Part - III

Principles of Electronic Communication

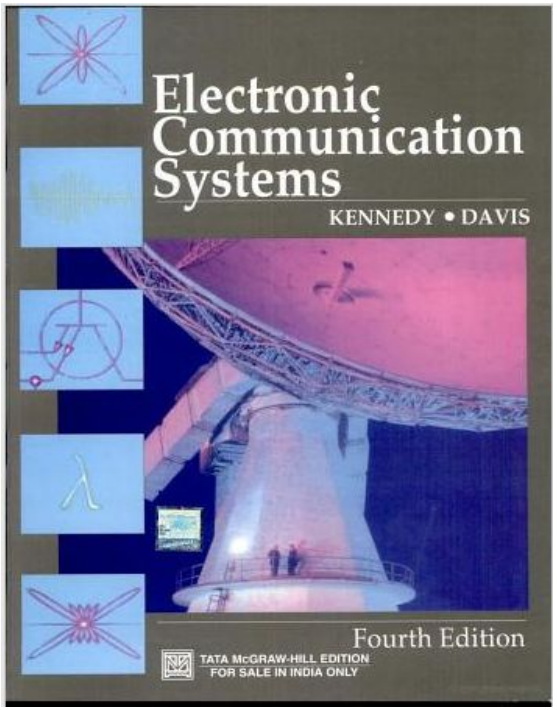
Chapter-8: Introduction to Digital Communication

Reference:

Electronic Communication Systems by

Kennedy & Davis ,

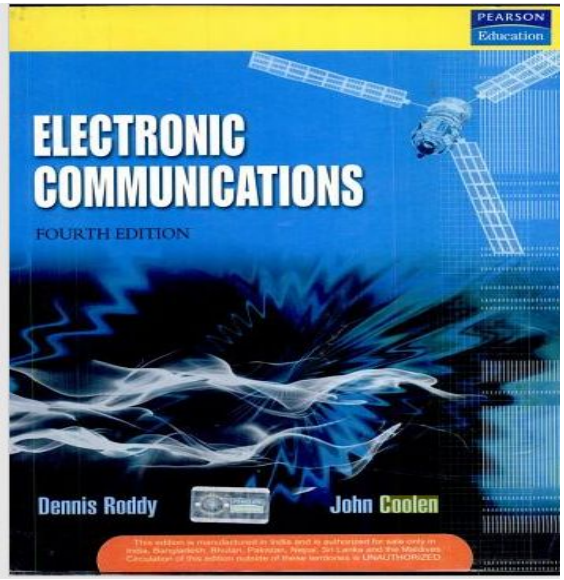
4th edition,2004,TMH Edition



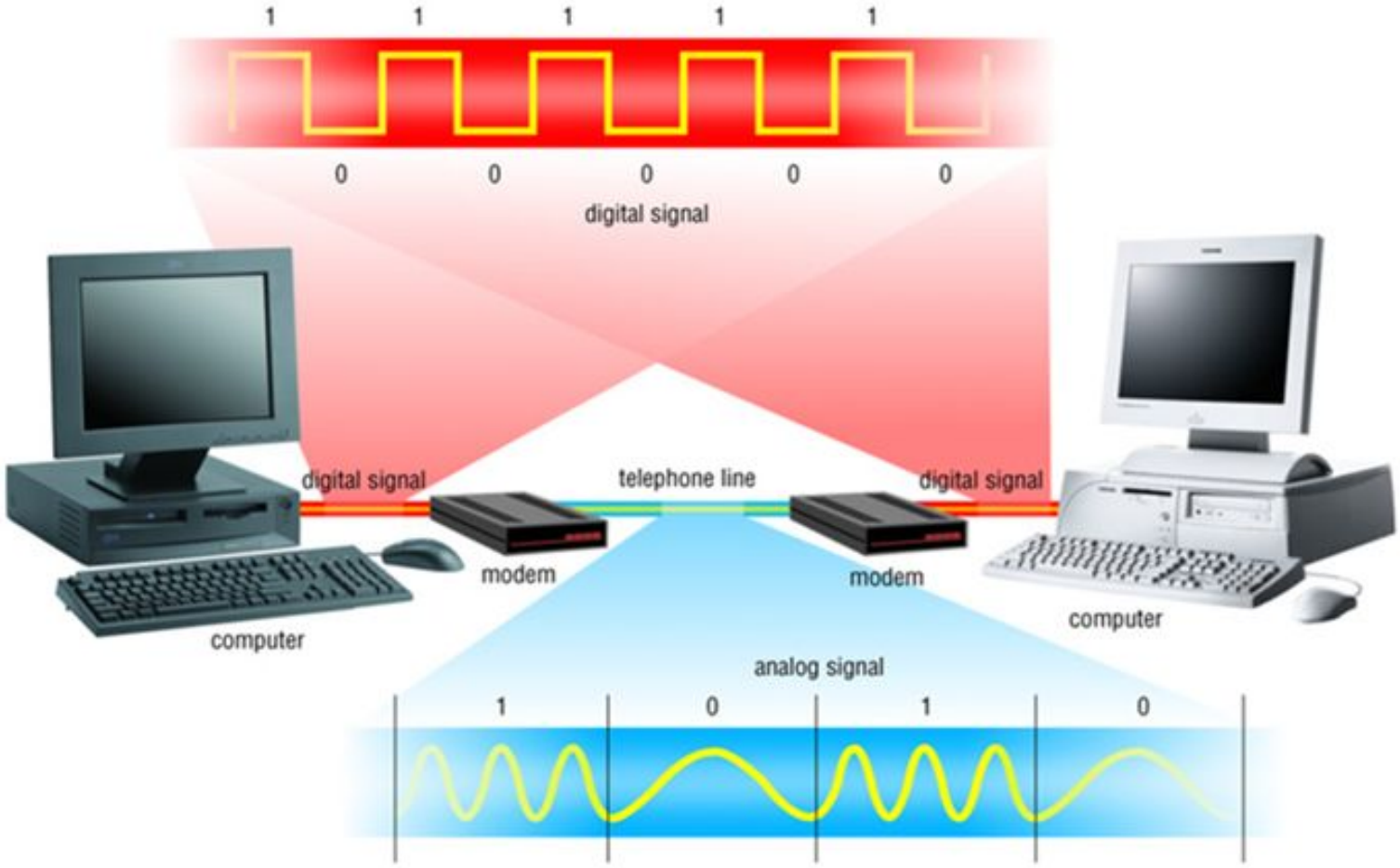
Introduction to digital communication

Reference :

