

UNIT - I

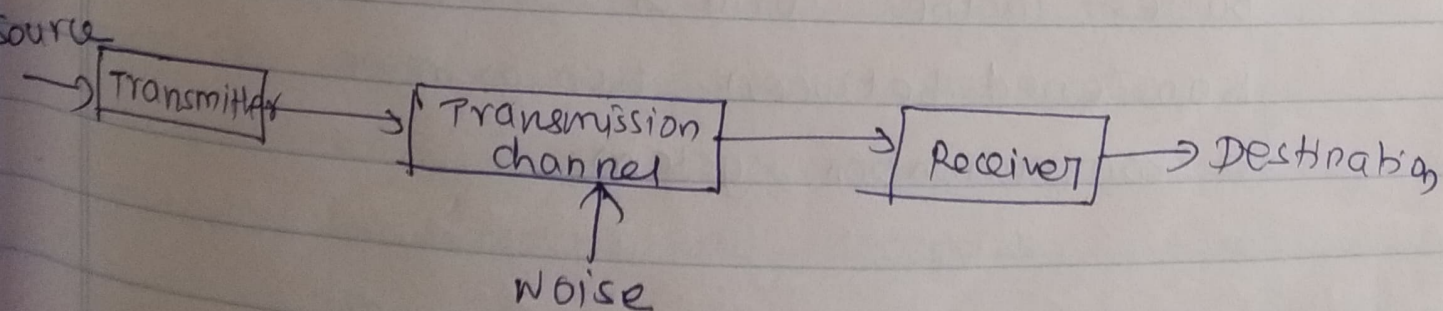
BASICS OF COMMUNICATION

Introduction - Elements of comm. system -
classification of signals - Communication channels
- Analog & Digital types of communication.

Introduction:

Communication is the process of establishing connection (or link) b/w two points for information exchange. Two main barriers in communication are language and distance. The electrical communication is one which is reliable and economical and where, the all forms of information signal are converted into an electrical signal in the form of voltage or current before being transmitted through some medium.

Basic communication system:



The transmitter is required to make the signal suitable for conduction over the channel. And the receiver is required to convert the signal from transmission channel and make suitable for transmission.

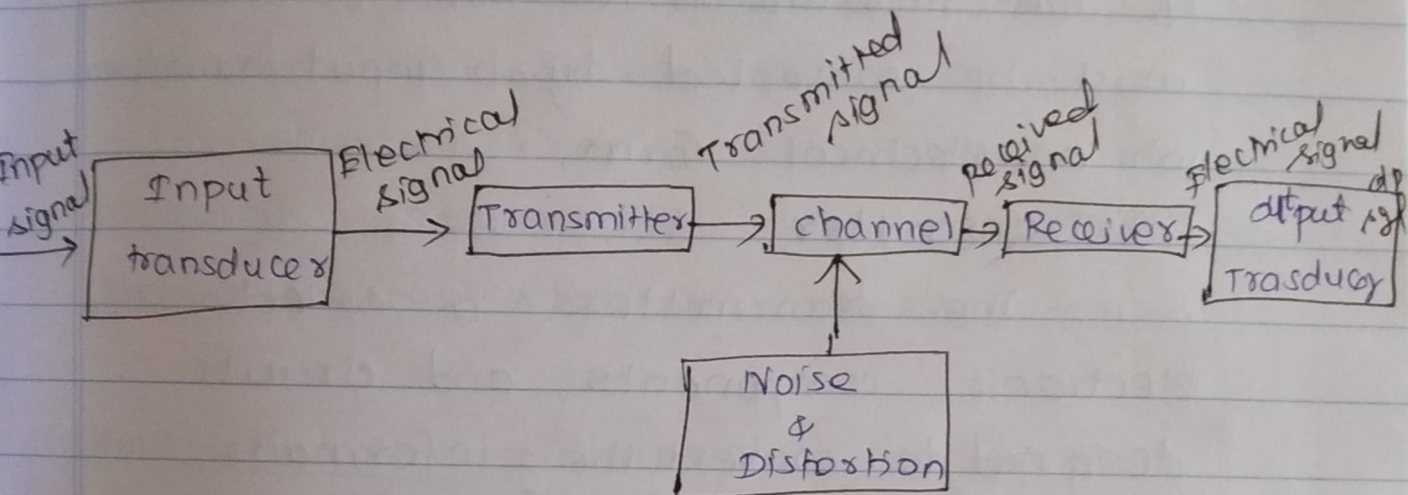
Basic types of communication systems:

- (i) Analog communication system
- (ii) Digital communication system.

Analog communication system: It is a system in which the information signal is transmitted and received in an analog form means of continuously varying signal such as sine wave. Here both the information and carrier are analog signals.

Digital communication system: The digital pulses in the form of code words are transferred between two or more points in a communication system.

Elements of communication system:



The basic communication components are,

- (i) transmitter
- (ii) A communication channel or medium
- (iii) A receiver.

(i) Information source:

The information is basically the news, one wishes to convey. The original source information can be in an analog form, such as the human voice, music and television picture or in a digital form, such as binary coded numbers and computer data.

The most common form of digital

is binary, which has two levels (0s or 1s).
If the information is non electrical, it must be converted by an input transducer into an electrical form.

(ii) Transmitter:

The transmitter is a collection of electronic components and circuits designed to convert the information (modify) into a signal suitable for transmission over a given communication medium for efficient transmission. This can be achieved through a process known as modulation.

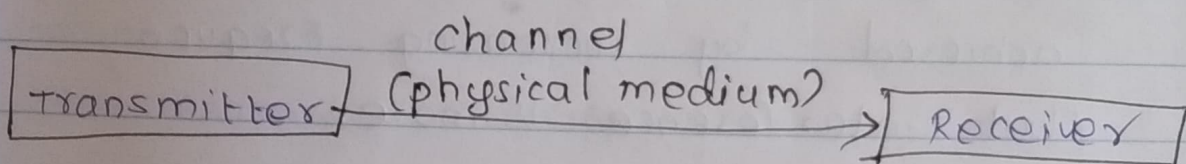
In addition, to that, it increases the power level of the signal. The power level should be increased in order to cover a long distance.

(iii) communication channel:

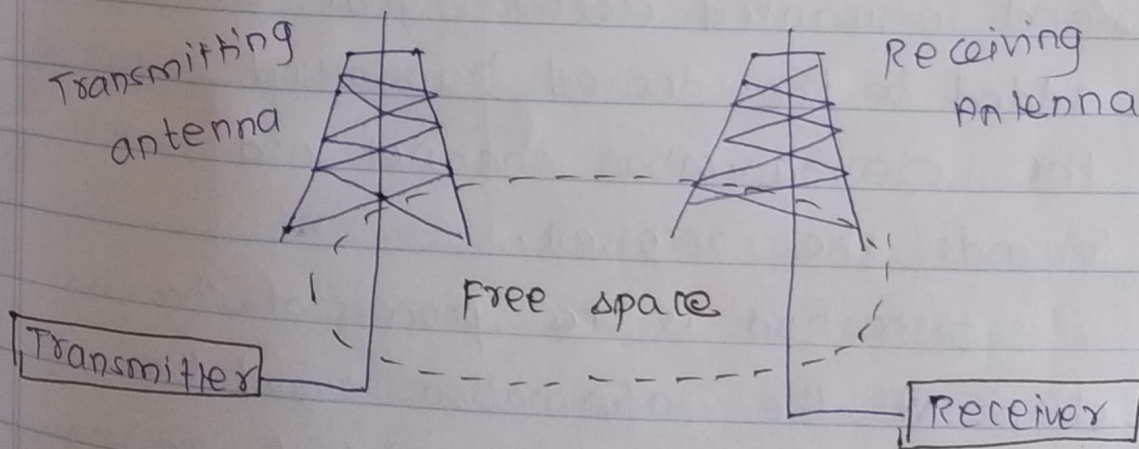
The communication channel is the transmission medium by which the electrical signal is sent from the transmitter to the receiver. depending on the type of communication channel, two types of communication system will exist.

