Shariatpur polytechnic Institute

COMMUNICATION ENGINEERING

SUB. CODE: 26842

PRESENTED BY

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Learning Outcome (Theoretical)

After undergoing the subject, students will be able to

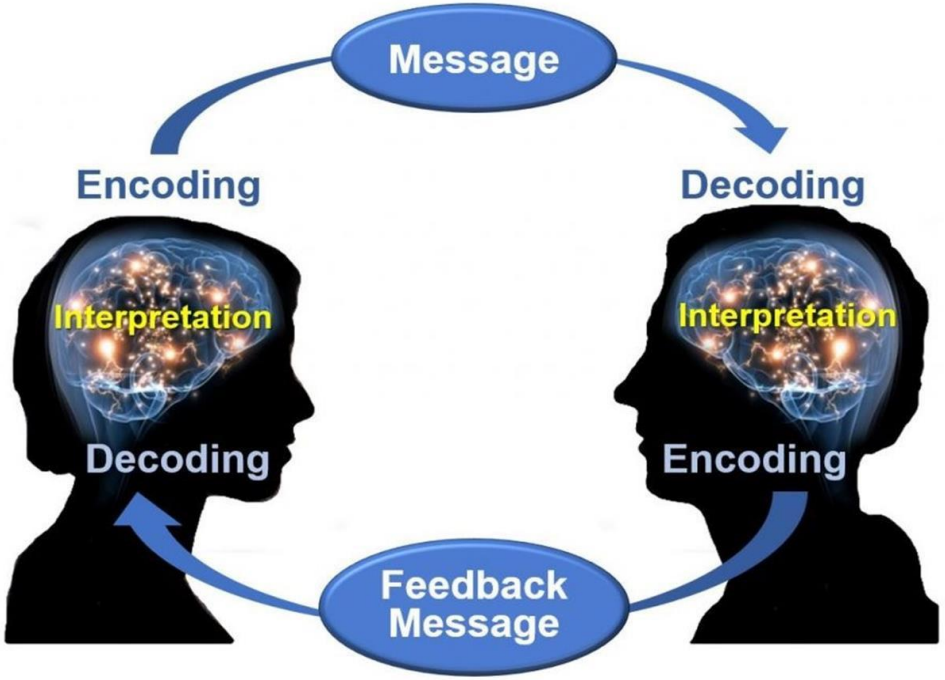
- ✓ Explain Basics of Communication.
- ✓ Illustrate Signals and Noise in Telecommunication.
- ✓ Describe Modulation.
- ✓ Discuss Modulator And Demodulator.
- ✓ Explain Radio Transmitter.
- ✓ Describe Radio Receiver.
- ✓ Describe Multiplexing and Multiple Access Techniques.
- ✓ Explain Digital Communication.
- ✓ Describe Optical Fiber Communication.
- ✓ Explain Satellite and Mobile Communication

Learning Outcome (Practical)

After undergoing the subject, students will be able to

- ✓ Identify the analog and digital signals and measure frequency.
- ✓ Show the AM wave forms.
- ✓ Measure the modulation index for AM wave forms.
- ✓ Demonstrate the working of SSB and DSB modulation.
- ✓ Demonstrate the working of frequency modulation (FM).
- ✓ Demonstrate the operation of radio transmitter (AM/FM).
- ✓ Demonstrate the operation of radio receiver (AM/FM).
- ✓ Demonstrate the working of Pulse Code Modulation (PCM).
- ✓ Demonstrate the working of ASK/FSK/PSK.
- ✓ Demonstrate the operation of optical fiber communication system.
- ✓ Perform the optical fiber splicing.
- ✓ Demonstrate the satellite home receiving system.

Chapter-01
Basic Communication



What is a communication system?.

Communication systems are designed to transmit information.

- Communication systems Design concerns:

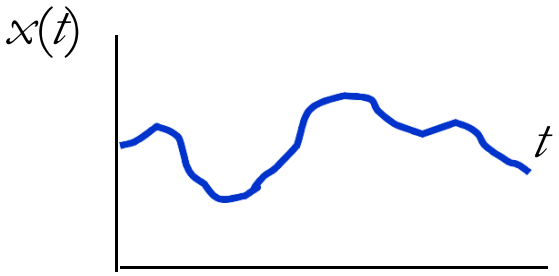
- Selection of the information-bearing waveform;
- Bandwidth and power of the waveform;
- Effect of system noise on the received information;
- Cost of the system.