Electronic Communications
by Denis Roddy & John Coolen ,
4th edition, Pearson Education,2009



INTRODUCTION TO DIGITAL COMMUNICATION



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Digital Communication-Introduction

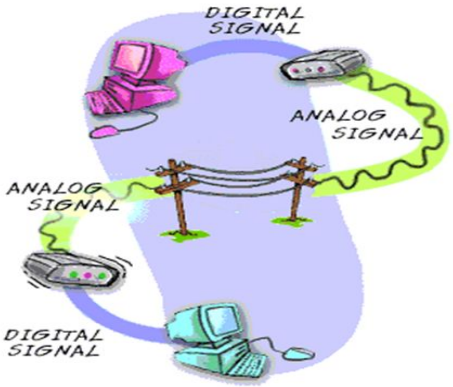
- Objectives:
  1. *State Nyquist Sampling Theorem*
  2. *Explain the principle of Pulse Amplitude Modulation Techniques*
  3. *Explain the function blocks of a Digital Communication System*
  4. *Mention advantages & disadvantages of Digital Modulation*
  5. *Explain the principle of different types of Digital Modulation Techniques*

Sampling

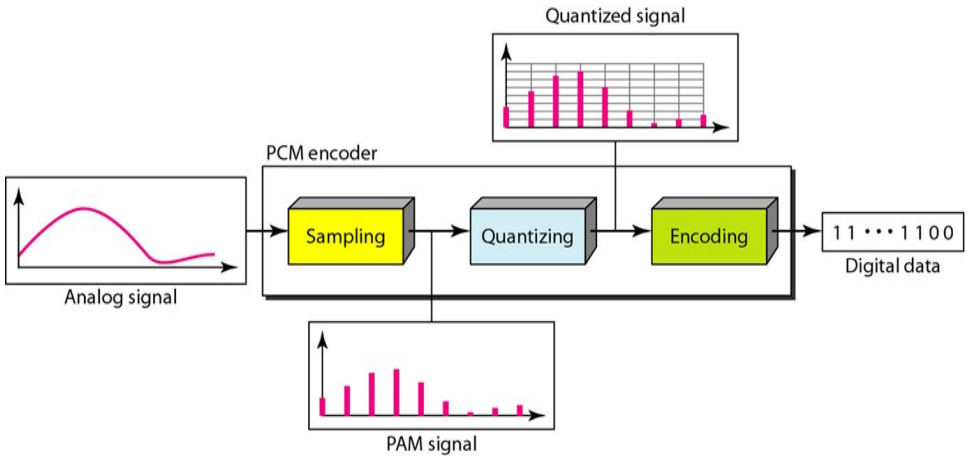
- Introduction
  - *Sampling Examples in real world situations*
  - *Sampling for Analog-to-Digital Conversion*

Sampling

- **Steps involved in Analog to Digital Conversion**
  - *Sampling (sampling.docx)*
  - *Quantizing*
  - *Encoding*



