

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



**Ministry of Higher Education and Scientific Research  
Foundation of Technical Education  
Technical College / Al-Najaf**



**Training package in  
Introduction  
For students of second class**

**Lecturer  
Ahmed H. Hadi**

# **1/ Over view**

## **1 / A –Target population :-**

**For students of second class in  
Communications Techniques Engineering Department**

## **1 / B –Rationale :-**

**Elements of a communication system.**

## **1 / C –Central Idea :-**

- **Define System**
- **Elements of a communication system.**

## **1 / D –Objectives:**

- **Define System**
- **Define Signal**
- **Designation of Frequencies**

## 2/ Pre test :-

### Multiple Choice Questions With Answer

1. Voice Frequency (VF) is

(a) 30-300 MHz

(b) 3-30 kHz

(c) 300-3 kHz

2. Very High Frequency (VHF) is

(a) 3-30 MHz

(b) 30-300 MHz

(c) 3-30 GHz

### **3/ Performance Objectives :-**

#### **References**

<b>1-</b>	<b>Introduction to communication systems Ferrel G. Stremler</b>
<b>2-</b>	<b>Communication Systems (Analog and Digital) By Sanjay Sharma</b>
<b>3-</b>	<b>Analog Communication A. P. Godse U. A. Bakshi</b>
<b>4.</b>	<b>Communication Theory and systems T. R. Ganesh Babu, and G. Srinivasan:</b>

# Syllabus

<b>The week</b>	<b>Details</b>
<b>1</b>	<b>Periodic and aperiodic signals, even and odd signals, energy and power signals</b>
<b>2</b>	<b>Singularity functions: Unit impulse function; unit step function; Unit ramp function</b>
<b>3</b>	<b>Fourier series: Trigonometric Fourier series, complex Fourier exponential series</b>
<b>4</b>	<b>Fourier transform: properties of Fourier transform</b>
<b>5</b>	<b>convolution and impulses system response and filters</b>
<b>6</b>	<b>Parseval's theorem for energy signals.</b>
<b>7-8</b>	<b>Noise: Band-limited white noise; thermal noise; Shot noise, noise figure.</b>

<b>9-10</b>	<b>Amplitude modulation: Amplitude modulation suppressed carrier, generation of DSB-SC signals, demodulation (detection) of DSB-SC signals</b>
<b>11-12</b>	<b>Amplitude modulation: Amplitude modulation large carrier (AM), the AM spectrum, carrier and sideband power in AM, generation of DSB-LC signals, demodulation (detection) of DSB-LC signals</b>
<b>13-14</b>	<b>Single-sideband (SSB) modulation, generation of SSB signals, demodulation of SSB signals</b>
<b>15</b>	<b>Frequency-division multiplexing (FDM)</b>
<b>16-219</b>	<b>Angle modulation: FM and PM, narrowband FM, wideband FM, FM spectral analysis, FM bandwidth, general approximations</b>

<b>20</b>	<b>Phase modulation</b>
<b>21-22</b>	<b>Generation of wideband FM signals: Indirect FM, direct FM, Demodulation of FM signals</b>
<b>23</b>	<b>Phase modulation: the PM spectrum PM, PM transmitter.</b>
<b>24-25</b>	<b>Noise in CW modulation: system models and parameters; interference noise in linear modulation ;noise in exponential modulation; comparison of CW modulation system</b>
<b>26</b>	<b>Sampling and pulse modulation: sampling theory and practice, pulse modulation: Pulse amplitude modulation (PAM)</b>
<b>27</b>	<b>Time-division multiplexing (TDM)</b>
<b>28</b>	<b>Pulse duration modulation (PDM), PDM and Pulse position modulation (PPM)</b>
<b>29-30</b>	<b>Pulse code modulation (PCM), Delta Modulation (DM), and Differential Pulse Code Modulation (DPCM)</b>

