COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

Digital Signal Processing (DSP)

CTE 306

Lecture 2

- Introduction to DSP -

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Signals

- A signal is a function of time representing a physical variable, eg: voltage, current etc.
- A signal is defined as a function of one or more independent variables.
  - For example, the function x(t) = 5t
  - That signal is represented as a function of an independent variable t (time).
- Signals are functions of independent variables that carry information.

Signals

- Typical think of signals in terms of communication and information

  - Radio signal.
  - Broadcast or cable TV.
  - Audio.
  - Electric voltage or current in a circuit.

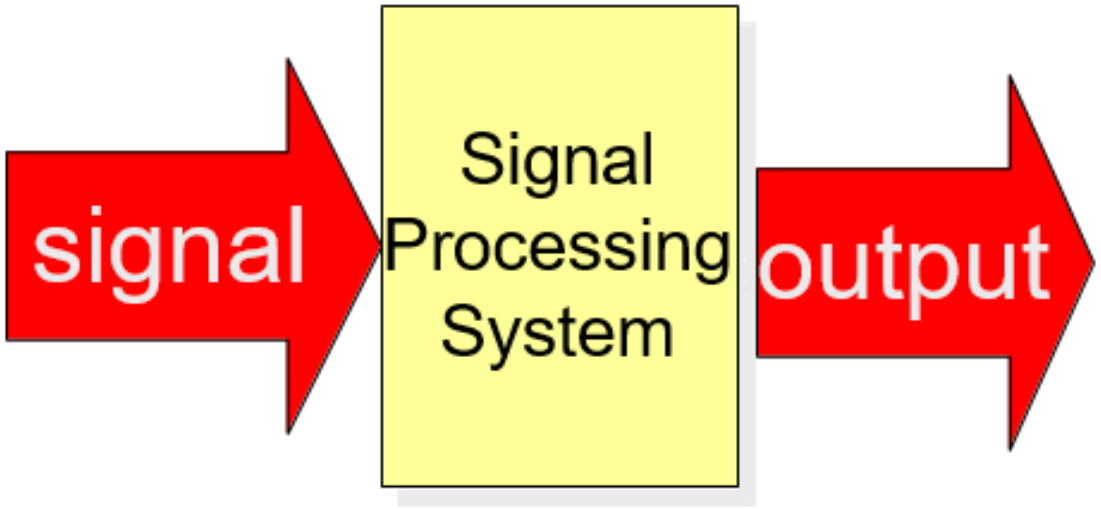
- More generally, any physical or abstract quantity that can be measured, or influences one that can be measured, can be thought of as a signal.

Signals

- Typical systems take a signal and convert it into another signal,
  - Radio receiver.
  - Audio amplifier.
  - Modem.
  - Microphone.
  - Cell telephone.
  - Cellular metabolism.
  - National and global economies.