Source : *http://www.jhigh.co.uk/ComputingSG/GPPs/Communications*

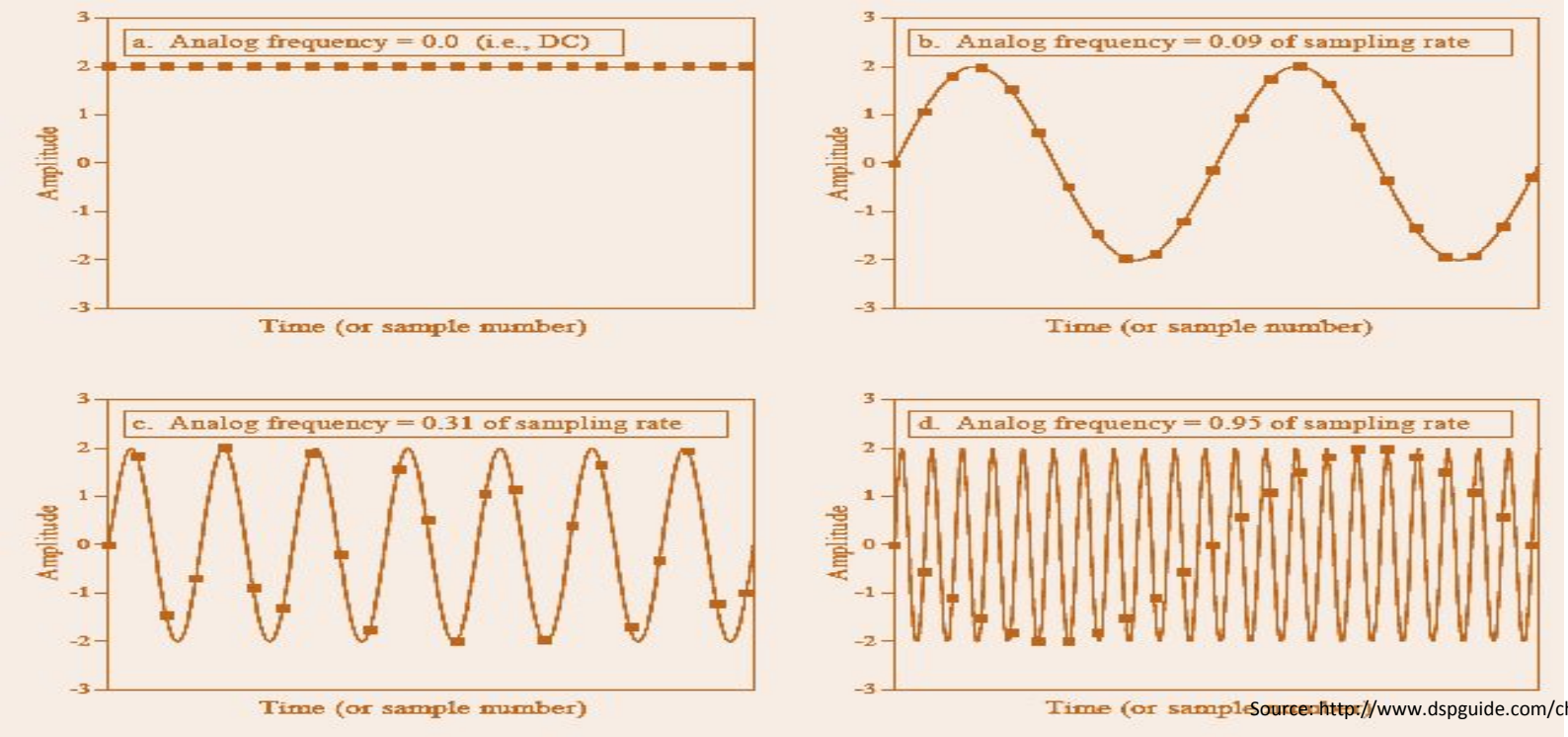


Source:: 112.196.5.130/edusat/poly/Electrical/sem-/Pulse%20Modulation.ppt

Sampling Illustration

- **Nyquist Sampling Theorem Statement**

"It is possible to reconstruct a band-limited analog signal from periodic samples, as long as the sampling rate is at least twice the highest frequency component of the signal."



Source: http://www.dspguide.com/ch3/2.htm

Self Test

1. *Why sampling is required?*

   A. It is required for modulation.

   B. It is necessary to suppress the effect of noise in communication channel.

   C. Sampling is necessary before an analogue signal can be converted into digital form.

   D. Without sampling, a signal can't be transmitted and stored.

2. *Why data is preferred in digital form?*

   A. Because in digital form, the effect of noise can be cancelled easier.

   B. Because in digital form, error control, data security and compression are possible.

   C. Because digital devices are easier to design and implement.

   D. All reasons are correct.

ACTIVITY:

Try and find out the effect of sampling of a sinusoidal signal if the signal frequency is equal to , less than and more than the Nyquist sampling frequency.