# Some Useful Formulas

## Trigonometric Identities

$$e^{\pm j\alpha} = \cos \alpha \pm j \sin \alpha,$$

$$\sin \alpha = \frac{1}{2j} (e^{j\alpha} - e^{-j\alpha}),$$

$$\cos \alpha = \frac{1}{2} (e^{j\alpha} + e^{-j\alpha}).$$

$$2 \cos \alpha \cos \beta = \cos(\alpha + \beta) + \cos(\alpha - \beta),$$

$$2 \sin \alpha \cos \beta = \sin(\alpha + \beta) + \sin(\alpha - \beta),$$

$$2 \sin \beta \cos \alpha = \sin(\alpha + \beta) - \sin(\alpha - \beta),$$

$$2 \sin \alpha \sin \beta = \cos(\alpha - \beta) - \cos(\alpha + \beta),$$

$$\sin^2 \alpha + \cos^2 \alpha = 1,$$

$$\sin^2 \alpha = \frac{1}{2} [1 - \cos(2\alpha)],$$

$$\cos^2 \alpha = \frac{1}{2} [1 + \cos(2\alpha)],$$

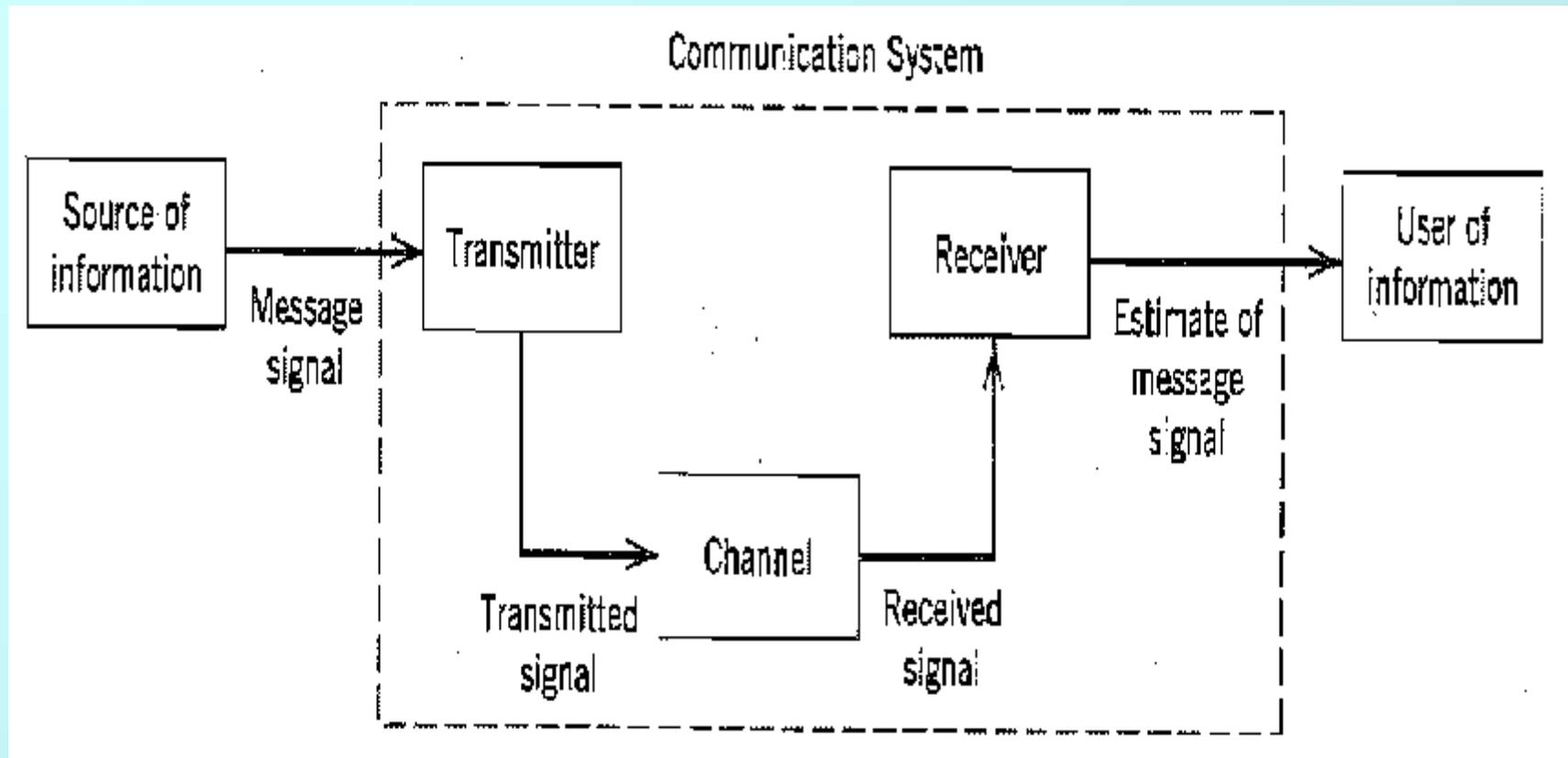
# DESIGNATION OF FREQUENCIES

<b>30-300 Hz</b>	<b>Extremely Low Frequency</b>	<b>(ELF)</b>
<b>300-3 kHz</b>	<b>Voice Frequency</b>	<b>(VF)</b>
<b>3-30 kHz</b>	<b>Very Low Frequency</b>	<b>(VLF)</b>
<b>30-300 kHz</b>	<b>Low Frequency</b>	<b>(LF)</b>
<b>300-3 MHz</b>	<b>Medium Wave Frequency</b>	<b>(MW)</b>
<b>3-30 MHz</b>	<b>Short Wave Frequency</b>	<b>(SW)</b>
<b>30-300 MHz</b>	<b>Very High Frequency</b>	<b>(VHF)</b>
<b>300-3000 MHz</b>	<b>MHz Ultra High Frequency</b>	<b>(UHF)</b>
<b>3-30 GHz</b>	<b>Super High Frequency</b>	<b>(SHF)</b>
<b>30-300 GHz</b>	<b>Extremely High Frequency</b>	<b>(EHF)</b>

## **Introduction**

**Irrespective of the form of communication process being considered, there are three basic elements to every communication system, namely, transmitter, channel, and receiver, as depicted in Figure below. The transmitter is located at one point in space, the receiver is located at some other point separate form the transmitter, and the channel is the physical medium that connects them.