

# Digital Modulation Techniques



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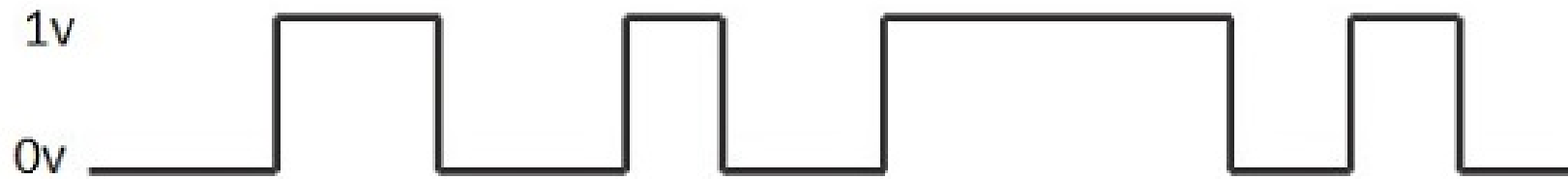
# Digital Modulation Techniques

- Digital Modulation provides more information capacity, high data security, quicker system availability with great quality communication. Hence, digital modulation techniques have a greater demand, for their capacity to convey larger amounts of data than analog modulation techniques.
- ASK – Amplitude Shift Keying
  - The amplitude of the resultant output depends upon the input data whether it should be a zero level or a variation of positive and negative, depending upon the carrier frequency.
- FSK – Frequency Shift Keying
  - The frequency of the output signal will be either high or low, depending upon the input data applied.
- PSK – Phase Shift Keying
  - The phase of the output signal gets shifted depending upon the input. These are mainly of two types, namely Binary Phase Shift Keying BPSK and Quadrature Phase Shift Keying QPSK, according to the number of phase shifts. The other one is Differential Phase Shift Keying DPSK which changes the phase according to the previous value.

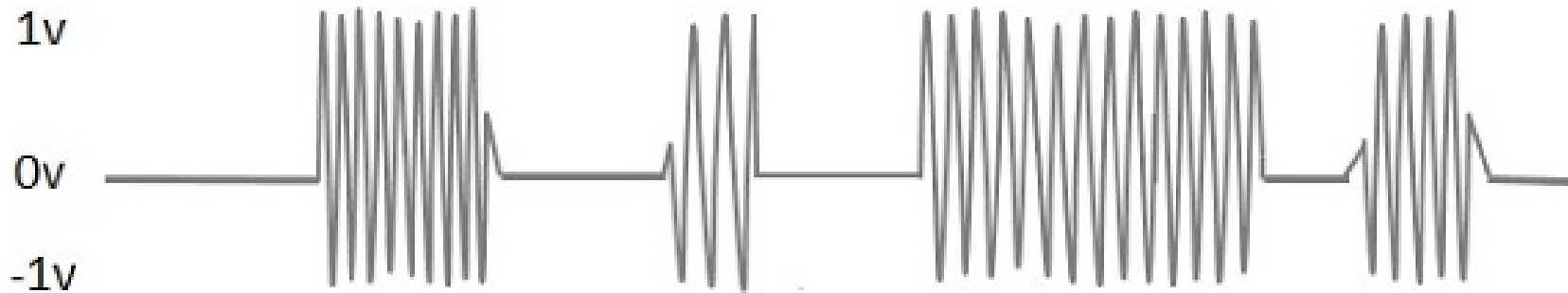
# Amplitude Shift Keying

- Amplitude Shift Keying ASK is a type of Amplitude Modulation which represents the binary data in the form of variations in the **amplitude** of a signal.
- Any modulated signal has a **high frequency** carrier. The binary signal when ASK modulated, gives a **zero value for Low input** while it gives the **carrier output for High input**.