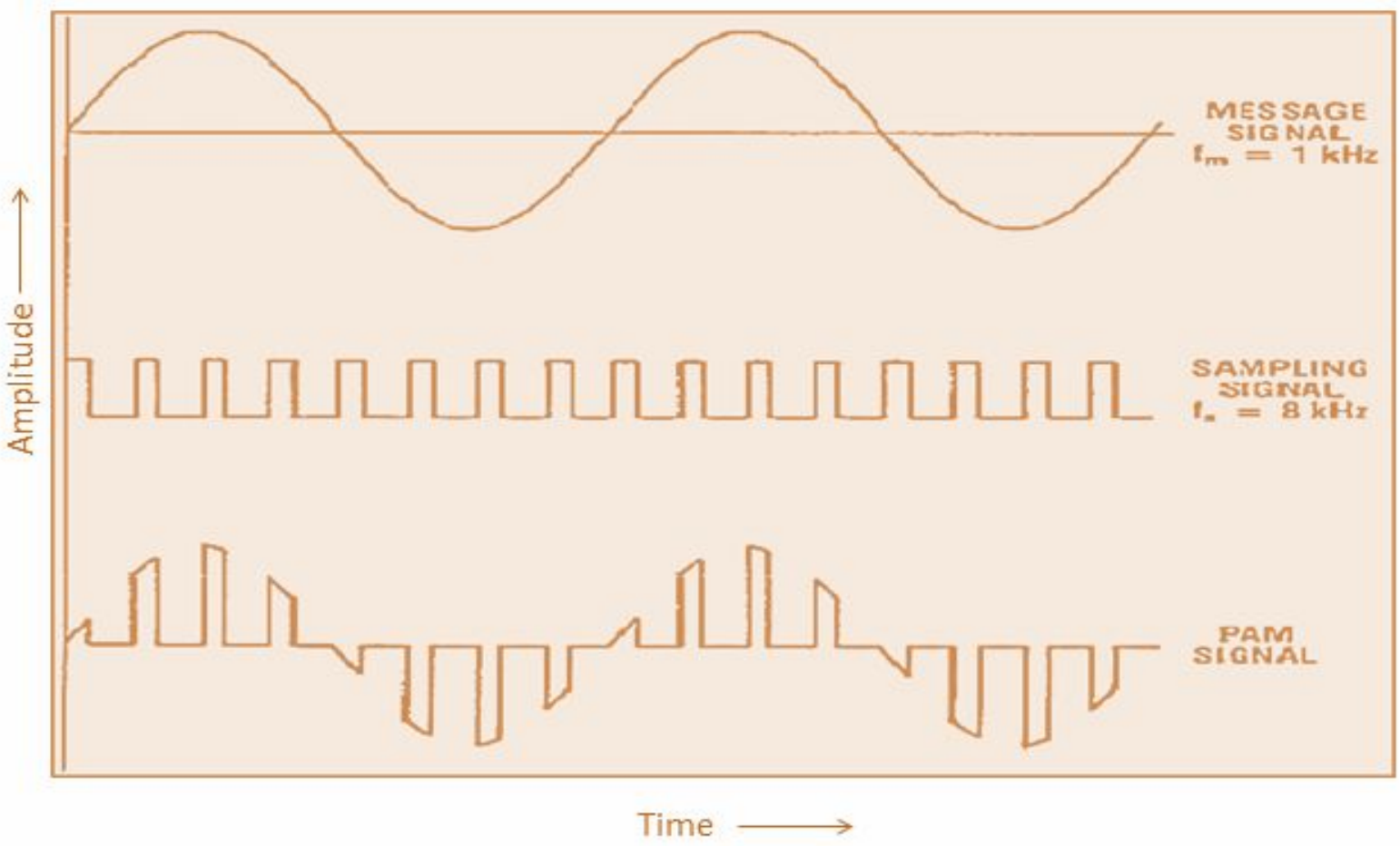
Pulse Modulation Techniques

- **Digital Transmission of Analog Data**

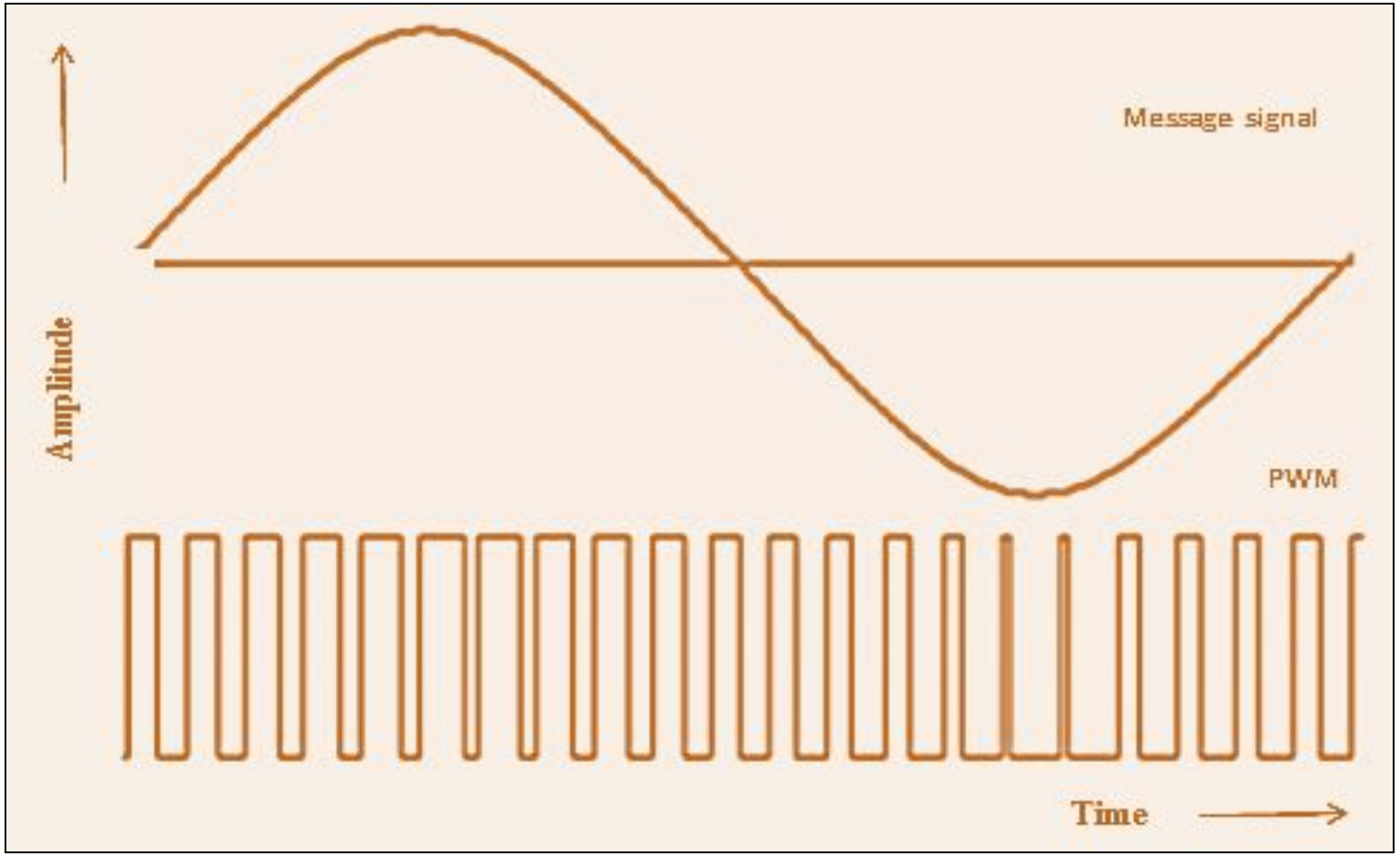
- **Types of Digital Transmission**
  - *Pulse Amplitude Modulation (PAM)*
  - *Pulse Width Modulation (PWM)*
  - *Pulse Position Modulation (PPM)*

