Communication Systems

Module 3

Digital Communication Systems

Digital Communication

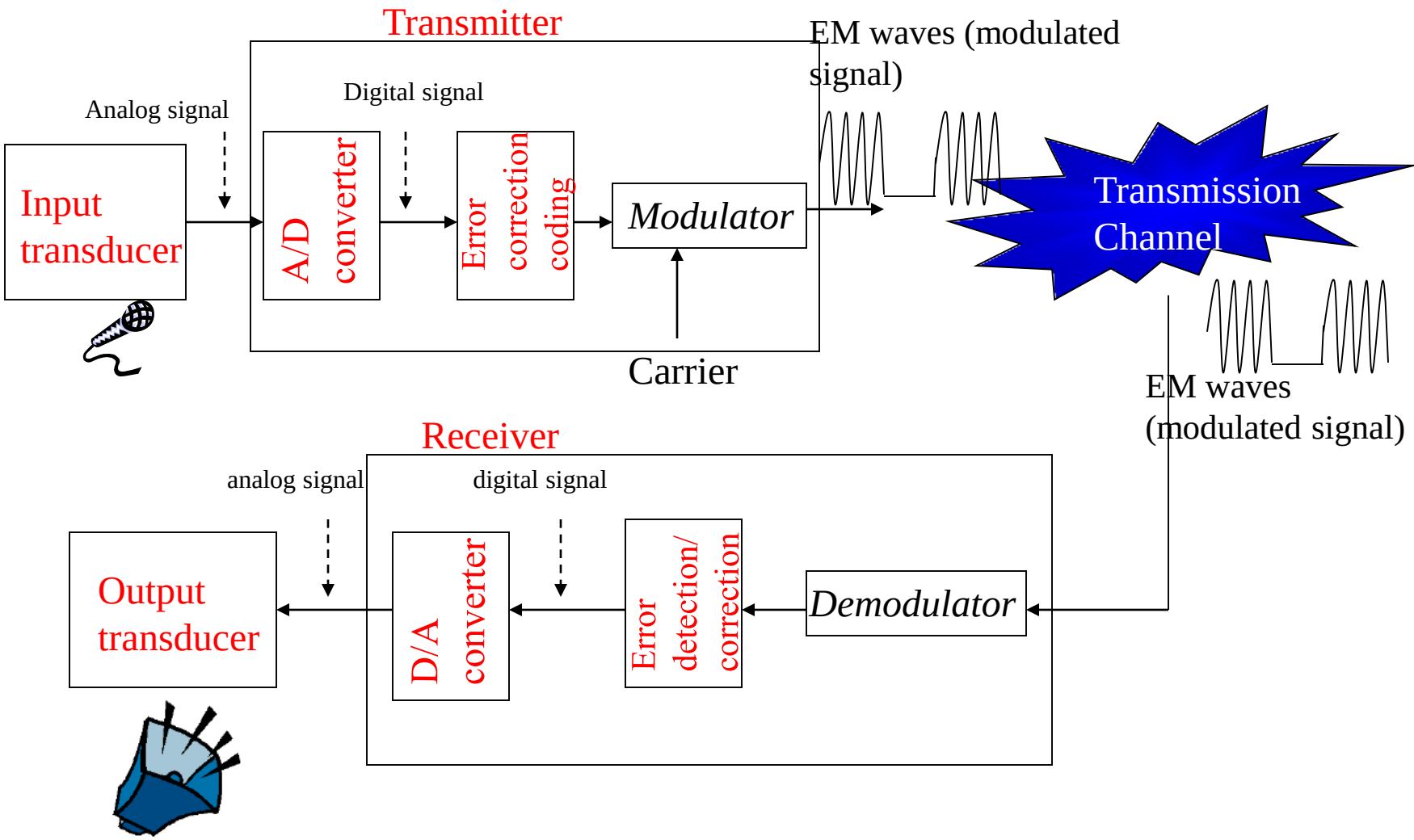
Advantages :

- Less Distortion, Low noise & interference.
- Regenerative Repeaters can be used.
- Digital Circuits are more reliable.
- Hardware implementation is more flexible.
- Secrecy of information.
- Low probability of error due to error detection and error correction.
- Multiplexing - (TDM)
- Signal Jamming is avoided.