# Amplitude Shift Keying



Input binary sequence

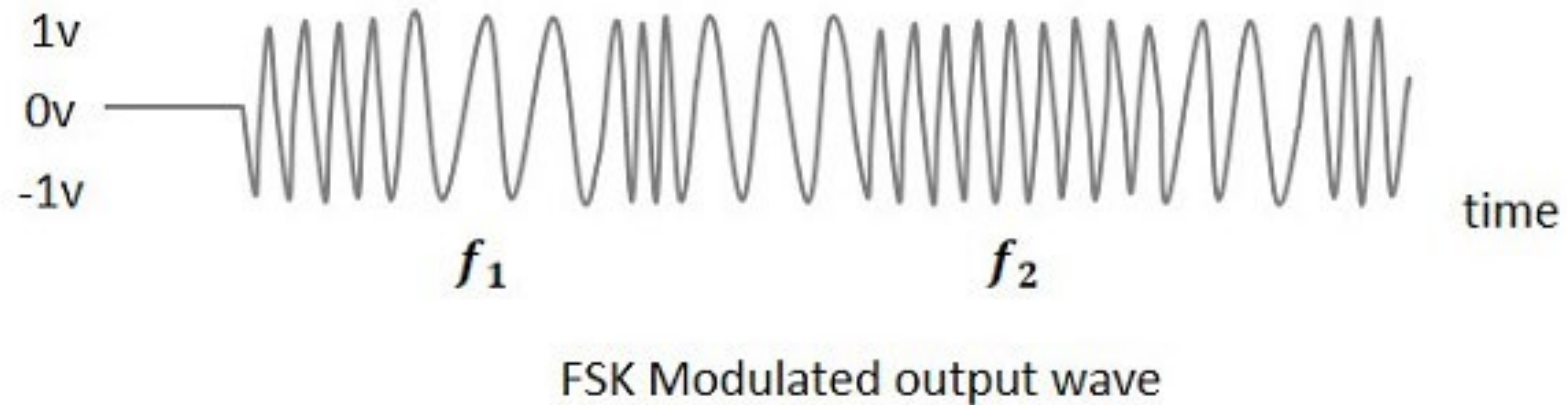
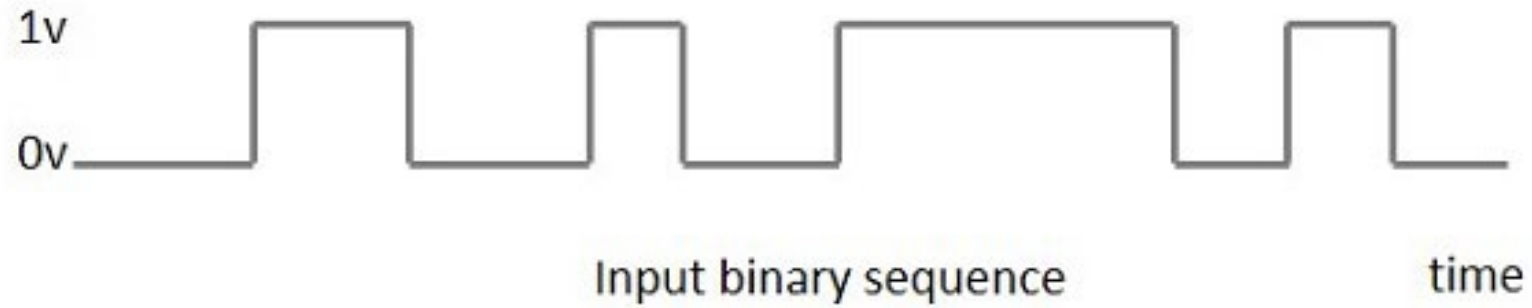


ASK Modulated output wave

# Frequency Shift Keying

- Frequency Shift Keying FSK is the digital modulation technique in which the **frequency** of the carrier signal varies according to the digital signal changes. FSK is a scheme of frequency modulation.
- The output of a FSK modulated wave is **high in frequency** for a binary High input and is **low in frequency** for a binary Low input. The binary 1s and 0s are called Mark and Space frequencies.