Pulse Modulation Techniques.docx

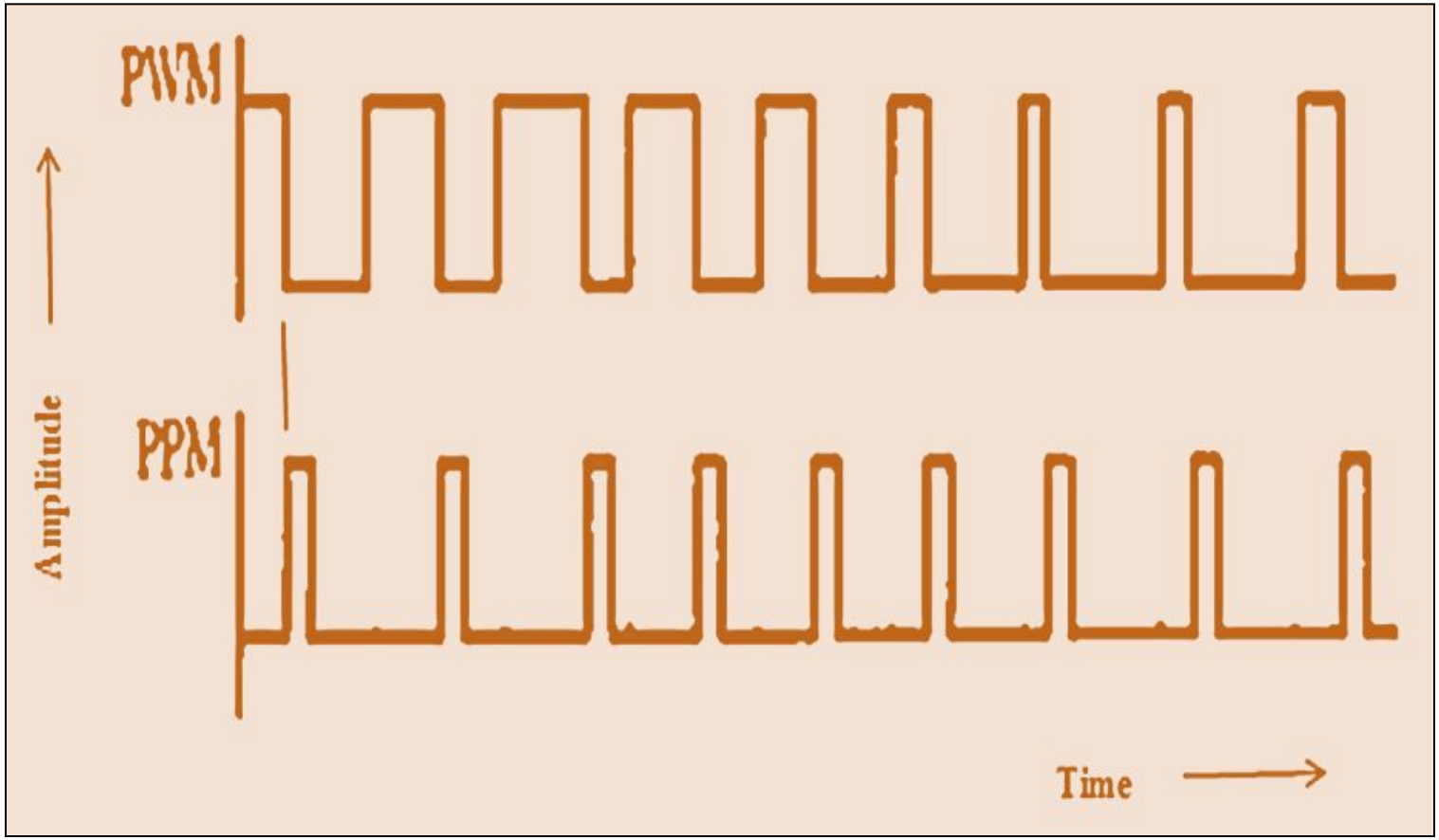
Pulse Amplitude Modulation (PAM)



Pulse Width Modulation (PWM)



Pulse Position Modulation (PPM)



Self Test

1. *Pulses are often used to transmit information because*

   A. pulses often require less energy for transmission than analog signals.

   B. pulses are often less affected by noise than analog signals.

   C. With pulses, several messages can be transmitted on the same channel.

   D. all of the above.

2. *In pulse modulation, the parameters usually made to vary in proportion to the message signal are*

   A. rise time or overshoot.

   B. amplitude or frequency.

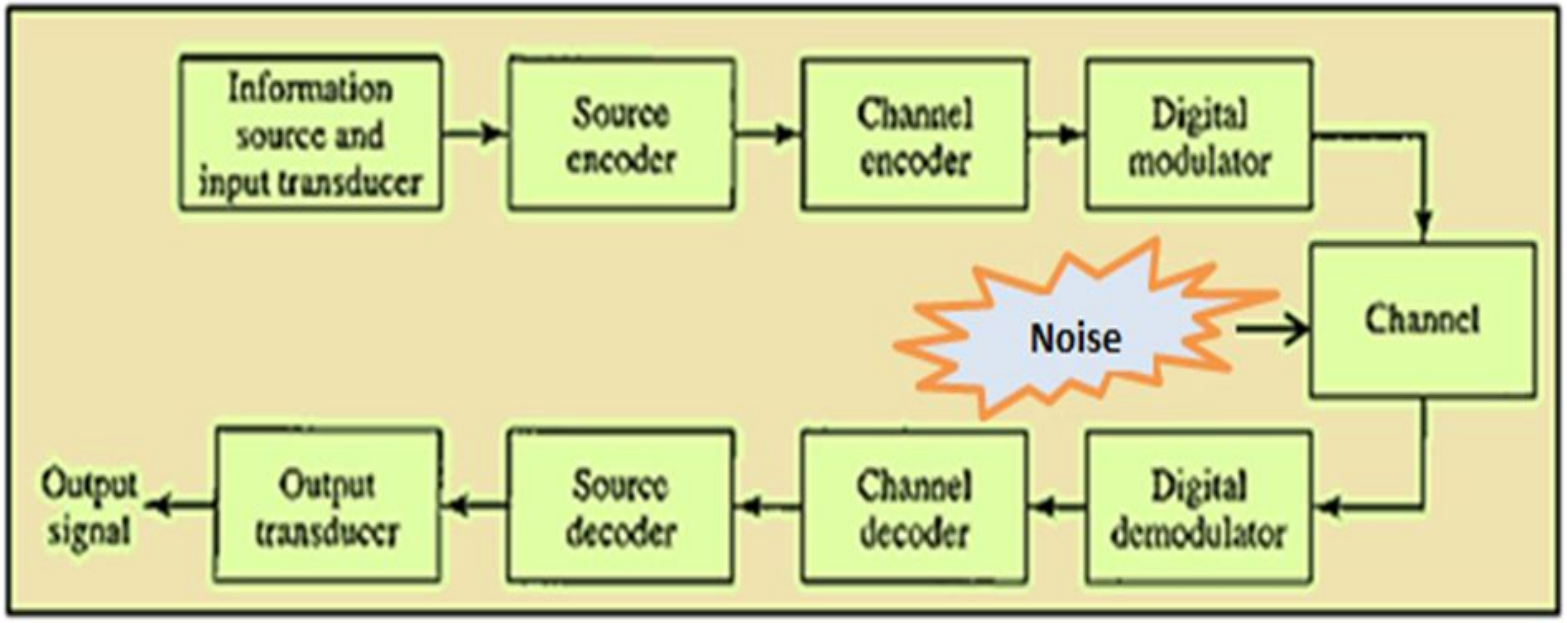
   C. amplitude, width or position.