Disadvantages :

- Large Bandwidth
- Synchronization

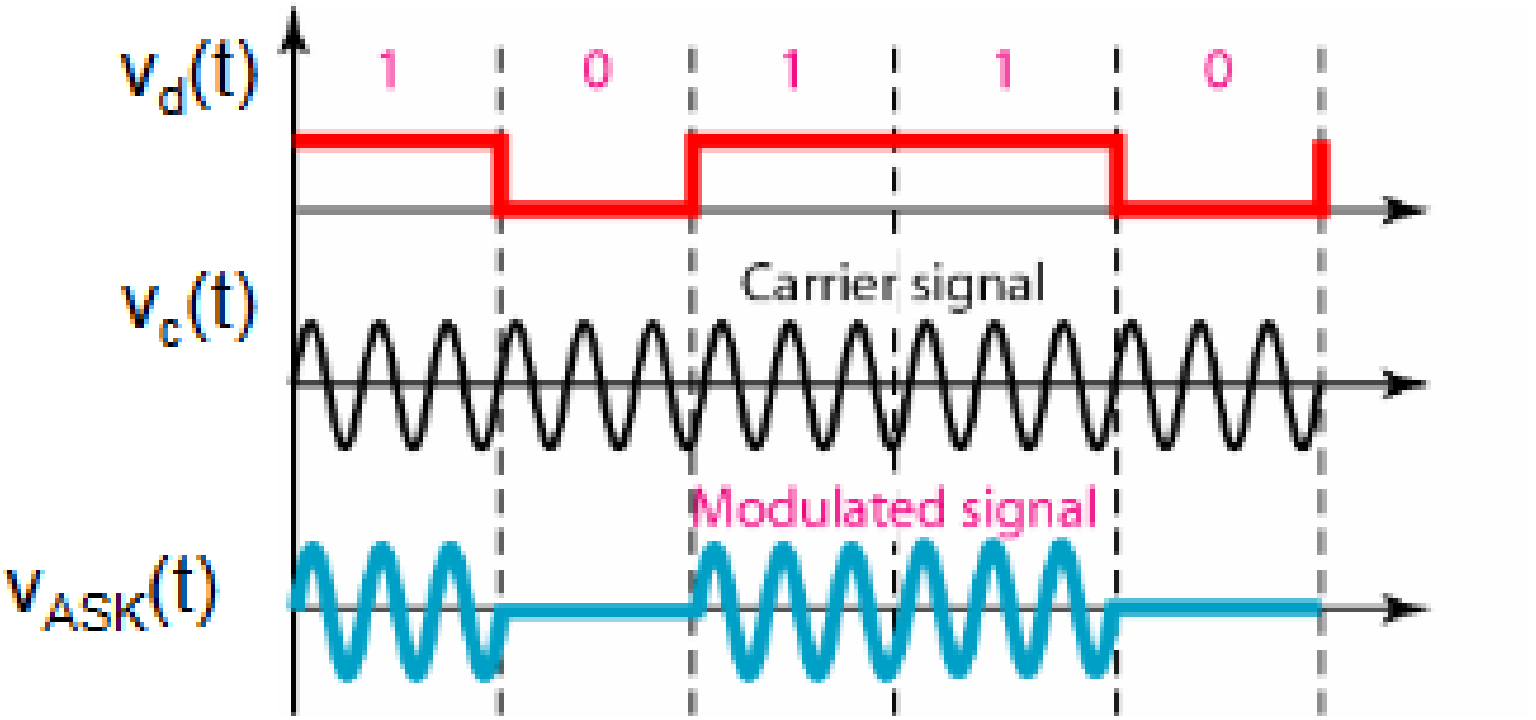
Basic digital communications system



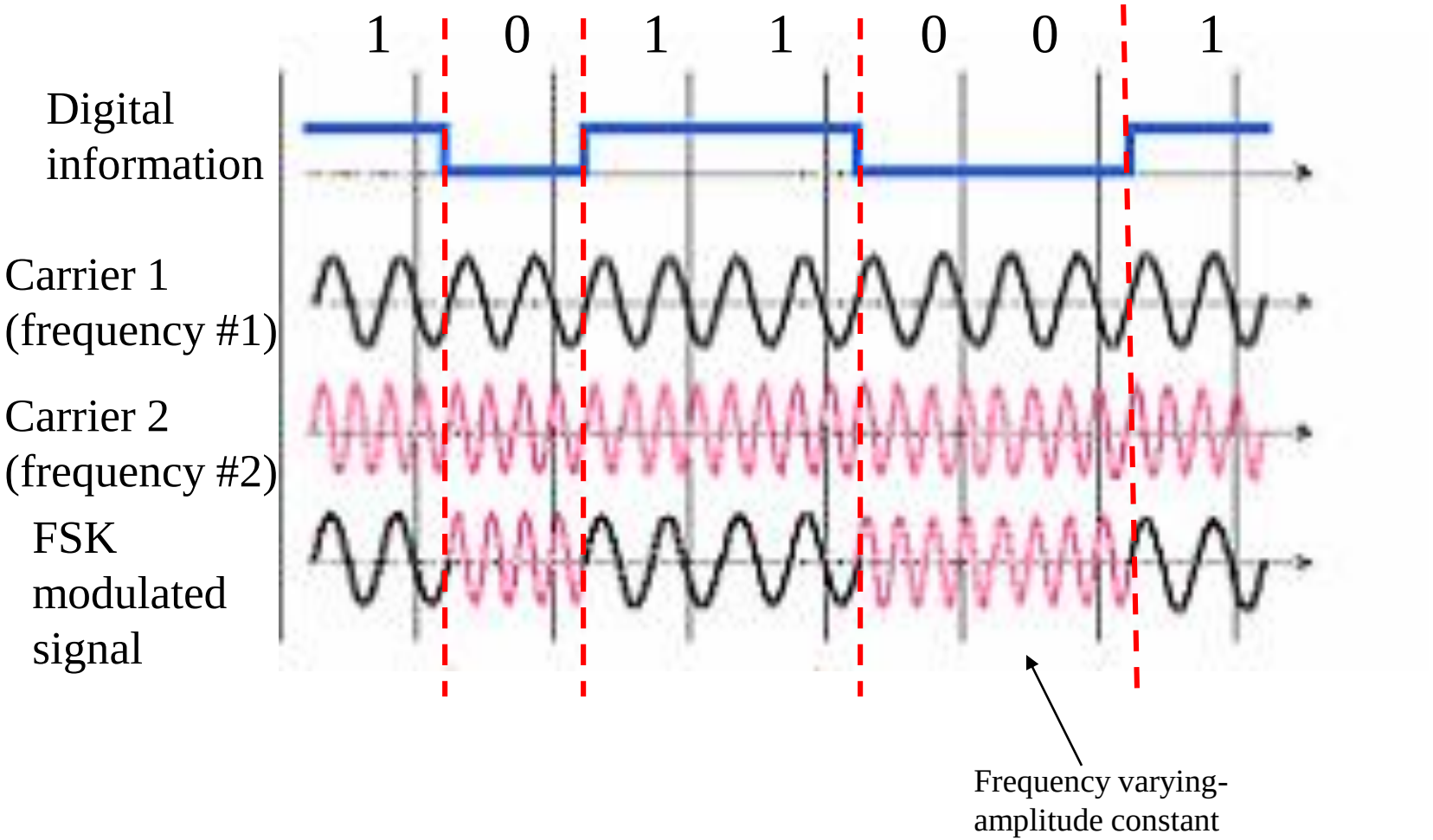
Types of Digital Modulation Techniques

- Amplitude Shift Keying (ASK)
  - ASK involves the process of switching the carrier either on or off, in correspondence to a sequence of digital pulses that constitute the information signal. One binary digit is represented by the presence of a carrier, the other binary digit is represented by the absence of a carrier. Frequency remains fixed
- Frequency Shift Keying (FSK)
  - FSK involves the process of varying the frequency of a carrier wave by choosing one of two frequencies (binary FSK) in correspondence to a sequence of digital pulses that constitute the information signal. Two binary digits are represented by two frequencies around the carrier frequency. Amplitude remains fixed.
- Phase Shift Keying (PSK)
  - Another form of digital modulation technique in which phase of a transmitted signal is varied to convey information.

