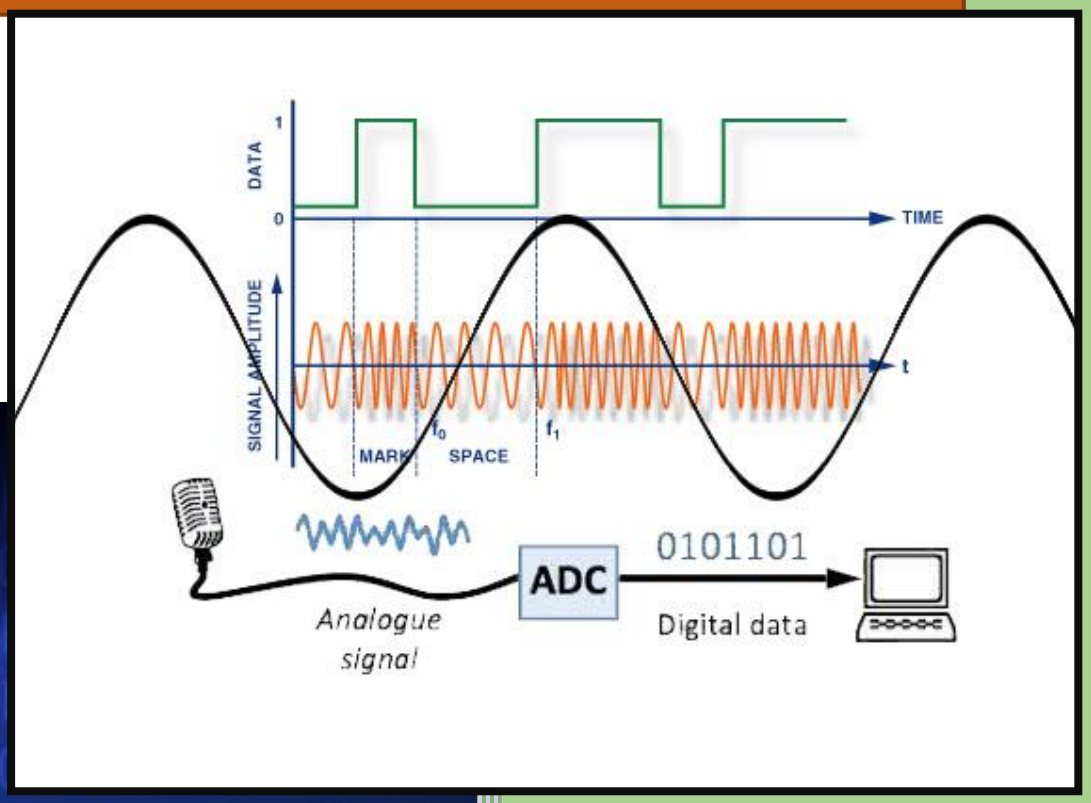
SUBJECT:

COMMUNICATION DESIGN SYSTEM

Digital Modulation



ASSIGNMENT

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Modulation

Modulation is the process of converting data into electrical signals optimized for transmission.

