1650 KHz
	S.W	4.65 to 15.8 MHz
FM		88 to 108 MHz

Free comm^n (Radio comm^n)
microwave link — repeaters → at 30 km.
1) Receives signal 2) Reduces noise
3) amplifies 4) Transmits.

Satellite links :- comm^n is b/w earth station & satellite

Bandwidth of 300 to 3400 Hz is adequate for telephone conversation.

$$f = \frac{c}{\lambda}$$

Use of radio frequency spectrum

higher is the wavelength (ie frequency is less) lesser is the tendency of of radio waves to disperse and more tendency to travel in the straight line.

For e-g UHF wave.

* channel – The channel in the electronic comm^n is a means to carry the signal from one place to other
① wire channels ② Coaxial cable ③ optical fibre cables ④ satellite links ⑤ microwave links ⑥ space.

Pager → Written Text

message given on telephone line is directed to service service station
In telephone comm^n – AM is used.

From service centre to pager digital mod^n may be PCM or PAM is used to and the message gets displayed on screen

VLF = pointer to point comm^{N} over short distance only.

LF - marine & navigation purpose.
MF - Broadcast parpose
HF - point to point comm^{N} in short wave range (S.S.B or military application).

VHF - TV, Radar comm^{N}

UHF = microwave comm^{N}
SHF - satellite
EHF - microwave + satellite.