Digital and Analog Sources and Systems

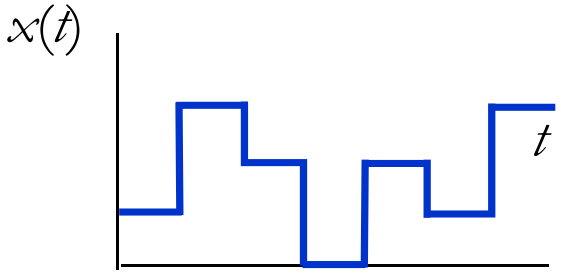
Basic Definitions:

Analog Information Source :
An analog information source produces messages which are defined on a continuum. (E.g. :Microphone)

Digital Information Source :
A digital information source produces a finite set of possible messages. (E.g. :Typewriter)



Analog



Digital

Digital Communication

Advantages

- Relatively inexpensive digital circuits may be used;
- Privacy is preserved by using data encryption;
- Data from voice, video, and data sources may be merged and transmitted over a common digital transmission system;
- In long-distance systems, noise dose not accumulate from repeater to repeater. Data regeneration is possible
- Errors in detected data may be small, even when there is a large amount of noise on the received signal;
- Errors may often be corrected by the use of coding.

Disadvantages

- Generally, more bandwidth is required than that for analog systems;
- Synchronization is required.

Digital and Analog Sources and Systems

A digital communication system transfers information from a digital source to the intended receiver (also called the sink).

An analog communication system transfers information from an analog source to the sink.

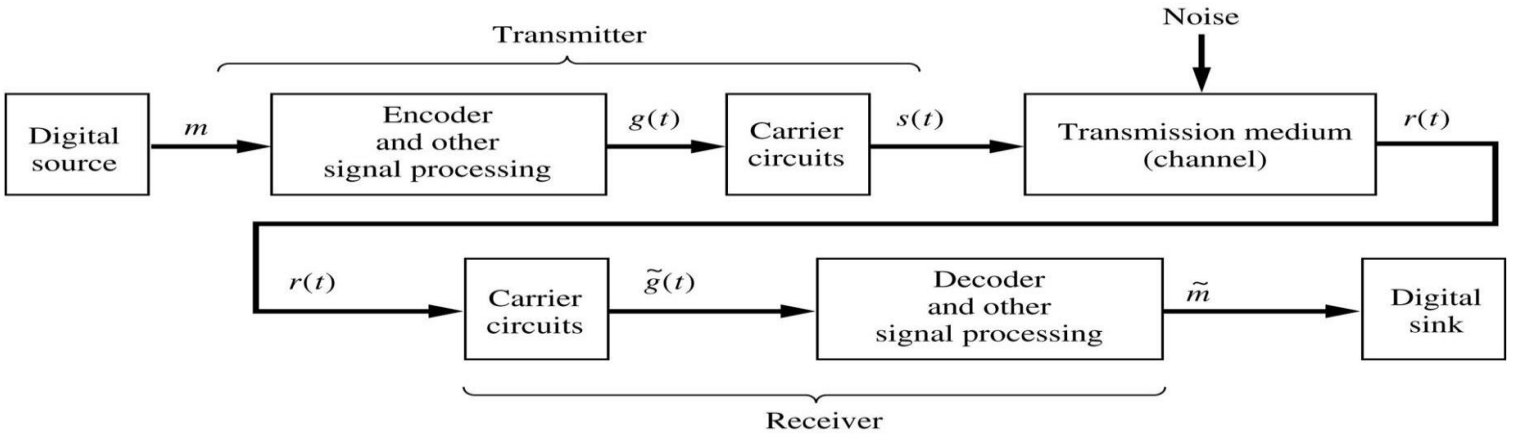
A digital waveform is defined as a function of time that can have a discrete set of amplitude values.

An Analog waveform is a function that has a continuous range of values.