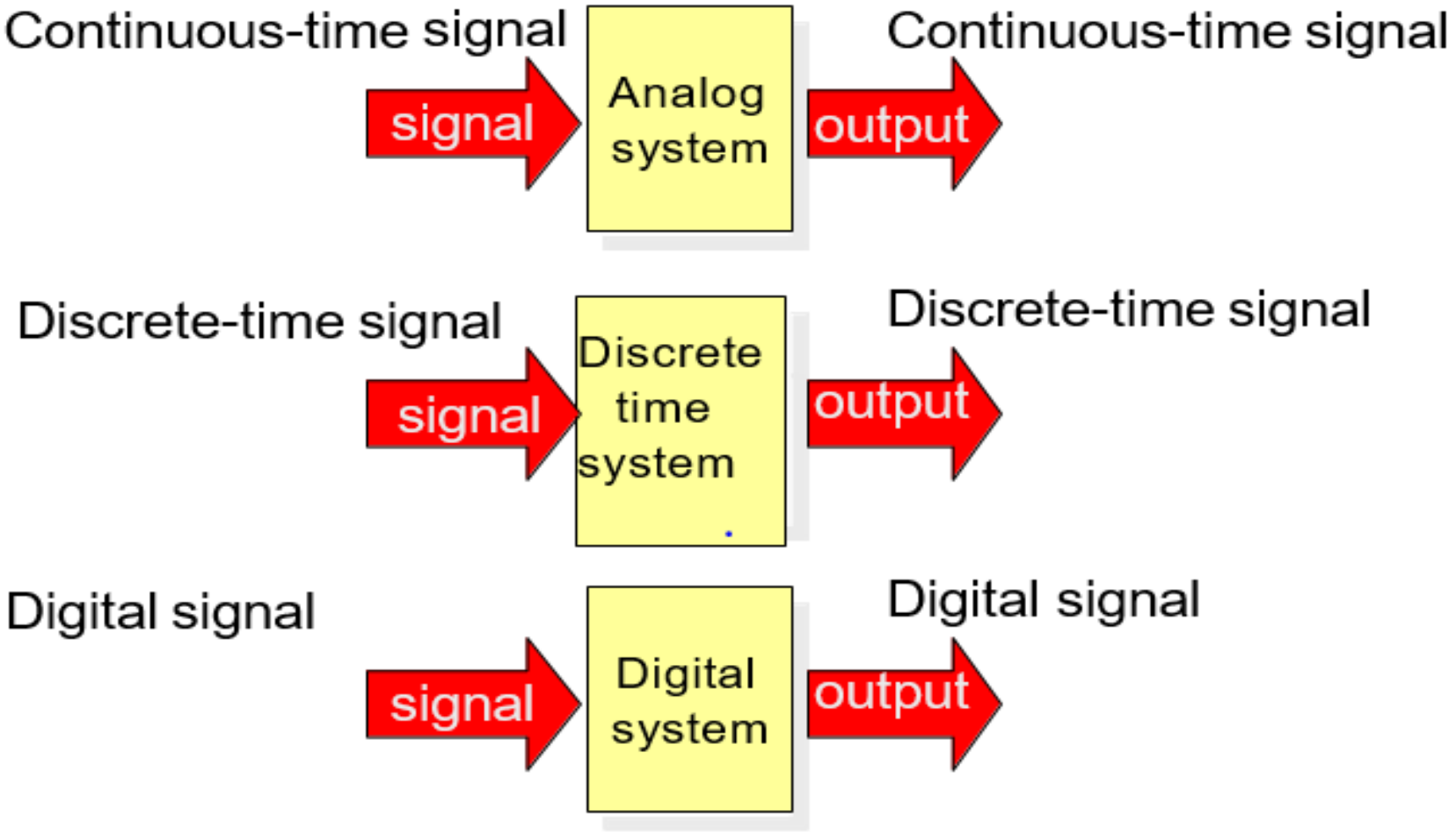
- Internally, a system may contain many different types of signals.

- In general, a system transforms input signals into output signals.



- Facilitate the extraction of desired information.