(a) Wire or Line Communication:

It uses the physical communication mediums like simple wires, coaxial cables, a waveguide (or) an optical fiber. Here, message transmission capability is limited but produces reliable communication.



(b) Wireless or Radio Communication:



The information signal is transmitted through free space in the form of "electromagnetic [EM] waves" called "radio waves" and are radiated from the

through channel
the signal

transmitter in open space through a device called antenna.

Eg: Radio or TV broadcasting and Satellite communication.

It is mostly used for long distance communication and the number of users as well as wide coverage area can be achieved by increasing frequency range but interference is more.

(iv) Noise :

Noise is one of the most serious problems in communication. Noise is random and unwanted electric signal which gets added to the desired transmitted signal in the communication channel and travels towards the receiver.

Distortion is the process of changing shape of the information signal that may mislead message signal instead of reaching the correct destination due to noise.

(v) Receiver:

The main function of the receiver is to reproduce the original message from the

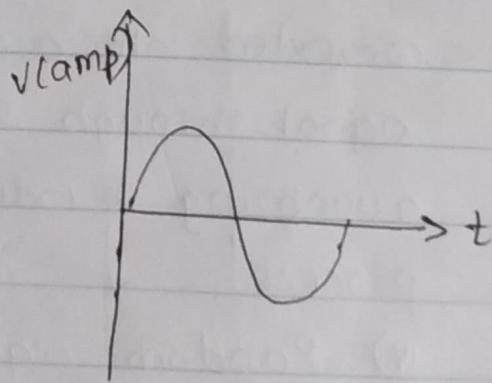
distorted signal which contains information signal as well as noise that available at the input of it from the channel.

The receiver output is fed to the output transducer, which converts the electrical signal to its original message form and the destination is the unit to which the message is communicated.

CLASSIFICATION OF SIGNALS:

(i) Continuous-time (CT) signal:

The signals that are defined for every instant of time or over a "continuous range of time" and is also called as "analog signal", denoted by $x(t)$

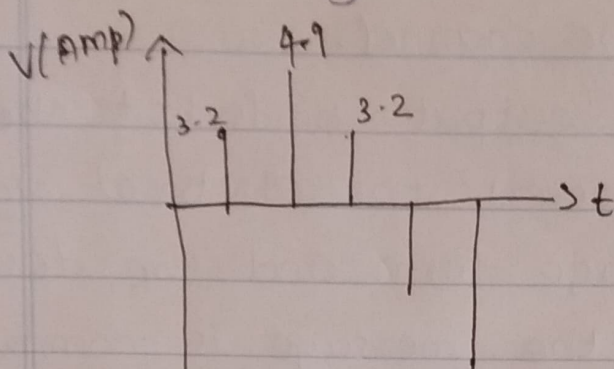


(ii) Discrete-time signal: (DT)

The signal that are defined at "discrete (particular) instants of time" are known as discrete signal. They

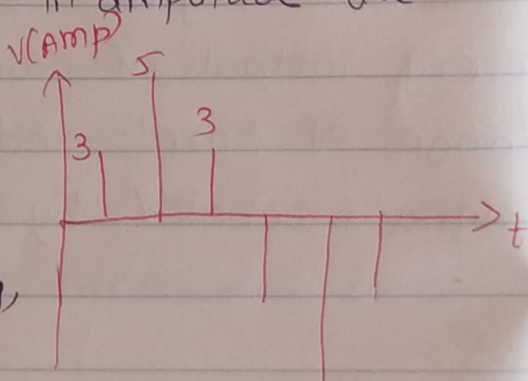
are transmitted through channel () and the signal ()

are "continuous in amplitude" but "discrete in time". They are denoted by $x(n)$.



