Communications and Signal Processing Lab

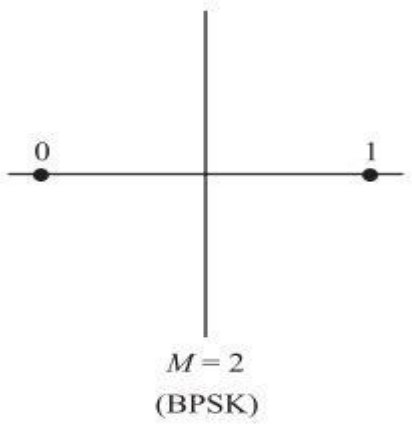
Assignment No.-4

EE21MTECH14002

1. Binary Phase Shift Keying (BPSK):

BPSK (Binary Phase-shift Keying) is a digital modulation scheme that transmits data by modulating two separate phases of a reference signal (the carrier wave). The constellation points are commonly arranged in a circle with regular angular spacing. This results in the maximum phase separation between nearby locations and, as a result, thus provide the best immunity to corruption. They're arranged in a circle so that the same energy can be sent to all of them. The moduli of the complex numbers they represent will be the same as before, and the amplitudes required for the cosine and sine waves will be the same as well.

- **BPSK symbol set** = {1, -1}
- **Example:** 0 → 1, 1 → −1
- **Average energy:** $Es = 1$



Constellation Diagram of BPSK

Applications of BPSK

1. The **BPSK** modulation is a very basic technique used in various wireless standards such as CDMA, WiMAX (16d, 16e), WLAN 11a, 11b, 11g, 11n, Satellite, DVB, Cable modem etc.

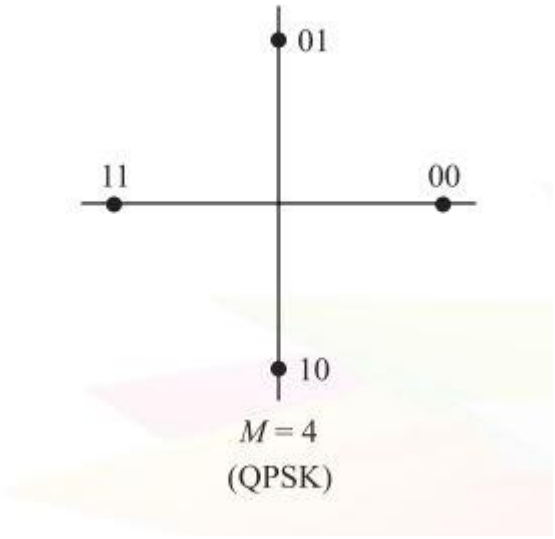
2. It is more robust among all the modulation types due to difference of 180 degree between two constellation points. Hence it can withstand severe amount of channel conditions or channel fading.

3. It is used in OFDM and OFDMA to modulate the pilot subcarriers used for channel estimation and equalization.

2. Quadrature Phase Shift Keying (QPSK):

A digital modulation technique is a technique in which the data is transmitted by modulating the phase of the carrier wave i.e., the carrier wave transition is always 90 degrees.

- **QPSK symbol set** = {1+1i, 1-1i, -1+1i, -1-1i}
- **Example:** 00 → $1 + 1i$
- **Average energy:** $Es = 2$



Constellation Diagram of QPSK

Advantages of QPSK

It provides good noise immunity.

Compared to BPSK, bandwidth used by QPSK is reduced to half.

The information transmission rate of Quadrature Phase Shift Keying is higher as it transmits two bits per carrier symbol.

Carrier power remains constant as the variation in the QPSK amplitude is small.