Signal Processing Systems



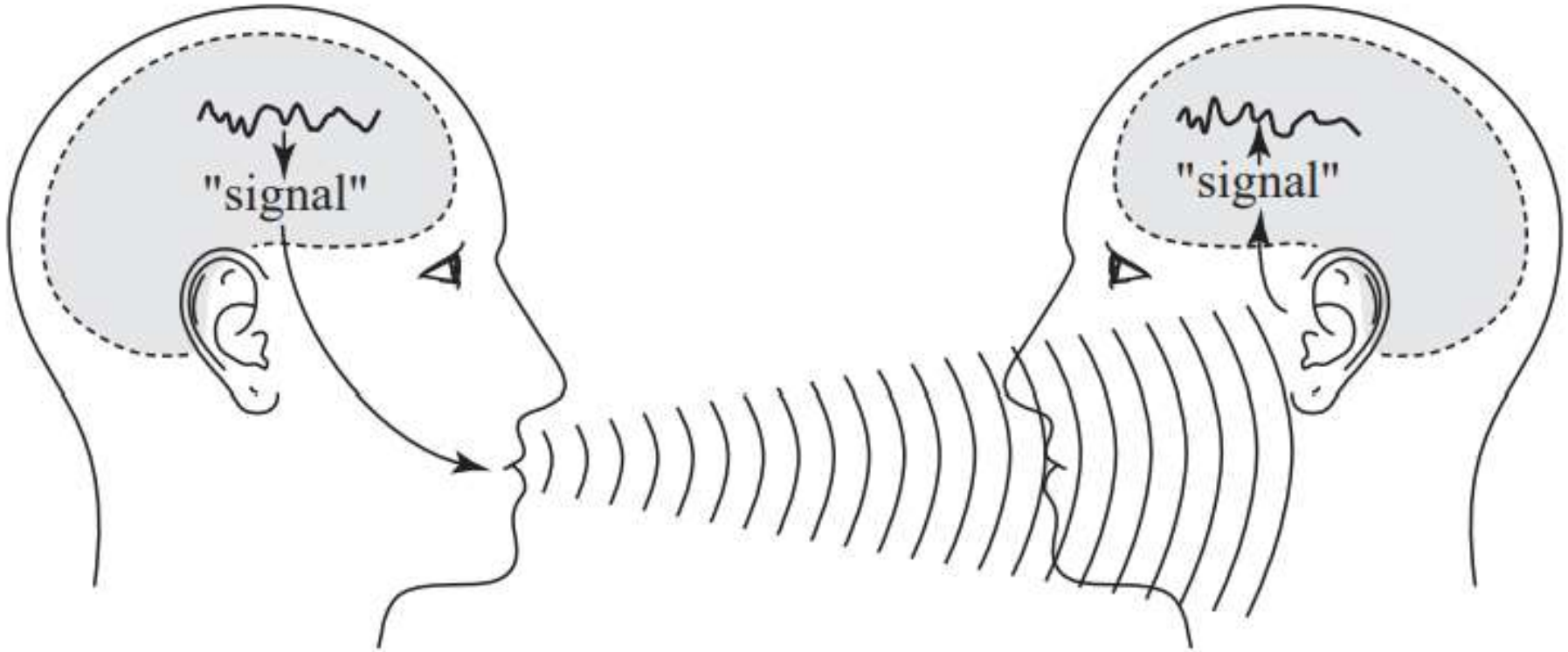


Fig:
Communication between two people involving signals and signal processing by systems

Classification of Signals

Based on different features for signals, we may identify five methods of classifying signals:

- Continuous-Time and Discrete-Time Signals.
- Analog and Digital Signals.
- Periodic and Non periodic Signals.
- Deterministic and Random Signals.
- Even and Odd Signals.