(iii) Digital signals:

The signals that are discrete in time and quantized in amplitude are digital signals. The analog signal can be converted into a digital signal through "sampling, quantizing & coding process".

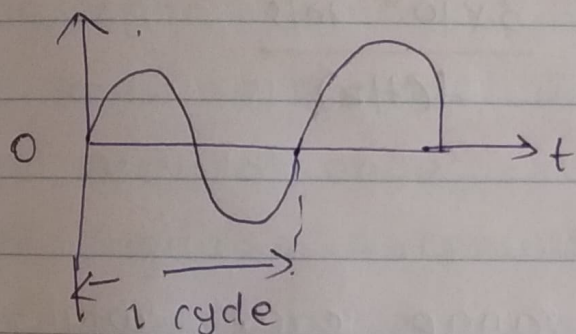


iv) Random signal:

A random signal is an unpredictable signal and is associated with a certain amount of uncertainty before it actually occurs.

Frequency :

It is defined as the number of cycles of a waveform per second i.e. number of "cycles per second" (CPS). It is expressed in hertz (Hz). Eg: 70 Hz:



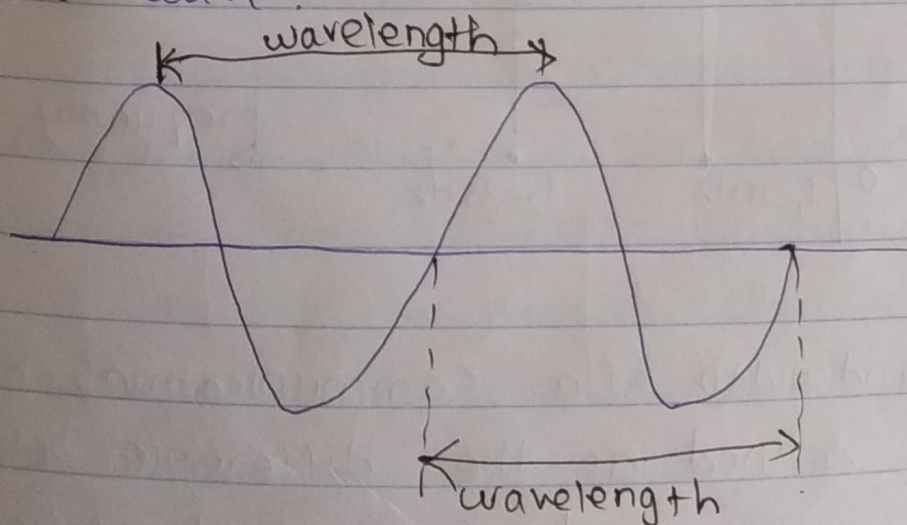
$$1 \text{ kHz} = 1000 \text{ Hz}$$

$$1 \text{ MHz} = 1000 \text{ kHz} = 10^6 \text{ Hz}$$

$$1 \text{ GHz} = 1000 \text{ MHz} = 10^9 \text{ Hz}$$

Wavelength :

Wavelength (λ) is defined as the distance between two points of similar cycles of a periodic wave.



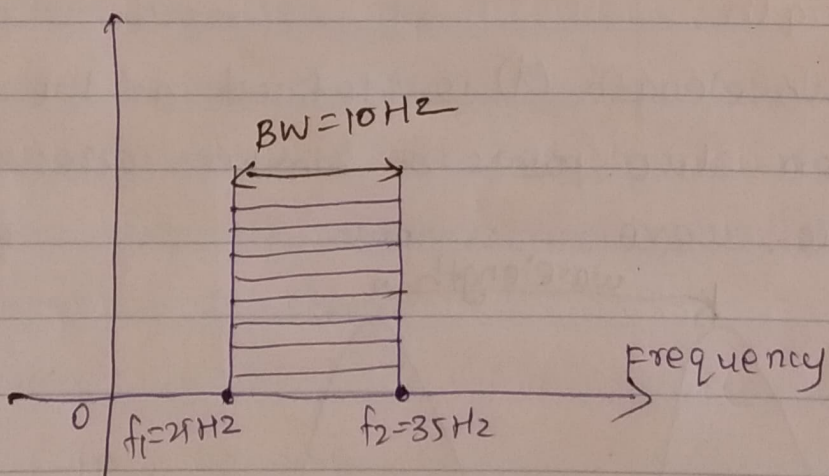
Relationship between Frequency & Wavelength:

$$\lambda(\text{wavelength}) = \frac{\text{speed of light } (c)}{\text{Frequency } (f)}$$

$$\lambda = \frac{3 \times 10^8 \text{ m/s}}{f(\text{Hz})}$$

Bandwidth:

Frequency range over which information signals are transmitted.



Bandwidth of a communication channel also defined as the difference between the upper and lower limit of frequency.

$$\text{BW} = f_2 - f_1 = 35 - 25 = 10 \text{ Hz}$$

COMMUNICATION CHANNEL:

The connection between the transmitter and receiver is established through the communication channel. The communication takes place through wires, wireless or fibre optic channels. Every communication channel has some problems. Some of them are

- a) Additive noise interference
- b) Signal Attenuation
- c) Amplitude and phase distortion
- d) Multipath distortion.

There are two main resources available with the communication channels. They are

a) channel Bandwidth:

This is the maximum possible range of frequencies that can be used for transmission.

b) Power in the transmitted signal:

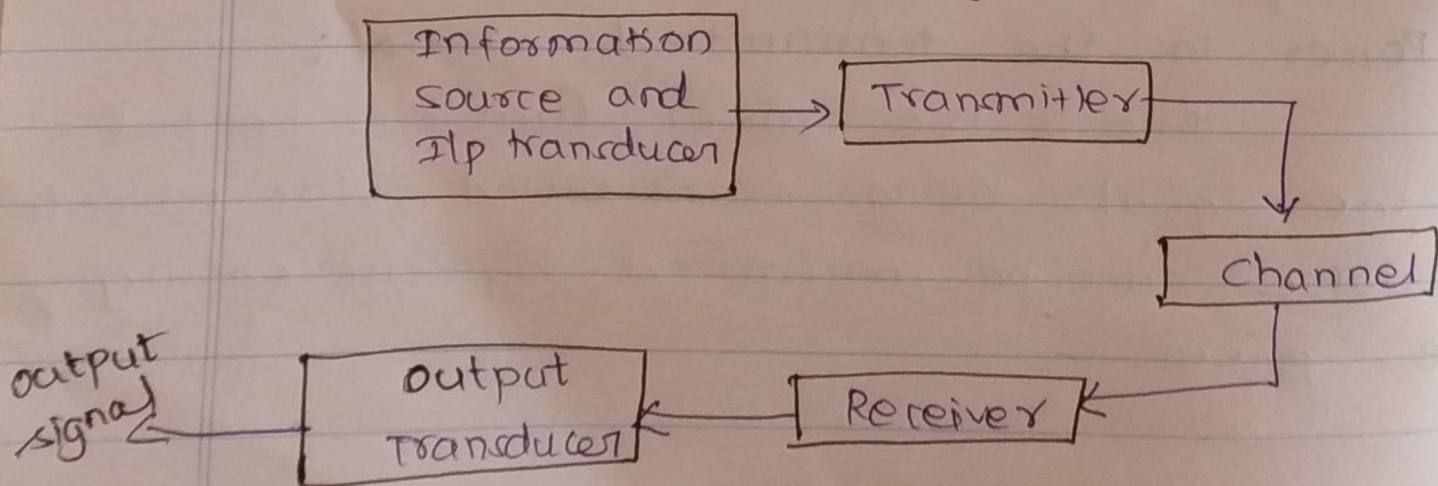
This is the power that can be put in the signal being transmitted. The effects of noise can be minimized by increasing the power.