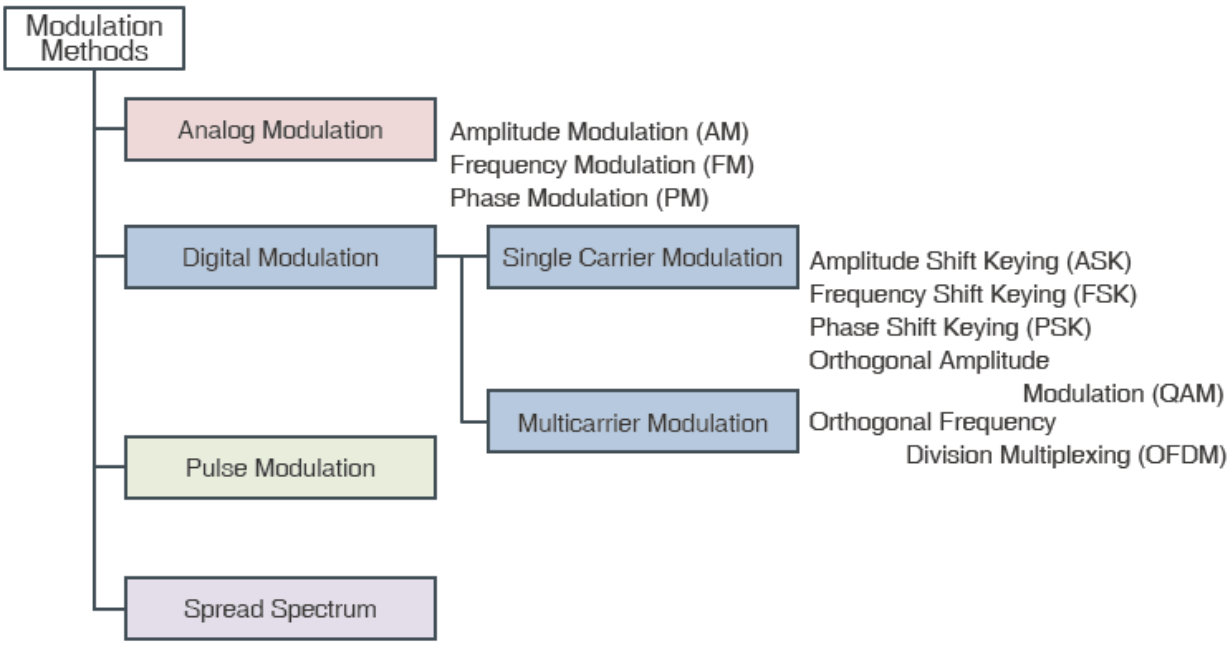
Modulation techniques are roughly divided into four types:

Analog modulation,

Digital modulation,

Pulse modulation,

Spread spectrum method.



Digital Modulation

Digital modulation is the process of encoding a **digital** information signal into the amplitude, phase, or frequency of the transmitted signal. The encoding process affects the bandwidth of the transmitted signal and its robustness to channel impairments.

It has three types:

Amplitude shift key (ASK)

Frequency shift key (FSK)

Phase shift key (PSK)

ASK – Amplitude Shift Keying

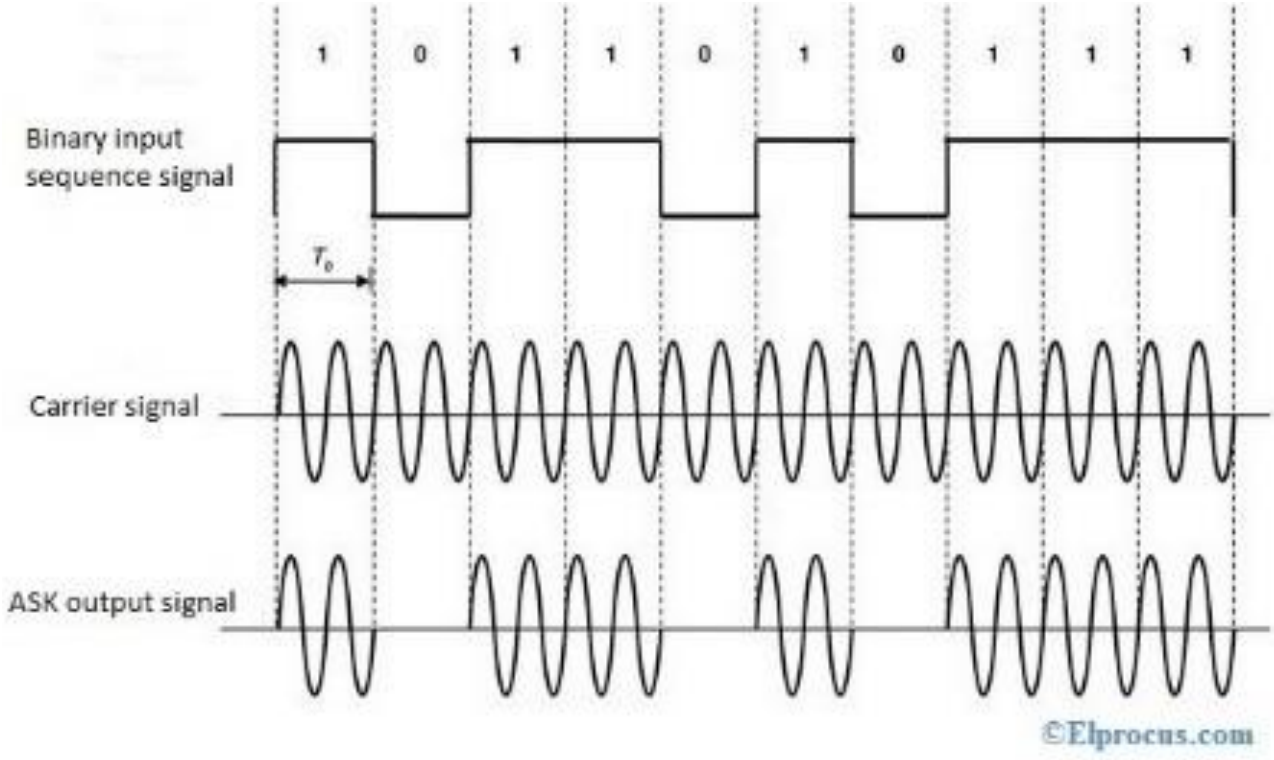
A digital modulation method that sends transmission data by varying the presence/absence of analog signals.

