

ASSIGNMENT No. 1

PRINCIPLES OF COMMUNICATION

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D10A

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1 Explain the block diagram of communication in detail.

→ Any communication system has five main blocks

a) Information source

b) Transmitter

c) Channel

d) Receiver

e) Destination

f) noise

a) Information source

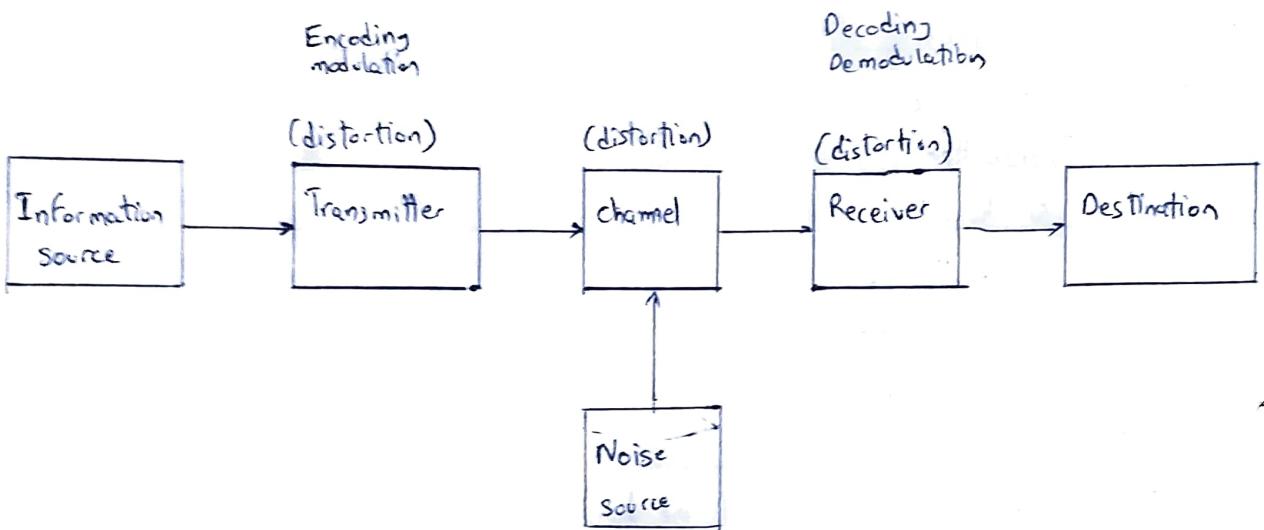
Information source is one of the basic concept of communications and information processing. It is object which encodes message data and transmits the information via a channel to one or more receiver.

For electrical communication purpose, we need to convert the message signal to electrical form, which is achieved using a suitable transducer. Transducer is a device which converts energy from one form to another. The electrical signal produced by the transducer is the actual input for the transmitter block of communications system.

b) Transmitter

The objective or function of the transmitter is to collect the incoming message signal and modify it in a suitable form, such that, it can be transmitted via the chosen channel to the receiving point. The functionality of the transmitter block is mainly decided by the block type or nature of the channel chosen for communication.

Transmitter block involves several operations, like amplification (increasing power level of th. signal), generation of High frequency carrier signal, modulation and then radiation of the modulated signal is transmitted or radiated into the atmosphere using antennae.



Block diagram of basic communication system

### c) Communication channel

Channel is the physical medium or the path used for transmission of electrical signal from the transmitter to the receiver. The physical medium can be conducting wires, coaxial cables, optical fibres or free space. The choice of a particular channel depends on the feasibility and also the purpose of communication system. The message signal in the modified form travels the channel to reach the entry point of receiver.

### d) Receiver:

The receiver block receives the incoming modified version of the message signal from the channel and process it to create the original (non-electrical) form of the message signal. The type of receiver used in communication system depends on processing required to recreate the original message signal and also on the final presentation of the message. Most receivers are of type super heterodyne and include processing steps like reception, amplification, mixing, demodulation and recreation of message signal.

### e) Destination

The destination is the final block in the communication system which receives the message signal and processes it to comprehend the information present in it.

### f) Noise

Noise is unwanted electrical signal or disturbance which gets added to the transmitted signal when it is travelling through the channel. Due to the noise the quality of transmitted information will degrade.

## 2) Explain different types of channels.

- A channel provides the connection between the transmitter and receiver. Depending on the type of communication medium, there are two types of communication channel
- Channel based on guided propagation
  - Channel based on free propagation.

