

# Principles of Communication - Modulation

# Introduction



 : Baseband Signal

## Introduction

### Information Signal

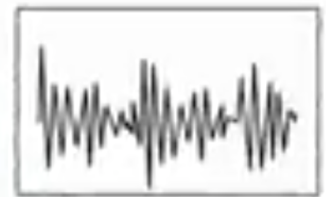
- Data



- Music



- Video



Electrical Form



Baseband Signal

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A signal can be anything like a sound wave which comes out when you shout. This shout can be heard only up to a certain distance. But for the same wave to travel over a long distance, you'll need a technique which adds strength to this signal, without disturbing the parameters of the original signal.

## What is Signal Modulation?

A message carrying signal has to get transmitted over a distance and for it to establish a reliable communication, it needs to take the help of a high frequency signal which should not affect the original characteristics of the message signal.

The characteristics of the message signal, if changed, the message contained in it also alters. Hence it is a must to take care of the message signal. A high frequency signal can travel up to a longer distance, without getting affected by external disturbances. We take the help of such high frequency signal which is called as a **carrier signal** to transmit our message signal. Such a process is simply called as Modulation.

## Need for Modulation

The baseband signals are incompatible for direct transmission. For such a signal, to travel longer distances, its strength has to be increased by modulating with a high frequency carrier wave, which doesn't affect the parameters of the modulating signal.

## Advantages of Modulation

The antenna used for transmission, had to be very large, if modulation was not introduced. The range of communication gets limited as the wave cannot travel to a distance without getting distorted.

Following are some of the advantages for implementing modulation in the communication systems.

- ▣ Antenna size gets reduced.
- ▣ No signal mixing occurs.
- ▣ Communication range increases.
- ▣ Multiplexing of signals occur.
- ▣ Adjustments in the bandwidth is allowed.
- ▣ Reception quality improves.



# Signals in the Modulation Process

Following are the three types of signals in the modulation process.

## Message or Modulating Signal

The signal which contains a message to be transmitted, is called as a **message signal**. It is a baseband signal, which has to undergo the process of modulation, to get transmitted. Hence, it is also called as the **modulating signal**.

## Carrier Signal

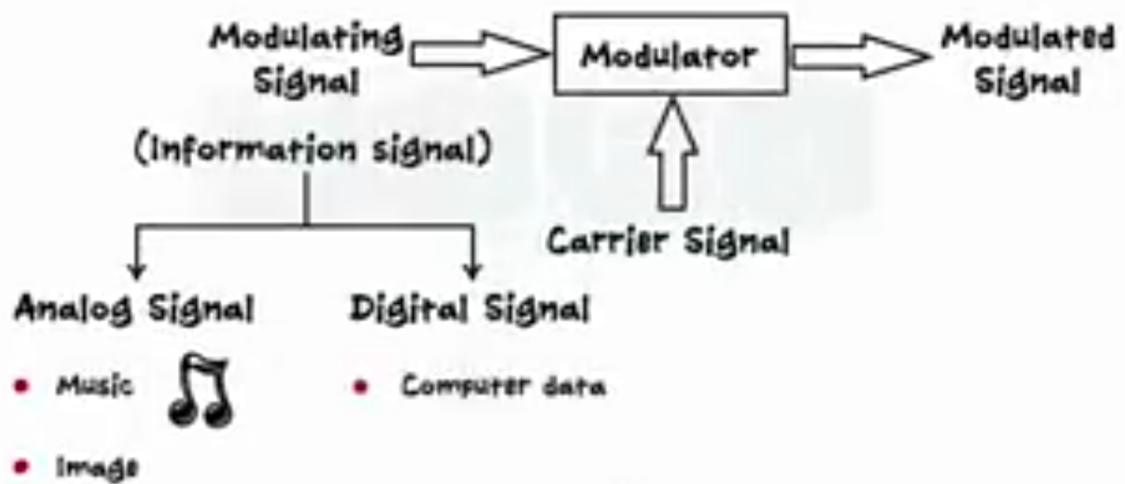
The high frequency signal which has a certain phase, frequency, and amplitude but contains no information, is called a **carrier signal**. It is an empty signal. It is just used to carry the signal to the receiver after modulation.

## Modulated Signal

The resultant signal after the process of modulation, is called as the **modulated signal**. This signal is a combination of the modulating signal and the carrier signal.