Continuous-Time and Discrete-Time Signals

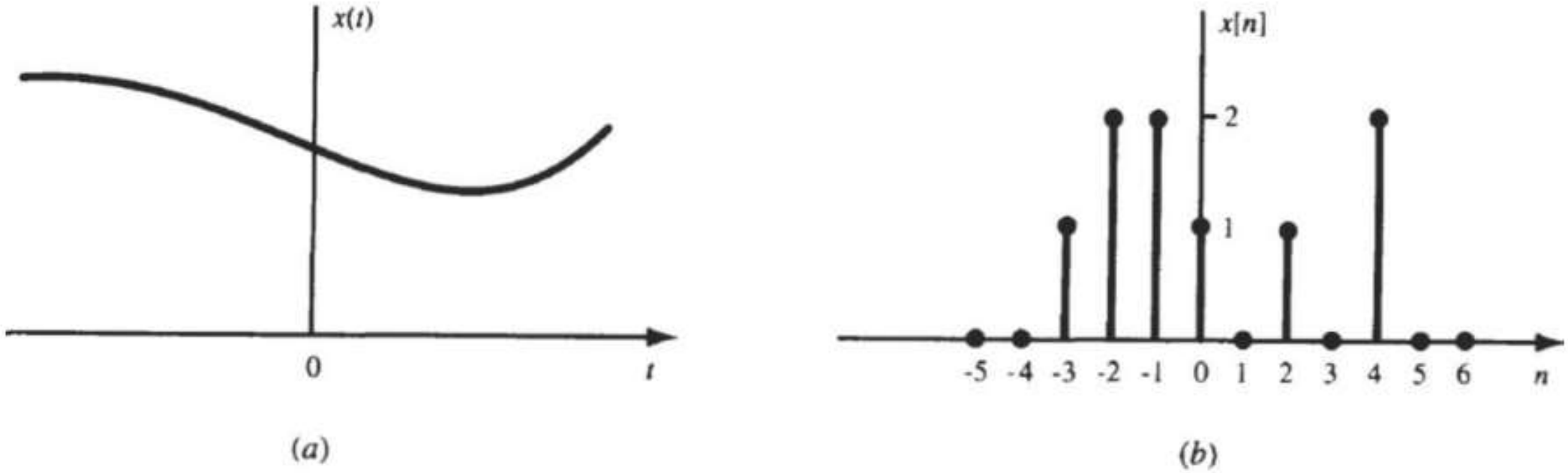


Fig: Graphical representation of :
(a) Continuous-time and **(b)** Discrete-time signals