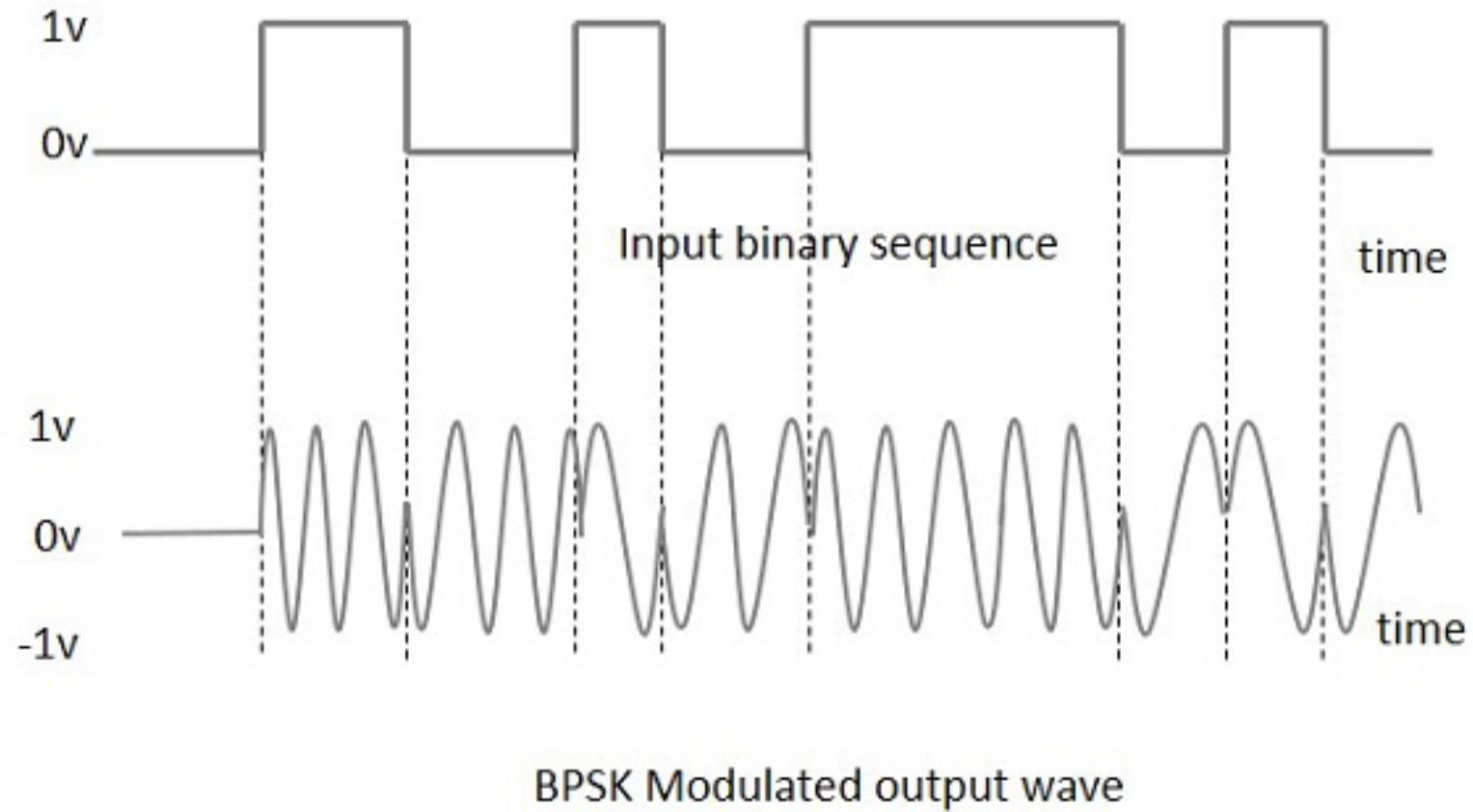
# Frequency Shift Keying



# Binary Phase Shift Keying

- 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.
- Binary Phase Shift Keying BPSK
  - This is also called as 2-phase PSK or Phase Reversal Keying. In this technique, the sine wave carrier takes two phase reversals such as  $0^\circ$  and  $180^\circ$ .
- BPSK is basically a Double Side Band Suppressed Carrier **DSBSC** modulation scheme, for message being the digital information.