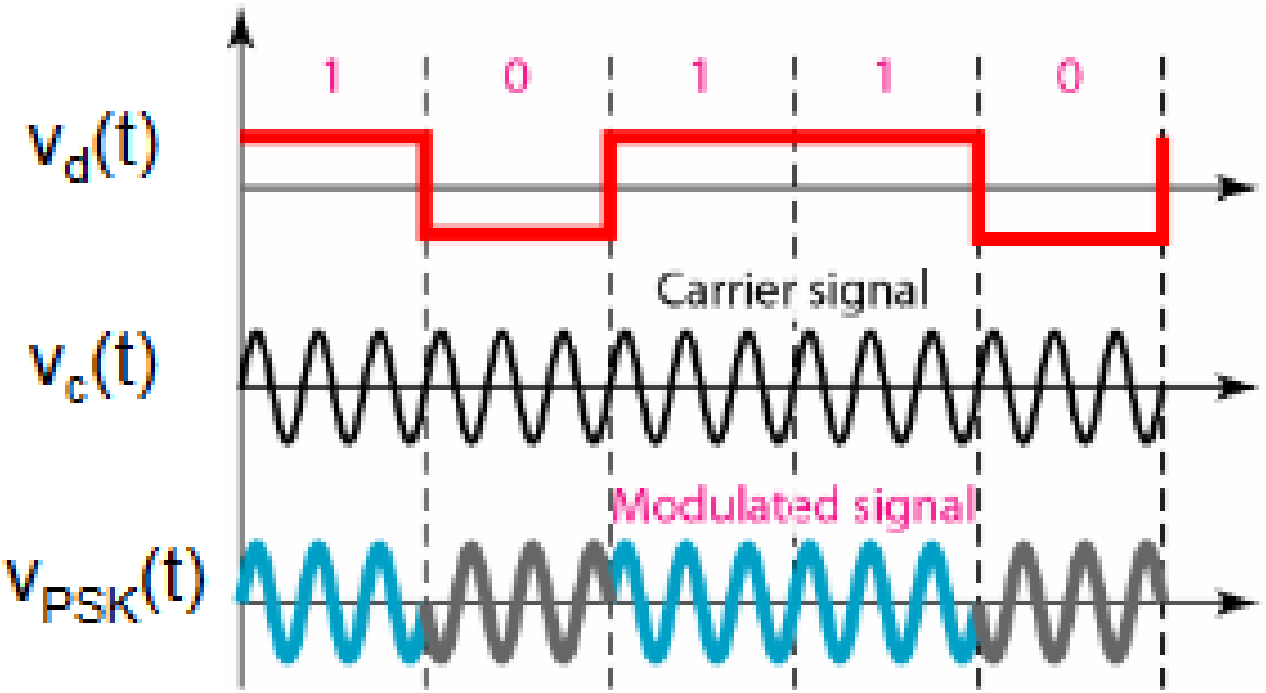
Amplitude Shift Keying



Frequency Shift Keying



Phase Shift Keying



Demodulation or Detection

- The reverse Process of Modulation is called Demodulation or Detection.

- A Modulated Signal must be Demodulated in order to recover the original signal.

- There are two broad categories of Detection methods
- Coherent Detection:
  - The process in which the receiver exploits knowledge of the carrier's phase to detect the signals.
- Non-coherent Detection:
  - The detection process in which the phase information of the carrier is not utilized.

SNR and BER

- **Noise:** is an error or undesired random disturbance of a useful information signal in a communication channel. The noise is a summation of unwanted or disturbing energy from natural and sometimes man-made sources.

- **Signal-to-noise ratio (abbreviated SNR or S/N):** is defined as the ratio of signal power to the noise power, often expressed in decibels.

- In digital transmission, the number of bit errors is the number of received bits of a data stream over a communication channel that have been altered due to noise, interference, distortion or bit synchronization errors. The **bit error rate (BER)** is the number of bit errors per unit time. The bit error ratio (also BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval. BER is a unit less performance measure.