Analog and Digital Signals

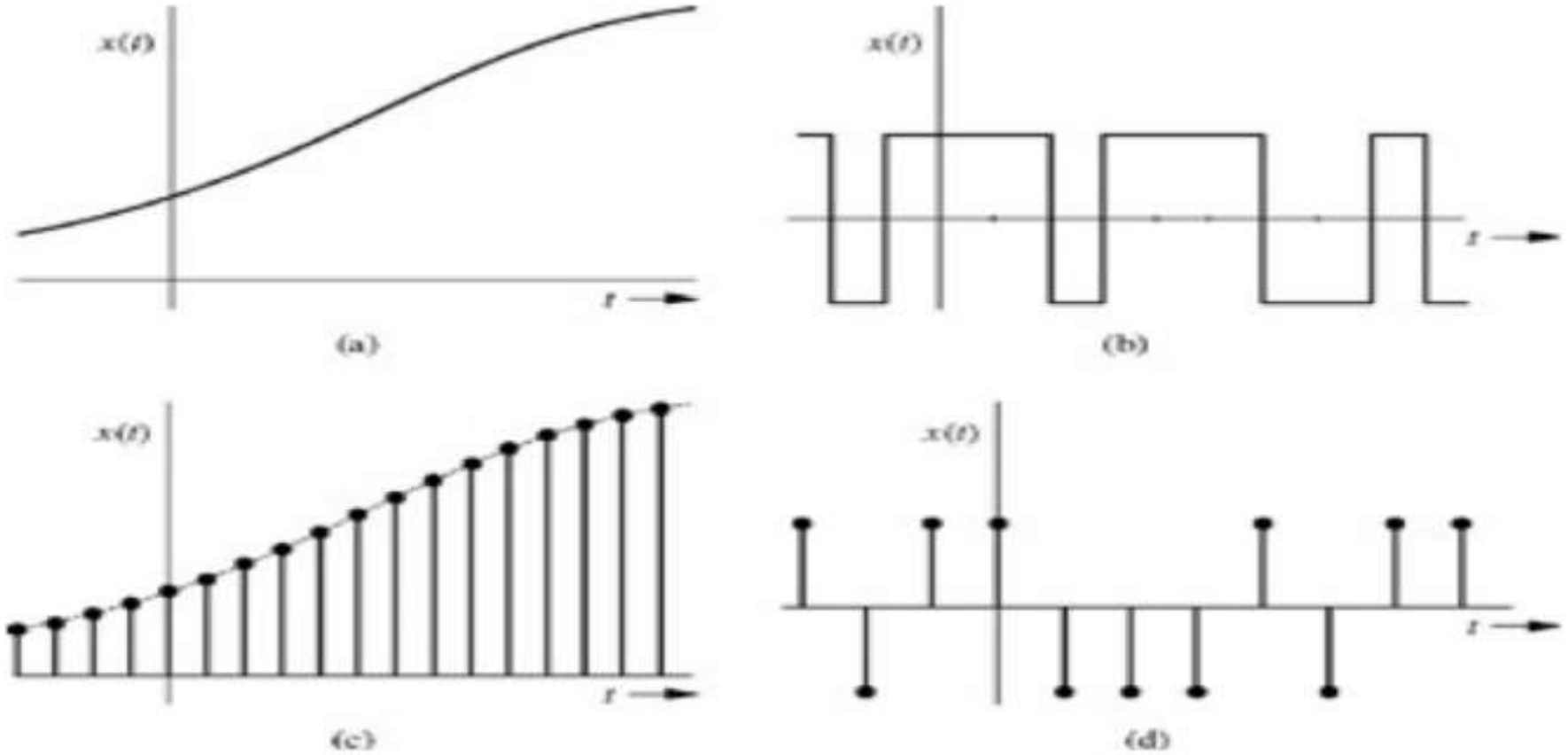


Fig: Graphical representation of:
(a) Analog, continuous time, **(b)** Digital, continuous time,
(c) Analog, discrete time, and **(d)** Digital, discrete time

Periodic and Non periodic Signals

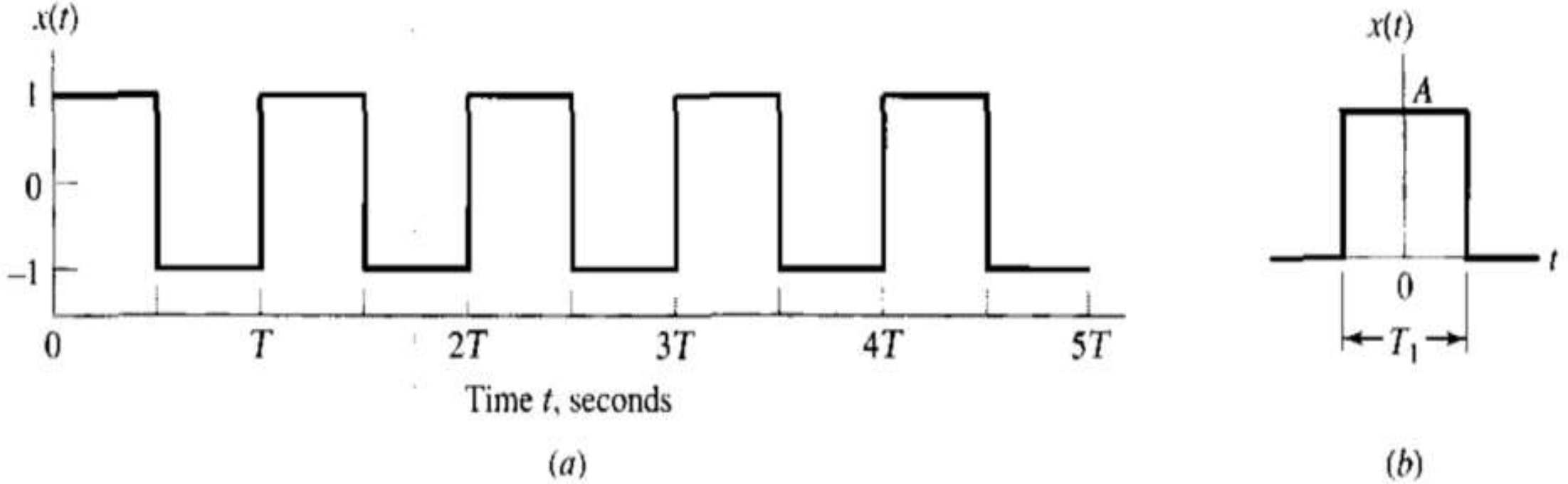


Fig: Graphical representation of:
(a) Periodic signal, square wave, **(b)** Non periodic, signal rectangular pulse