In ASK Phase and frequency will be remain constant.

OOK On Off keying

Mathematical equation:

$$S_{ASK}(t) = u(t) \cdot A_c \cos \omega_c t$$



FSK – Frequency Shift Keying

This technique utilizes the difference in the amplitude of analog signals to modulate digital signals by switching between low frequency and high frequency in order to represent 0 and 1.

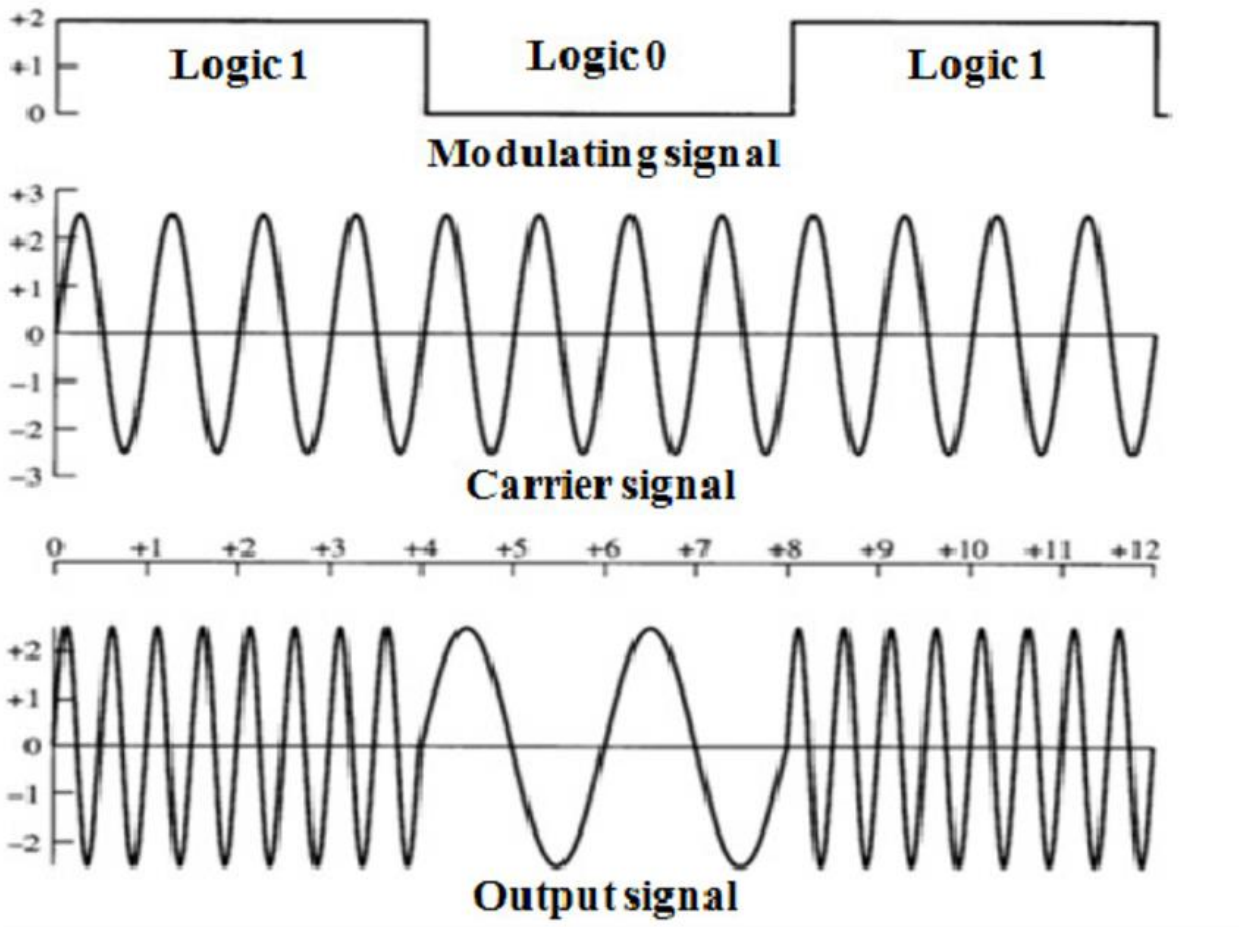
In FSK Amplitude and phase will be remain constant.