## Modulation Techniques

### Block Diagram of Modulation

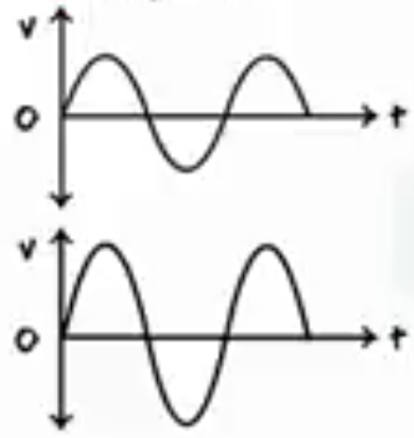


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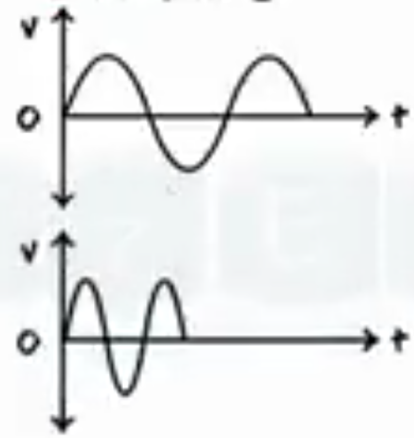
# Introduction

Basic Characteristics :