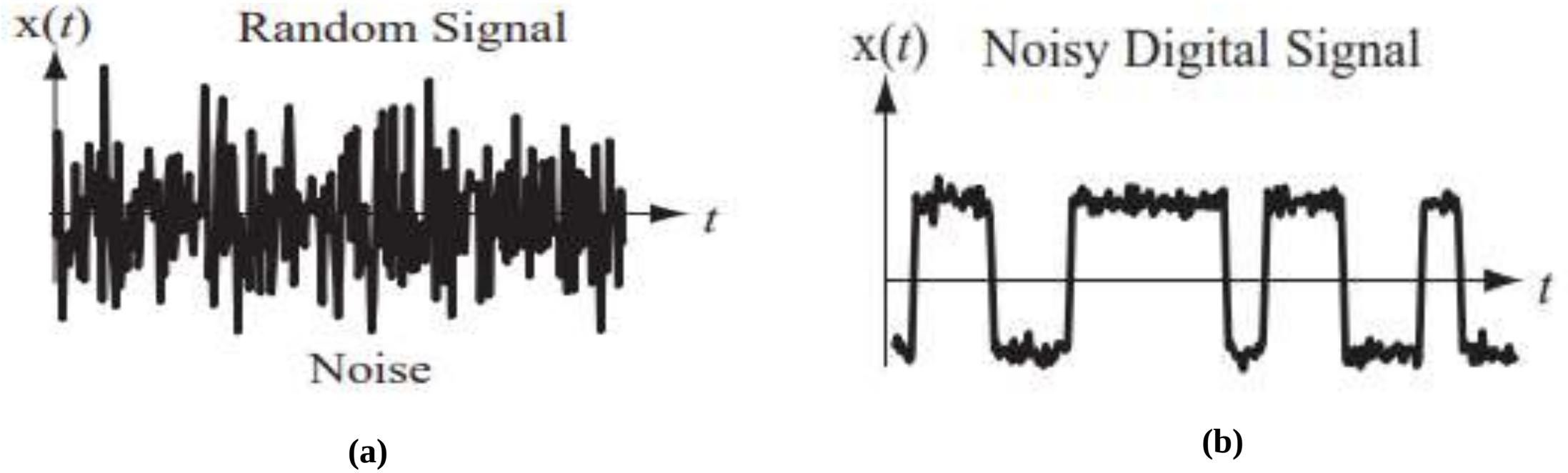
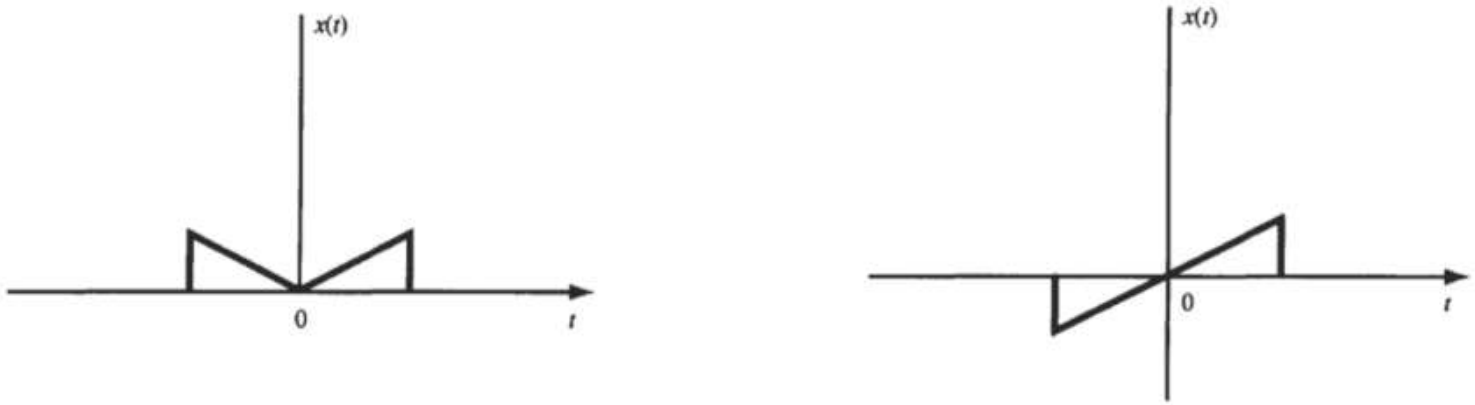


Fig: Graphical representation of:
(a) Random Signal, **(b)** Noisy Digital Signal



(a) **(b)**

Fig: Graphical representation of: **(a)** Even Signal **(b)** Odd Signal

Two symmetries of interest are as follows:

Definition: A real-valued signal is said to be even if, for all n,

$$x(n) = x(-n)$$

whereas a signal is said to be odd if, for all n

$$x(n) = -x(-n)$$