# Binary Phase Shift Keying

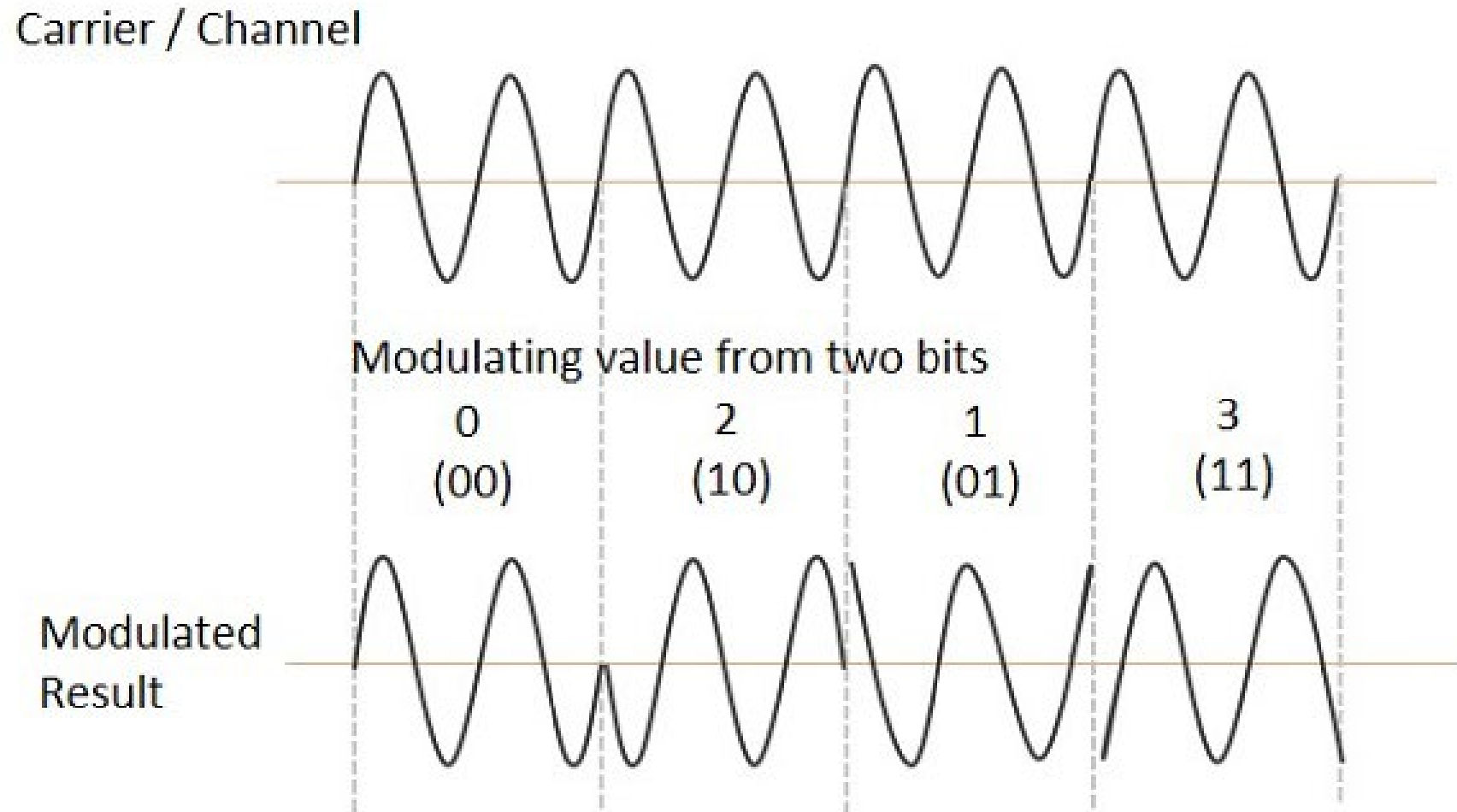




# Quadrature Phase Shift Keying

- This is the phase shift keying technique, in which the sine wave carrier takes **four phase reversals** such as  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$ , and  $270^\circ$ .
- If this kind of techniques are further extended, PSK can be done by eight or sixteen values also, depending upon the requirement.
- The Quadrature Phase Shift Keying QPSK is a variation of BPSK, and it is also a Double Side Band Suppressed Carrier DSBSC modulation scheme, which **sends two bits of digital information** at a time, called as bigits.
- Instead of the conversion of digital bits into a series of digital stream, it converts them into bit pairs. This decreases the data bit rate to half, which allows space for the other users.

# Quadrature Phase Shift Keying



# Differential Phase Shift Keying

- In Differential Phase Shift Keying DPSK the phase of the modulated signal is shifted relative to the previous signal element. No reference signal is considered here. The signal phase follows the high or low state of the previous element. This DPSK technique doesn't need a reference oscillator.

# Differential Phase Shift Keying