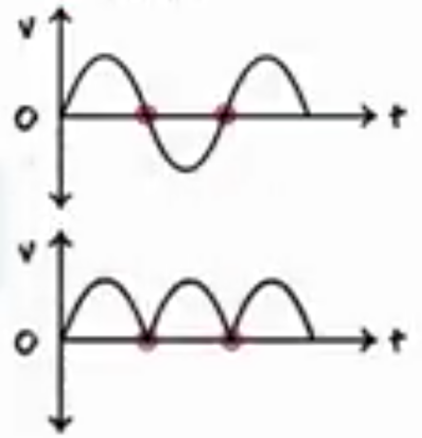
● Amplitude



● Frequency

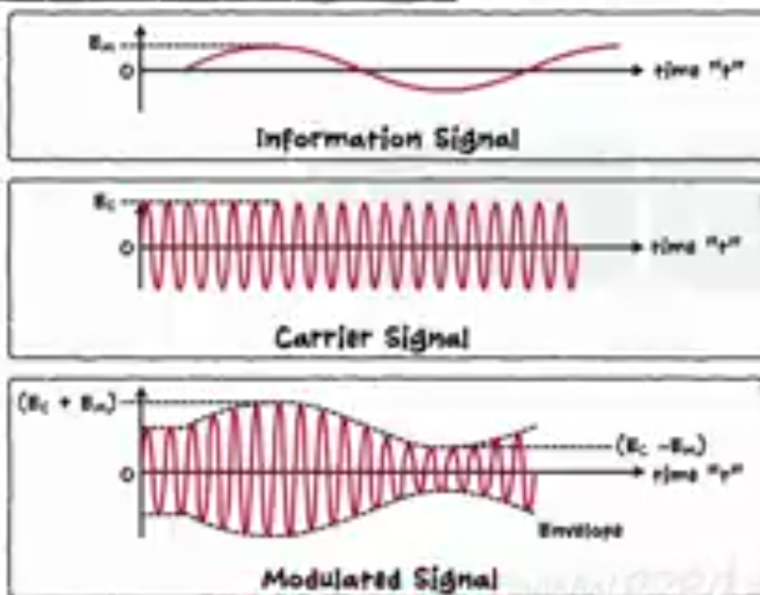


● Phase



## Modulation Techniques

### Amplitude Modulation

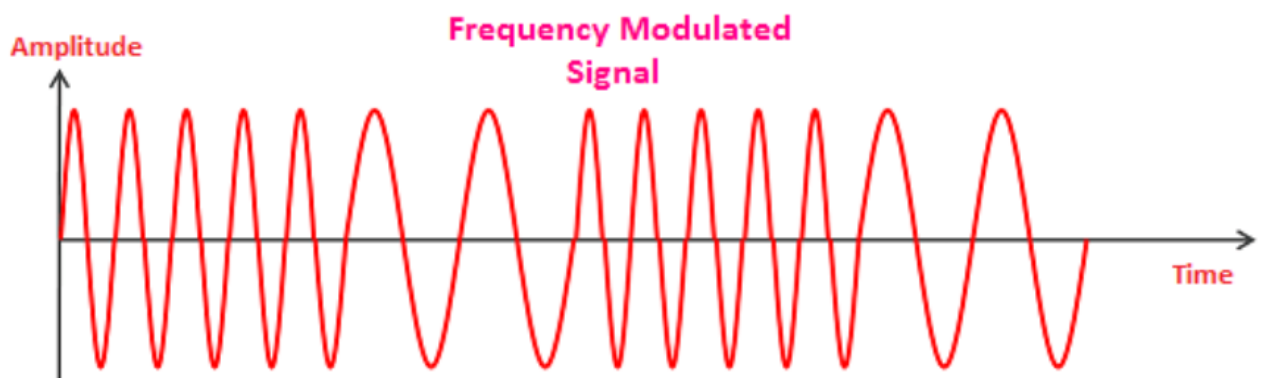
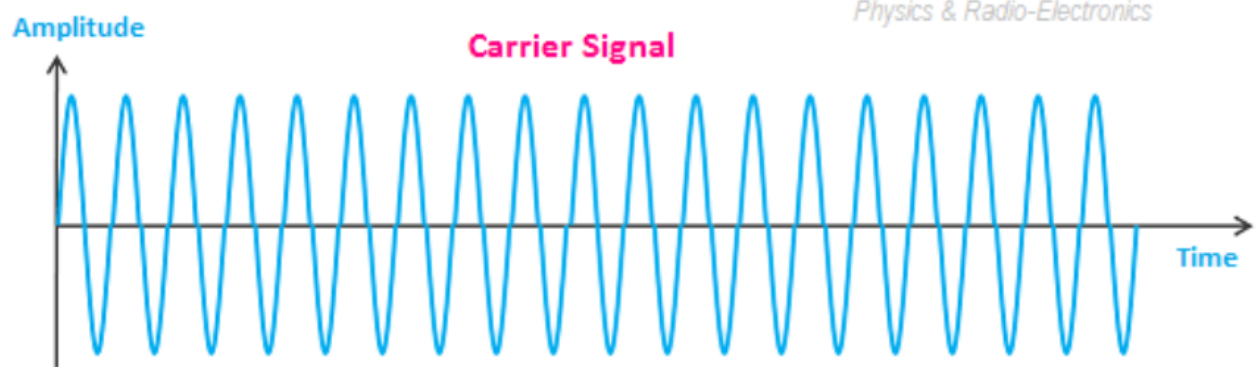
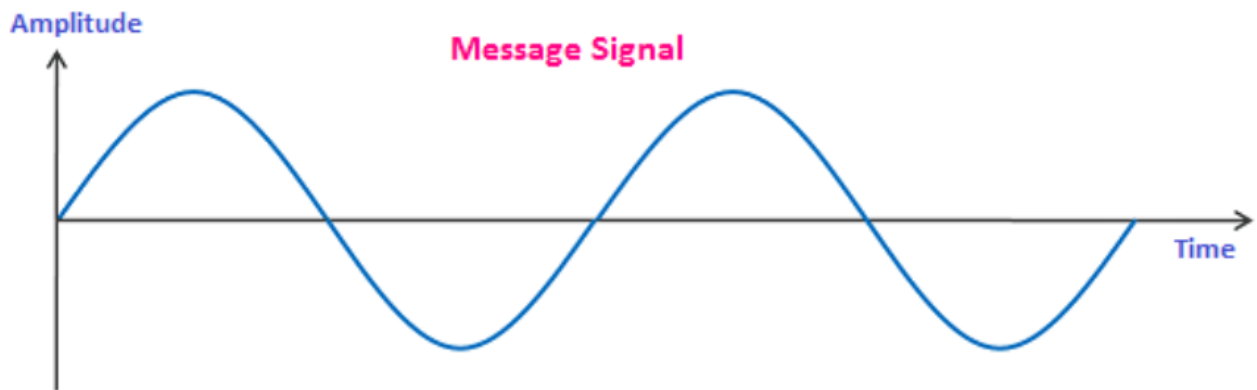


Amplitude Modulation is the process of changing the amplitude of the high frequency carrier signal with respect to the instantaneous value of the modulating signal.

## **2) Frequency modulation**

Frequency modulation is a type of modulation where the frequency of the carrier signal is varied (changed) in accordance with the amplitude of the message signal while the amplitude and phase of carrier signal remain constant.

## Frequency Modulation



From the above three figures, it can be observed that the frequency of the carrier signal is varied in accordance with the constant amplitude of the message signal.