**

**The purpose of the transmitter is to convert the message signal produced by the source of information into a form suitable for transmission over the channel. However, as the transmitted signal propagates along the channel, it is distorted due to channel imperfections. Moreover, noise and interfering signals ( originating from other sources ) are added to the channel output, with the result that the received signal is a corrupted version of the transmitted signal. The receiver has the task of operating on the received signal so as to reconstruct a recognizable form of the original message signal for a user.**



**Figure: Elements of a communication system.**

**There are two basic modes of communication:**

- 1. Broadcasting, which involves the use of a single power transmitter and numerous receivers that are relatively inexpensive to build. Here information-bearing signals flow only in one direction.**
- 2. Point-to-point communication, in which the 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.**

# Quiz /

## Define the following terms



**System** is a group of object that can interact harmoniously and that are combined in a manner intended to achieve a desired objective.



**Signal** is an event that serves, or at least is capable, to start some action; i.e. it can incite action.

## **5/ Post test :-**

**What are two basic modes of communication:**

- 1. Broadcasting, which involves the use of a single power transmitter and numerous receivers that are relatively inexpensive to build. Here information-bearing signals flow only in one direction.**
- 2. Point-to-point communication, in which the 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.**

## References

**1**

**T. R. Ganesh Babu, and G. Srinivasan:  
“ Communication Theory and systems”, 2006.**

**2**

**Sanjay Sharma: “Communication Systems  
(Analog and Digital) ”**