   D. all of the above.

3. *Differentiate between pulse modulation and continuous modulation*

Digital Communication Contd.,

- Need for Digital Modulation
- Block Diagram of a Digital Communication System



Digital Communication System.docx

- **Advantages of Digital Communication**

  - *Distortion, noise and interference*
  - *Use of Regenerative repeaters*
  - *Reliability*
  - *Flexible & Compatible hardware implementation*
  - *Secrecy of information.*
  - *Error detection and Error correction*
  - *Multiplexing of several channels*
  - *Availability of wideband channels*
  - *Increased system complexity in a cost effective manner*

- **Disadvantages of Digital Communication**
  - *Need for Large System Bandwidth*
  - *Need for System Synchronization*
  - *Circuit Complexity*

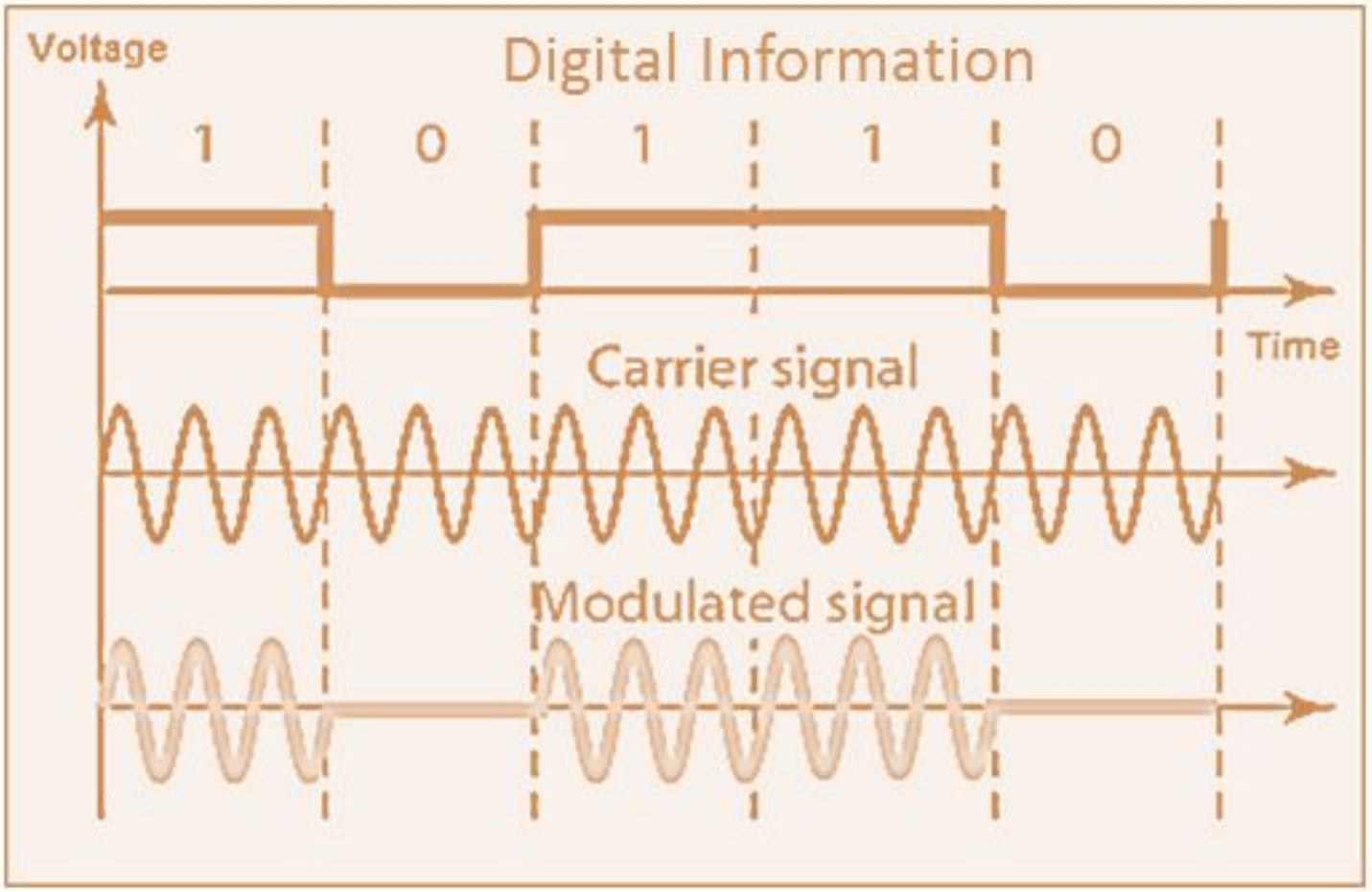
Refer Advgs & Disadvgs of Digital Communication.docx