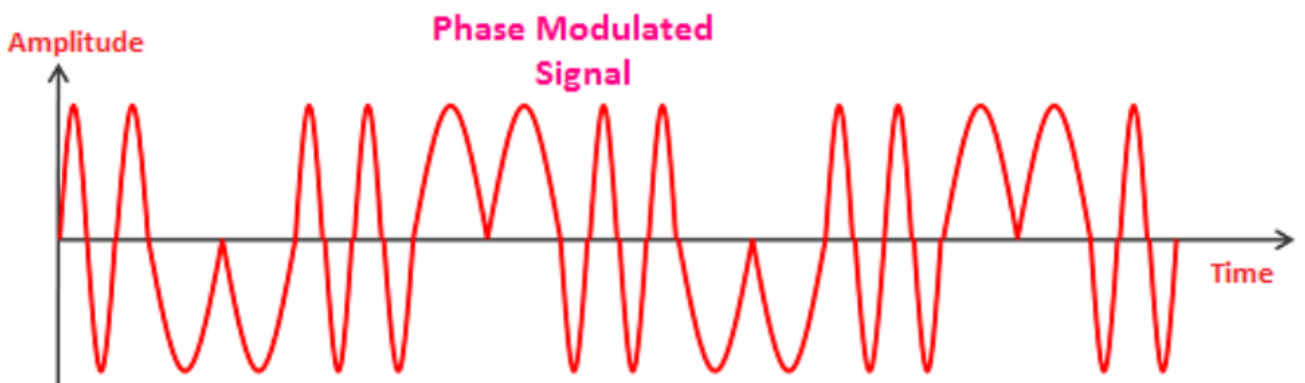
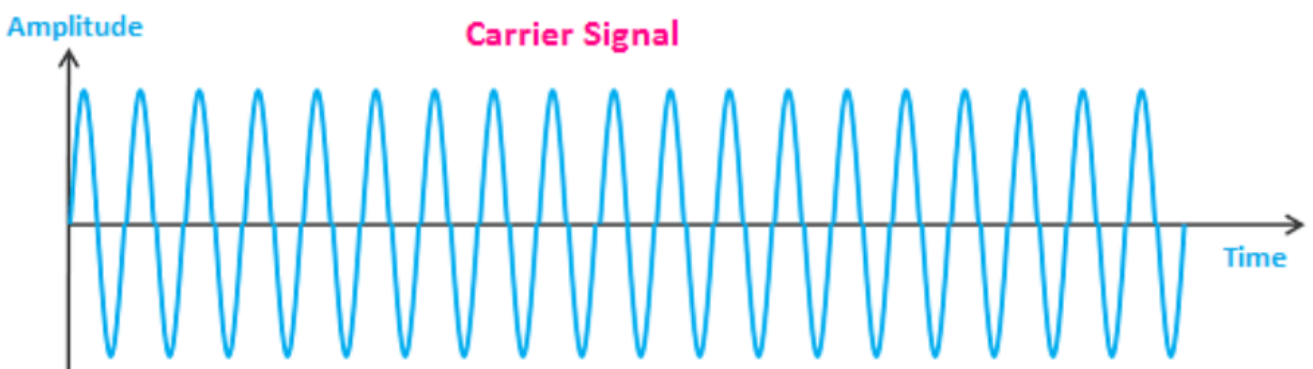
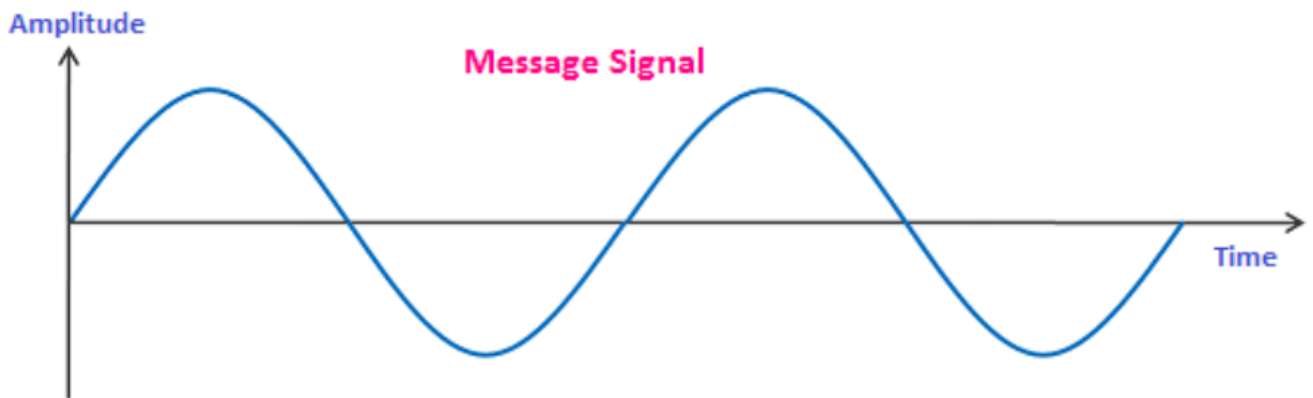




### **3) Phase modulation**

Phase modulation is a type of modulation where the phase of the carrier signal is varied (changed) in accordance with the amplitude of the message signal while the amplitude of carrier signal remains constant.

## Phase Modulation



In this type of modulation, when the phase is changed it also affects the frequency so this modulation also comes under frequency modulation.

The frequency and phase modulation comes under angle modulation. When the frequency or phase of the carrier signal is varied (changed) in accordance with the amplitude of the message signal, then it is called angle modulation.