The power and bandwidth limit the data rate of communication channel. Fibre optic channel transports light signals from one place to another just like metallic wire carries an electric signal.

Satellite essentially perform wireless communication. Satellites are repeaters. Broad area coverage is the main advantage of satellites. The power requirement is also less, since solar energy is used by satellites.

ANALOG TYPE OF COMMUNICATION:

In analog communication, the message or the information to be transmitted is in analog nature.



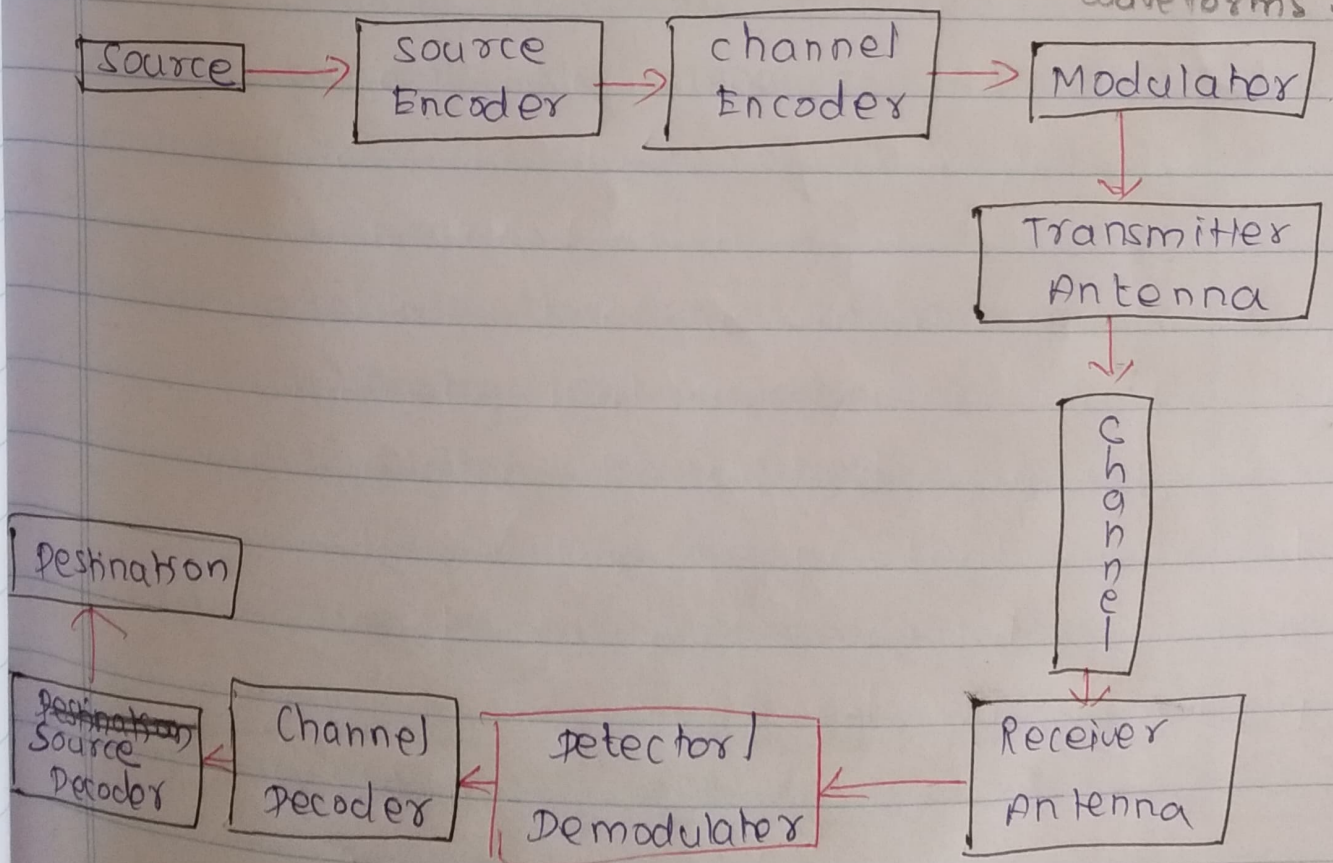
This analog message is obtained from the source such as speech, video, audio, etc.