- **Types of digital modulation techniques**

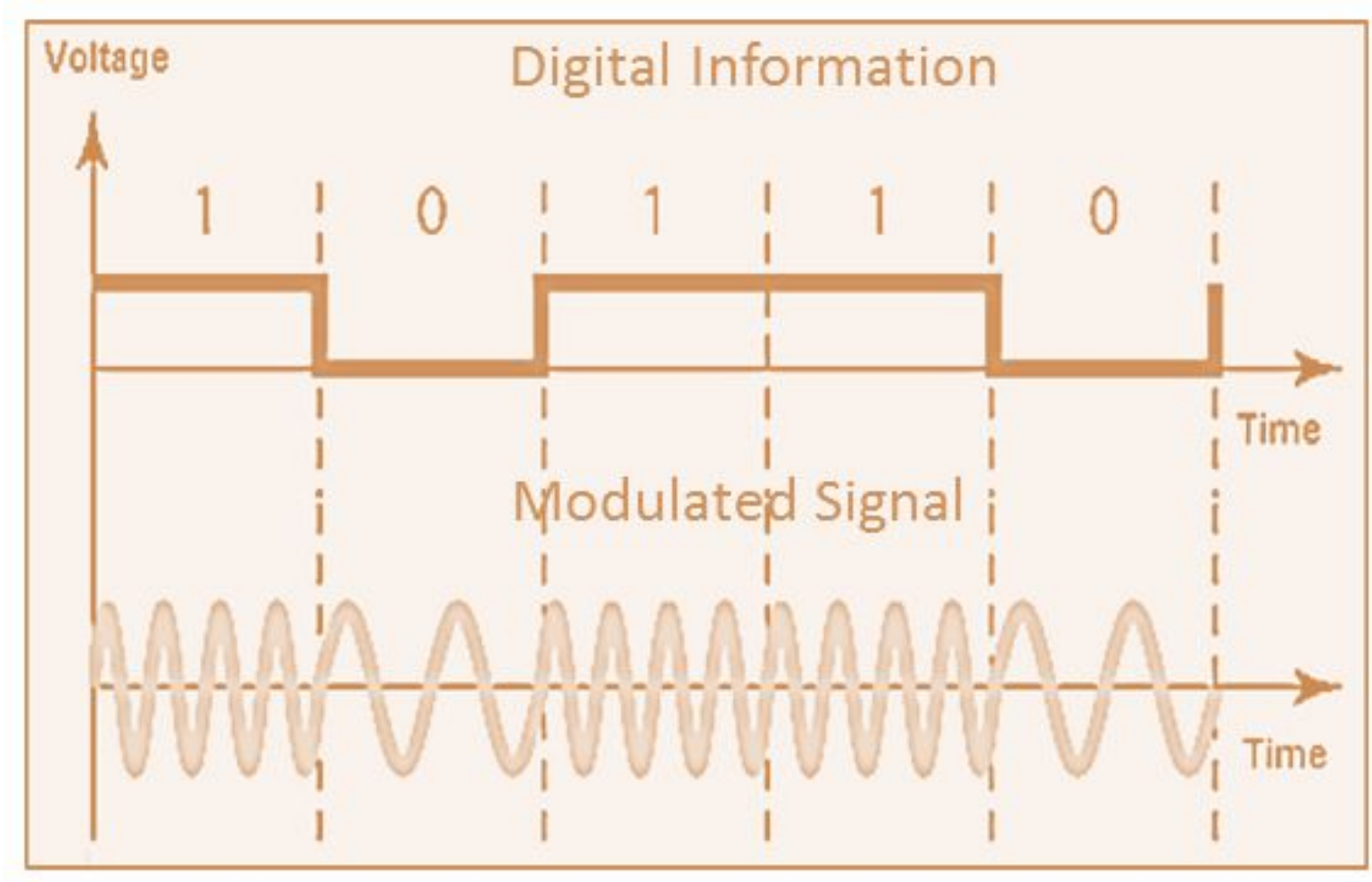
  - *Amplitude Shift Keying (ASK)*
  - *Frequency Shift Keying (FSK)*
  - *Phase Shift Keying (PSK)*