Mathematical Equation

$S_{FSK}(t) = A_c \cos(\omega_c +- \Omega) t$

1 frequency → $(\omega_c + \Omega)$

0 frequency → $(\omega_c - \Omega)$



PSK – Phase Shift Keying (QPSK)

Phase Shift Keying (PSK) is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications

In PSK Amplitude and frequency will be remain constant.

We make Changes in PSK with the help of constellation diagram in PSK

Mathematical Equation

$S_{PSK}(t) = A_c \cos[\omega_c t + \Phi(t)]$

1→ 180^o Phase shift ($\Phi(t) =$)

0→ 0^o Phase shift ($\Phi(t) = 0$)

While transmitting 1 & 0

Types of PSK

QPSK - Quadrature Phase Shift Keying

O-QPSK - Offset Quadrature Phase Shift Keying

8 PSK - 8 Point Phase Shift Keying

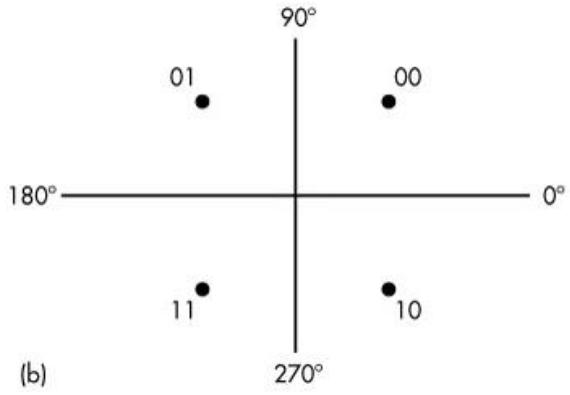
16 PSK - 16 Point Phase Shift Keying.

We will discuss QPSK in detail.