Message signal in this case are modulated at high carrier frequency inside the transmitter in order to produce modulated signal.

This modulated signal is then transmitted with the help of transmitting antenna to travel across the transmission channel.

DIGITAL COMMUNICATION:

source coding: The source encoder converts information waveform to bits, while the decoder converts bits back to waveforms.



The overall purpose of these systems are to message or sequence of symbols that are coming out from the source to the destination point at a very high data rate and higher accuracy as possible.

2 marks

① Define Communication:

Communication is defined as the process of exchange of information. Also, it is the process of establishing connection or link whereby the information is transferred from one point called as source to the other point called as destination.

② What is noise?

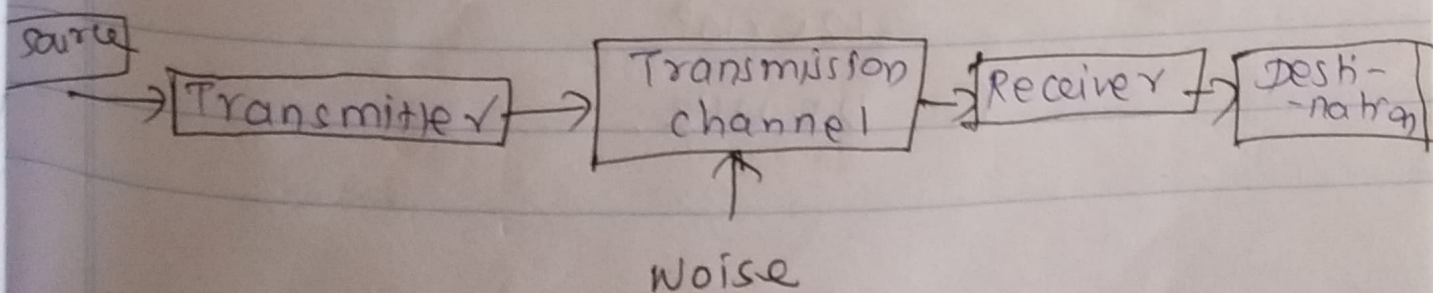
Noise is the unwanted electrical signal which gets added to the desired transmitted signal in the communication channel and travels towards the receiver. Noise is random in nature.

③ What are all the types of communication.

(a) Analog communication

(b) Digital communication

4) Draw the general communication system.



5) What is signal? Write its type.

The data or information converted into an electrical form suitable for transmission is called a signal. There are two types of signals. They are analog signal and digital signal.

6) Define the following terms.

(a) Frequency

(b) Wavelength

(c) Bandwidth.

} Refer notes for answer

7) Express a wavelength of 2.4m in term of Frequency.

$$\lambda = \frac{c}{f}, \quad \lambda = 2.4 \text{ m}, \quad f = ?$$

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

$$= \frac{3 \times 10^8}{2.4}$$

$$= 125 \times 10^6$$

$$f = 125 \text{ MHz}$$

8) Find the wavelength of a signal at each of the following frequencies.

(a) 950 MHz.

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{950 \times 10^6} = 0.315 \text{ m}$$

(b) 2.9 GHz

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{2.9 \times 10^9} = 0.103 \text{ m}$$

(c) 38 GHz

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{38 \times 10^9} = 0.007 \text{ m}$$

(d) 27 kHz

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{27 \times 10^3} = 0.111 \times 10^5 \text{ m}$$