Encoding and Decoding for Digital Communication

Coding involves adding extra (redundant) bits to data to reduce or correct errors at the output of the receiver.

The disadvantage of these extra bits is to increase the data rate and the bandwidth of the encoded signal.



General Digital Communication System

Deterministic and Random Waveforms

A Deterministic waveform can be modeled as a completely specified function of time.

$$w(t) = A\cos(\omega_0 t + \phi_0)$$

A Random Waveform (or stochastic waveform) cannot be modeled as a completely specified function of time and must be modeled probabilistically.

In this course we will focus mainly on deterministic waveforms.

Types of communication

There are various types of communication. Such as follows-

- Telephone communication network
- Telegraph/Teleprinter Network
- Facsimile
- Radio Network
- Television Network
- Radar Communication
- Microwave Network
- Satellite Network
- Computer Network
- Internet

Block Diagram of A Communication System

All communication systems contain three main sub systems:

1. Transmitter
2. Channel
3. Receiver

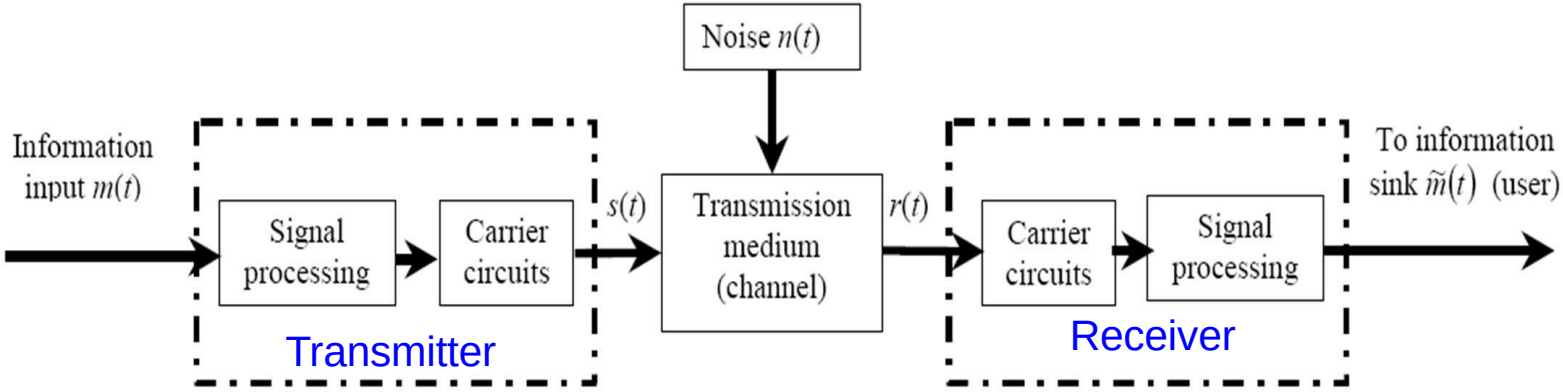


Fig. 1-1 Communication system.

Block Diagram of A Communication System

TRANSMITTER:

The **signal-processing block** is used for more efficient transmission.

Examples:

- In an analog system, the signal processor may be an analog low-pass filter to restrict the bandwidth of $m(t)$.
- In a hybrid system, the signal processor may be an analog-to-digital converter (ADC) to produce digital signals that represent samples of the analog input signal.

The **transmitter carrier circuit** converts the processed base band signal into a frequency band that is appropriate for the transmission medium of the channel.

Example:

- An amplitude –modulated (AM) broadcasting station with an assigned frequency of 850 kHz has a carrier frequency f_c=850kHz. The mapping of the base band input information waveform $m(t)$ into the band pass signal $s(t)$ is called modulation. It will be shown that any band pass signal has the form

$$s(t) = R(t)\cos(\omega_c t + \theta(t)) \qquad \omega_c = 2\pi f$$

If $R(t)$=1 and $\theta(t)$ = 0, $s(t)$ would be a pure sinusoid of frequency $f=f_c$ with zero bandwidth.