### i) Telephone channels

It is designed for providing service to voice signals such as telephones. These channels are also used for world wide internet connection. Features of the telephone are as follows

- Bandpass characteristics over 300 to 3400 Hz has flat amplitude response
- High signal to noise ratio of about 30 dB
- Approximately linear response

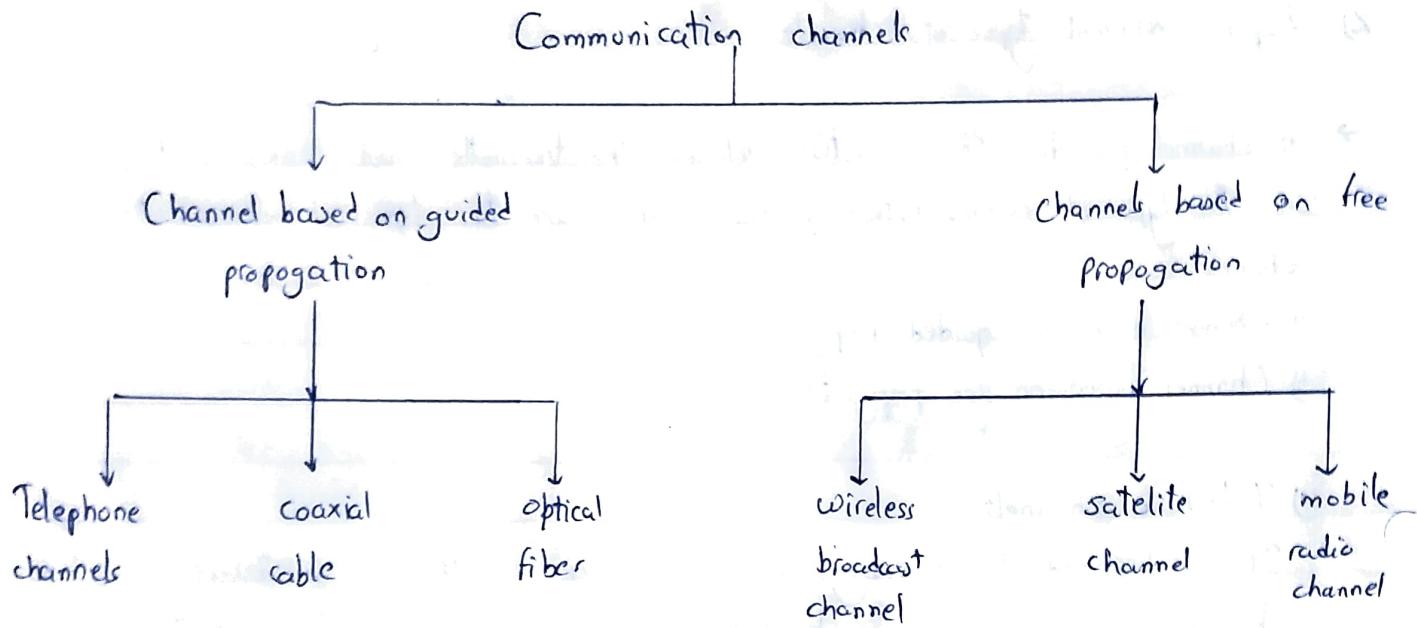
Since the data and images are strongly affected by the phase delay variation, it is essential to use an equaliser.

### ii) Coaxial cable

Coaxial cables consists of two concentric conductors separated by a dielectric material. The external conductor is metallic braid and is used for shielding. This cable was initially developed for analogue telephone networks to carry more than 10000 channels at a time. It is used in cable modems, ethernet LAN and more digital communication system.

The important characteristic of a co-axial cable may be listed as follows

- It has large bandwidth and low losses.
- Because of shield provided, this cable has excellent noise immunity.



- Map [ ]  
Date [ ]
- iii) It is suitable for both point to point or point to multipoint applications.
  - iv) These are expensive compared to twisted pair cables but cheaper than optical fibre cable.

### 3) Optical fibre cables:

It consists of an inner glass core surrounded by a glass cladding which has a lower R.I. Light signals are transmitted in the form of intensity modulated signals which is tapped in the form of networks, telephone systems, LANs. The characteristics of an optical fibre cable listed as under:

- i) Higher bandwidth, therefore can operate at higher data rates.
- ii) Reduced losses as the signal attenuation is low.
- iii) Distortion is reduced hence better quality is assured.
- iv) The installation cost of optical fibres is very high.
- v) Small size and light weight.