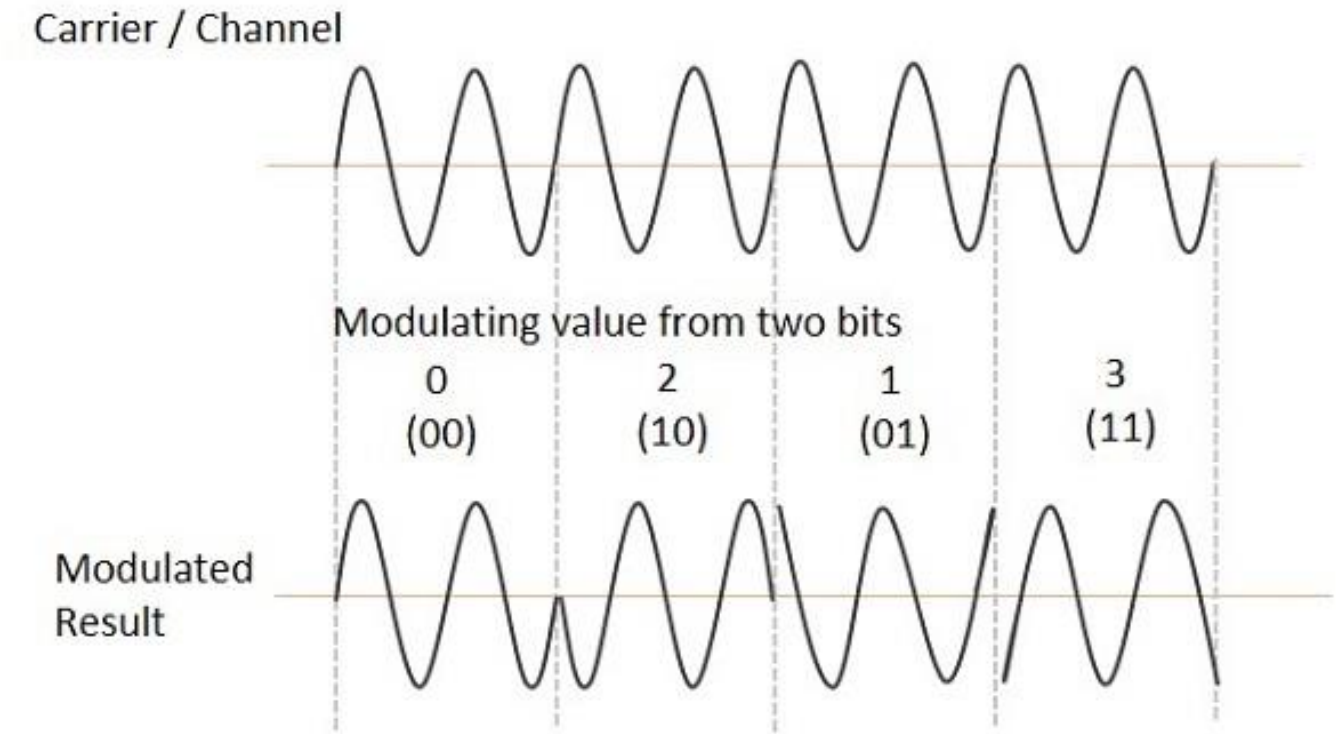
QPSK - Quadrature Phase Shift Keying

Quadrature Phase Shift Keying (QPSK) is a form of Phase Shift Keying in which two bits are modulated at once, selecting one of four possible

carrier phase shifts (0, 90, 180, or 270 degrees). QPSK allows the signal to carry twice as much information as ordinary PSK using the same bandwidth.



This is the Constellation Diagram of QPSK



Some Important Point

-Low frequency or the message signal is known as the **baseband signal**

-Baseband signal can’t be transmitted directly

But with the help of high frequency periodic signal, it can be transmitted

-The high frequency periodic signal, which carries the baseband signal is known as the **carrier signal**

-Every signal has the 3 basic properties: Amplitude, Phase, and Frequency.

-The modulation is the process where one of these properties of the carrier signal like (amplitude, frequency and phase), is changed according to the baseband signal

- Modulation is required to :

    To reduce the size of the Antenna size

To reduce the interference

To allow multiplexing of the signal