Block Diagram of A Communication System

Channel:

Channels represents the path in which signals travel from transmitter to receiver. Very general classification of channels are:

- **Wire**: Twisted-pair telephone line, coaxial cable, waveguide, and fiber-optic cables.
- **Wireless**: Air vacuum, and seawater.

In general, the channel medium attenuates the signal so that the delivered information $\tilde{m}(t)$ deteriorated from that of the source. The channel noise may arise from natural electrical disturbances or from artificial sources.

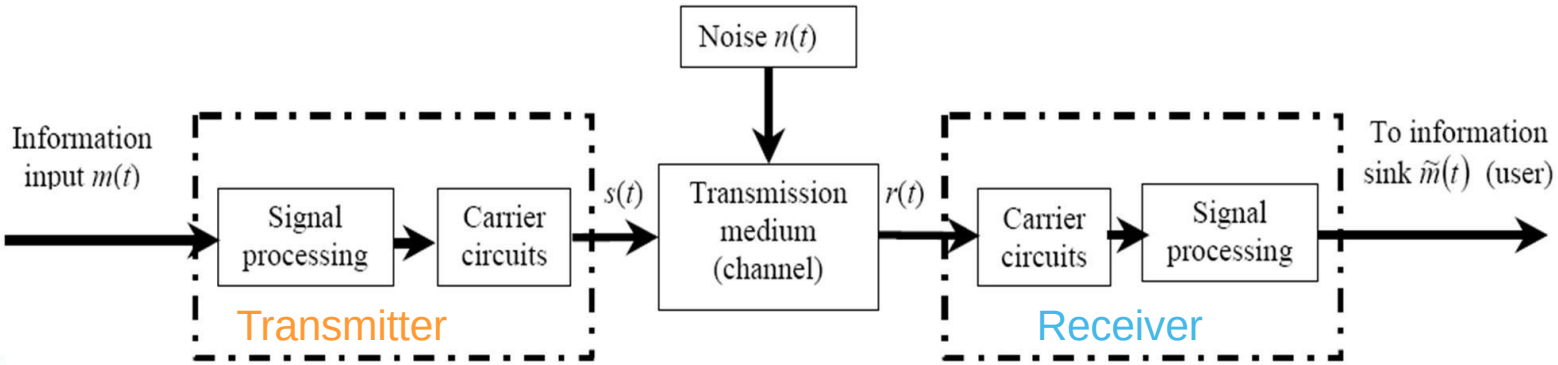


Fig. 1-1 Communication system.

Block Diagram of A Communication System

Receiver:

The receiver takes the corrupted signal at the channel output and converts it to be a base band signal that can be handled by the receiver's base band processor. The base band processor cleans up this signal and delivers an estimate $\tilde{m}(t)$ of the source information $m(t)$ to the communication system output.

In digital systems, the measure of signal deterioration is usually taken to be the probability of bit error $P(e)$ – also called **Bit Error Rate (BER)** of the delivered data $m(t)$.

In analog systems, the performance measure is usually taken to be the **Signal-to- noise Ratio (SNR)** at the receiver output.