Refer Digital Modulation Techniques.docx

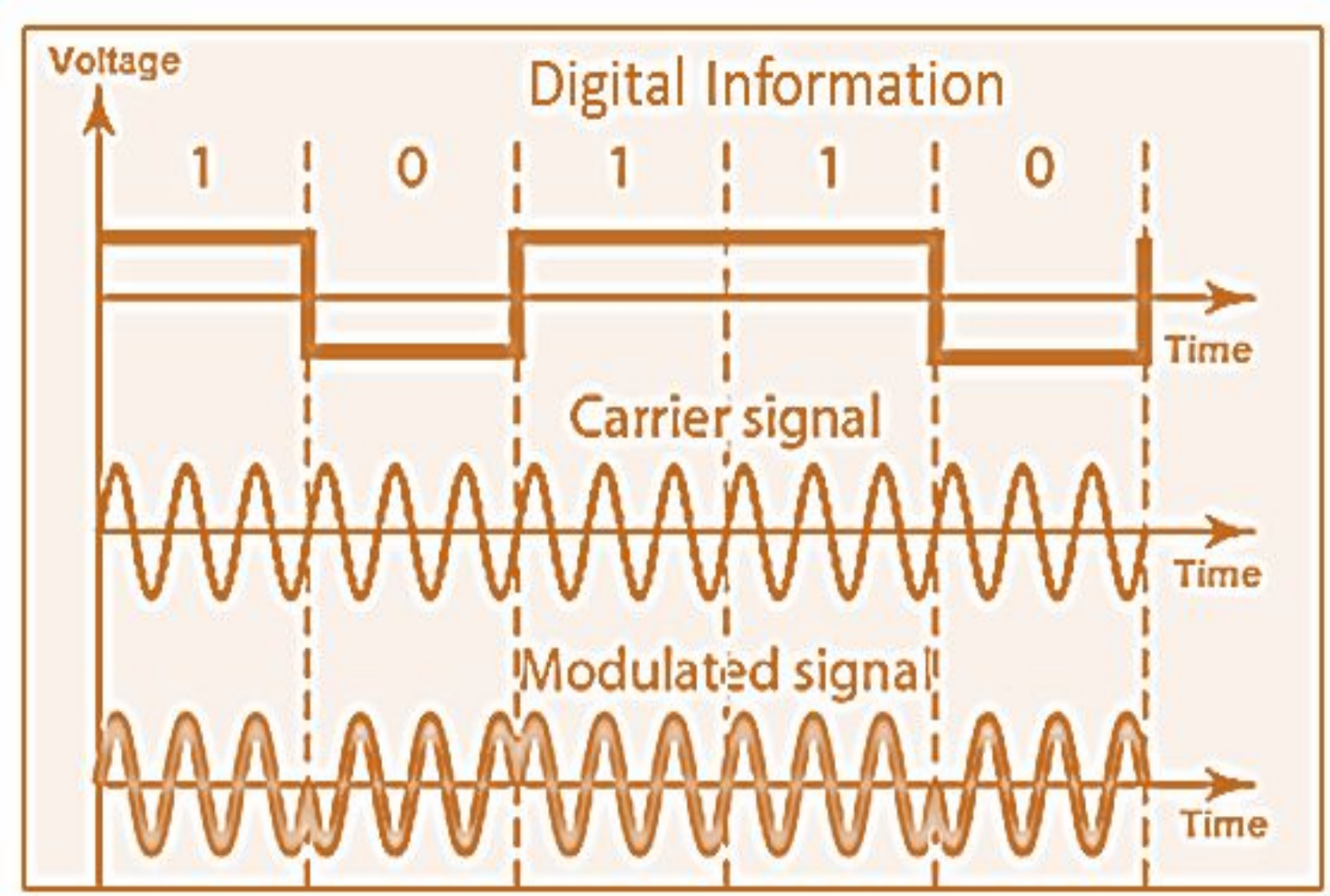
AMPLITUDE SHIFT KEYING (ASK)



FREQUENCY SHIFT KEYING (FSK)



PHASE SHIFT KEYING (PSK)



Application of ASK, FSK AND PSK

- **Applications : ASK**
  - *Transmission of digital data over optical fiber*
  - *Used as a type of modulation called On-Off Keying at radio frequencies*
- **Application : FSK**
  - *Variant of FSK (GMSK) in GSM Mobile Stds*
  - *Amateur radios, Modems , Caller ID's etc.,*
- **Application :PSK**
  - *Variants of PSK in Wireless LAN stds , Bluetooth stds, RFID's , Zig bee etc.,*

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Self Test

1 In _____, the peak amplitude of one signal level is 0; the other is the same as the amplitude of the carrier frequency.

A.PSK
B.ASK
C.FSK
D.none of the above

2 How many carrier frequencies are used in Binary FSK?

A.2
B.1
C.0
D.none of the above

Summary

In this module we have learnt:

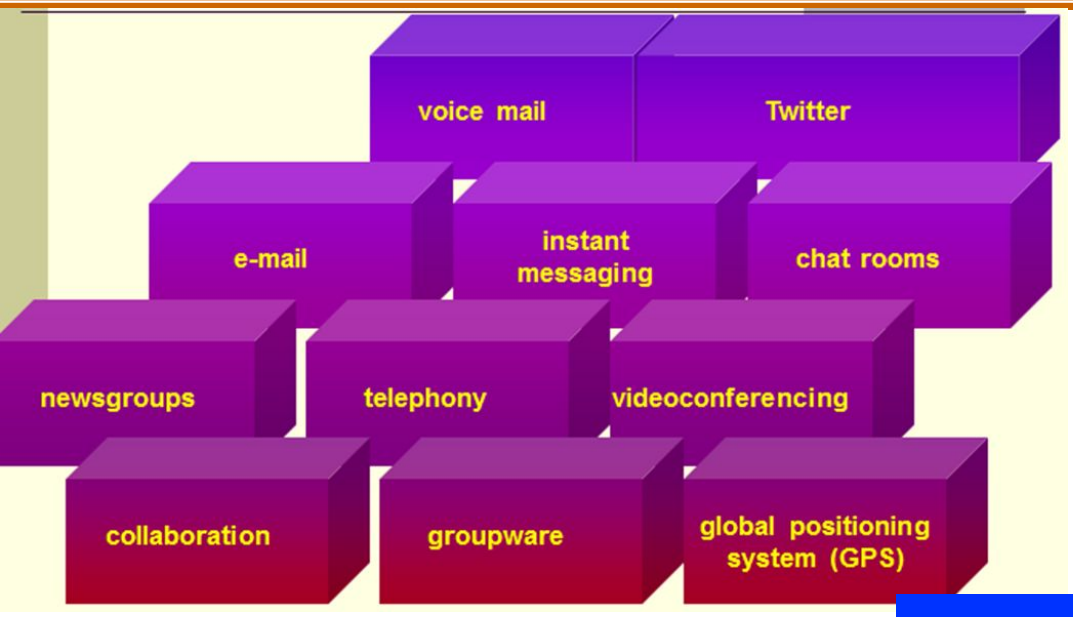
- *To state Nyquist sampling theorem (fs≥2fc, Where f_s is the sampling frequency and f_c is highest frequency contained in the signal) and apply this theorem to determine the sampling rate for sampling an analog signal without distortion.*

- *To define and distinguish various types of pulse modulation techniques such as PAM, PWM and PPM*

- *Draw and explain the various blocks of a General Digital Communication System*

- *To define, draw and distinguish different digital modulation techniques such as ASK, FSK and PSK.*

Applications of Digital Modulation To Communication Technologies



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