### 4) Wireless broadcast channels:

These channels are used for transmission of radio and TV signals. The information signal modulates a carrier frequency, which is different for every station. The transmitting antenna radiates the signal into free space in either of the three ways of propagation, namely, ground wave, sky wave and space wave. The receiver of super heterodyne type pick up the transmitted signals using an antenna.

### 5) Satellite channels:

Satellite microwave systems transmit signals between directional parabolic antennas. These systems use satellite which are in the geostationary orbit. Signal is sent through cable media to an antenna which then transmits the signal back to another location on earth.

- It uses frequency range between 11 GHz to 14 GHz
- Attenuation depends on frequency, power, antenna size and atmospheric conditions
- Signals are affected by EMI, jamming and eavesdropping
- Cost of building and launching is very high

### 6) Mobile radio channels

In this system, both the sender and receiver are allowed to move w.r.t each other. The radio propagation takes place due to scattering of EM waves from surfaces of surrounding building and diffraction over and around them.

Since the transmitted energy reaches receiver via multiple paths, it is called multipath communication.

3) What is modulation and explain need of modulation

→ Modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted

The following advantages justify the need for modulation in communication

→ Reduction in height of antenna

For efficient transmission and reception the height of antennas should be equal to quarter wavelength of the signal ( $\lambda/4$ ). Thus for a signal of frequency 10 kHz the required height of antenna about 75 Km which is practically impossible.

Now consider a modulated signal of frequency 1 MHz.

→ Increase the range of communication

Low frequency signals like that of audio gets attenuated very quickly.

Attenuation reduces with frequency of the signal and hence, the signal can travel quite long distance

→ Multiplexing

Modulation helps in shifting the given message signal frequency to a very high frequency range where it can occupy only negligible percentage of the spectrum. This means that more number of message signals can be accommodated at higher frequency.

#### 4) Explain electromagnetic spectrum of communication

→ An electromagnetic wave (EM) is a signal made of oscillating electric and magnetic field. The oscillations are sinusoidal in nature and measured as cycles per second or Hz. Oscillation can be as low as 1Hz. The entire range of frequencies that the EM wave can produce is termed as EM spectrum. In the radio communication system the frequencies ranging from a few Kilo hertz to many GHz and are used for various purposes. The EM spectrum in communication is classified in terms of frequency bands.

Frequency range (f)	EM spectrum nomenclature	Typical application
30 - 300 Hz	Extremely low frequency	Power line communication
0.3 - 3 kHz	Voice frequency	Intercom
3 - 30 kHz	Very low frequency (VLF)	Submarine communication
30 - 300 kHz	Low frequency (LF)	Marine communication
0.3 - 3 MHz	Medium frequency (MF)	AM broadcasting
3 - 30 MHz	High frequency (HF)	Landline
30 - 300 MHz	Very high frequency	FM broadcasting
0.3 - 3 GHz	Ultra high frequency	Cellular telephony
3 - 30 GHz	Super high frequency	Radar
30 - 300 GHz	Extremely high frequency	Satellite
43 - 430 THz	Infrared	LED, TV remote
430 - 750 THz	Visible light	Optical communication
750 - 2000 THz	Ultraviolet	Medical application

5) Compare Analogue and digital communication system.

→ Analogue communication

Digital communication

- Noise immunity is poor and affects signal quality
  - Repeaters can't be used between transmitter and receivers
  - Coding is not possible
  - FDM is used for multiplexing
  - Bandwidth required is lower than that of digital communication
  - Not suitable for transmission of secret information
- Noise immunity is excellent
  - Repeaters can be used to regenerate the message signal
  - Coding is possible
  - TDM is used for multiplexing
  - Due to high bit rates, higher channel bandwidth is needed.
  - Due to coding, only few permitted channels receive transmission signal

Q) Write advantages of digital communication over analog communication

- Advantages of digital communication are
  - Due to its digital nature, the interference of noise doesn't introduce many errors. Hence it has better noise immunity.
  - Due to channel coding techniques used in digital communication, it is possible to detect and correct the errors introduced during the data transmission - coding is not possible in analogue system.
  - Repeaters can be used to regenerate the digital signal thus improving immunity.
  - It is useful in military applications where only a few permitted receiver signal such secret message transmission is not possible in analog communication.
  - It is possible to use advanced data processing techniques like digital signal processing, image processing and so on.
  - It is becoming simpler and cheaper compared to analog communication due to invention of computers and ICs.