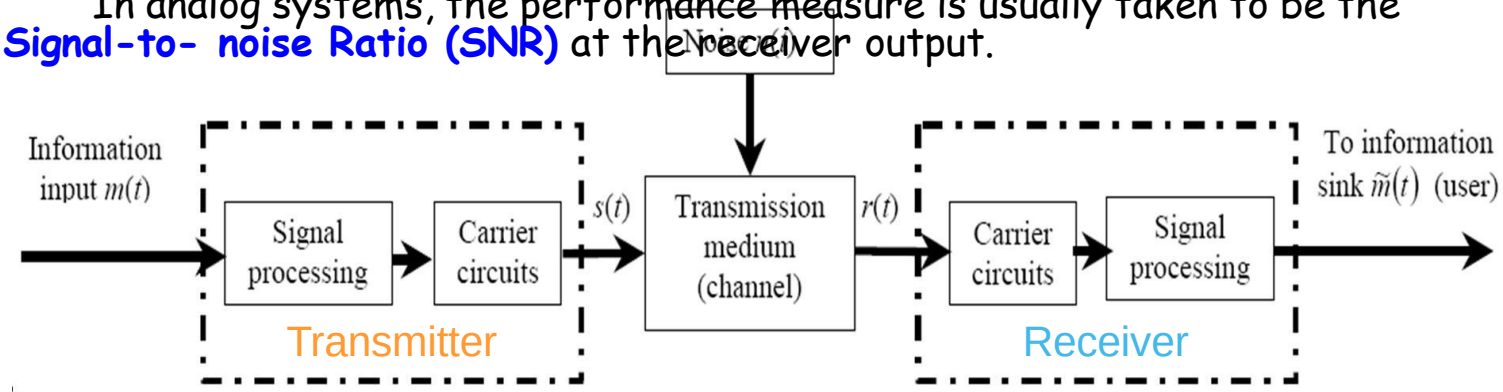


Fig. 1-1 Communication system.

FUNCTIONS OF BTRC.

The Bangladesh Telecommunication Regulatory Commission (BTRC) is the regulatory authority for the telecommunications sector in Bangladesh. Its primary functions include:

- ✓ Licensing and Regulation
- ✓ Spectrum Management
- ✓ Policy Formulation
- ✓ Consumer Protection
- ✓ Promotion of Competition
- ✓ Technical Standards and Interconnection
- ✓ Monitoring and Enforcement
- ✓ International Coordination
- ✓ Promotion of Universal Access:
- ✓ Research and Development

Overall, BTRC plays a crucial role in regulating and facilitating the development of the telecommunications sector in Bangladesh, aiming to ensure accessibility, affordability, and quality of services for all citizens while promoting industry growth and innovation.

IEEE-802 project group

The IEEE 802 project group is a series of standards developed by the Institute of Electrical and Electronics Engineers (IEEE) for local area networks (LANs) and metropolitan area networks (MANs). The IEEE 802 standards cover a wide range of technologies and protocols that govern the physical layer (PHY) and data link layer (DLL) of the OSI model. These standards are essential for ensuring interoperability and compatibility among different networking devices and systems. Here's an overview of the IEEE 802 project group:

✓ **Scope:** The IEEE 802 project group focuses on developing standards for various types of LANs and MANs, including wired and wireless technologies, as well as protocols for network management, security, and quality of service (QoS).

✓**Organizational Structure:** The IEEE 802 project group is divided into several working groups, each responsible for developing standards within specific areas of networking technology. These working groups operate under the umbrella of the IEEE 802 LAN/MAN Standards Committee (LMSC).

3.Working Groups: Some of the prominent working groups within the IEEE 802 project group include:

- ✓ IEEE 802.3 Ethernet Working Group:
- ✓ IEEE 802.11 Wireless LAN Working Group:
- ✓ IEEE 802.15 Wireless Personal Area Network (WPAN) Working Group:
- ✓ IEEE 802.16 Broadband Wireless Access Working Group:
- ✓ IEEE 802.1 Higher Layer LAN Protocols Working Group:

4. Impact: The standards developed by the IEEE 802 project group have had a significant impact on the networking industry, shaping the evolution of LAN and MAN technologies. These standards ensure interoperability, compatibility, and scalability, enabling seamless communication and connectivity across diverse network environments.

Overall, the IEEE 802 project group plays a pivotal role in setting the foundation for modern network infrastructures, driving innovation, and facilitating the adoption of emerging technologies in the field of networking.

Organization and functions of the ITU.

Organizations of the ITU:

ITU is the United Nations specialized agency for information and communication technologies (ICTs). The Organization is made up of a membership of 193 Member States and more than 1000 companies, universities and international and regional organizations. Headquartered in Geneva, Switzerland, and with regional offices on every continent, ITU is the oldest agency in the UN family – connecting the world since the dawn of the telegraph in 1865.

The ITU's main activities include:

- ✓ Standardising telecommunications technologies, services and operations, including tariffs and numbering plans.
- ✓ Allocating radio frequency bands to different services and coordinating and registering frequency assignments and satellite orbital positions so as to avoid harmful interference.
- ✓ Promoting the development of telecommunications infrastructure and services, regulatory institutions, and human resources in developing countries.
- ✓ Providing information on global telecommunications trends and developments.


Any
Questions


Thank You!