SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

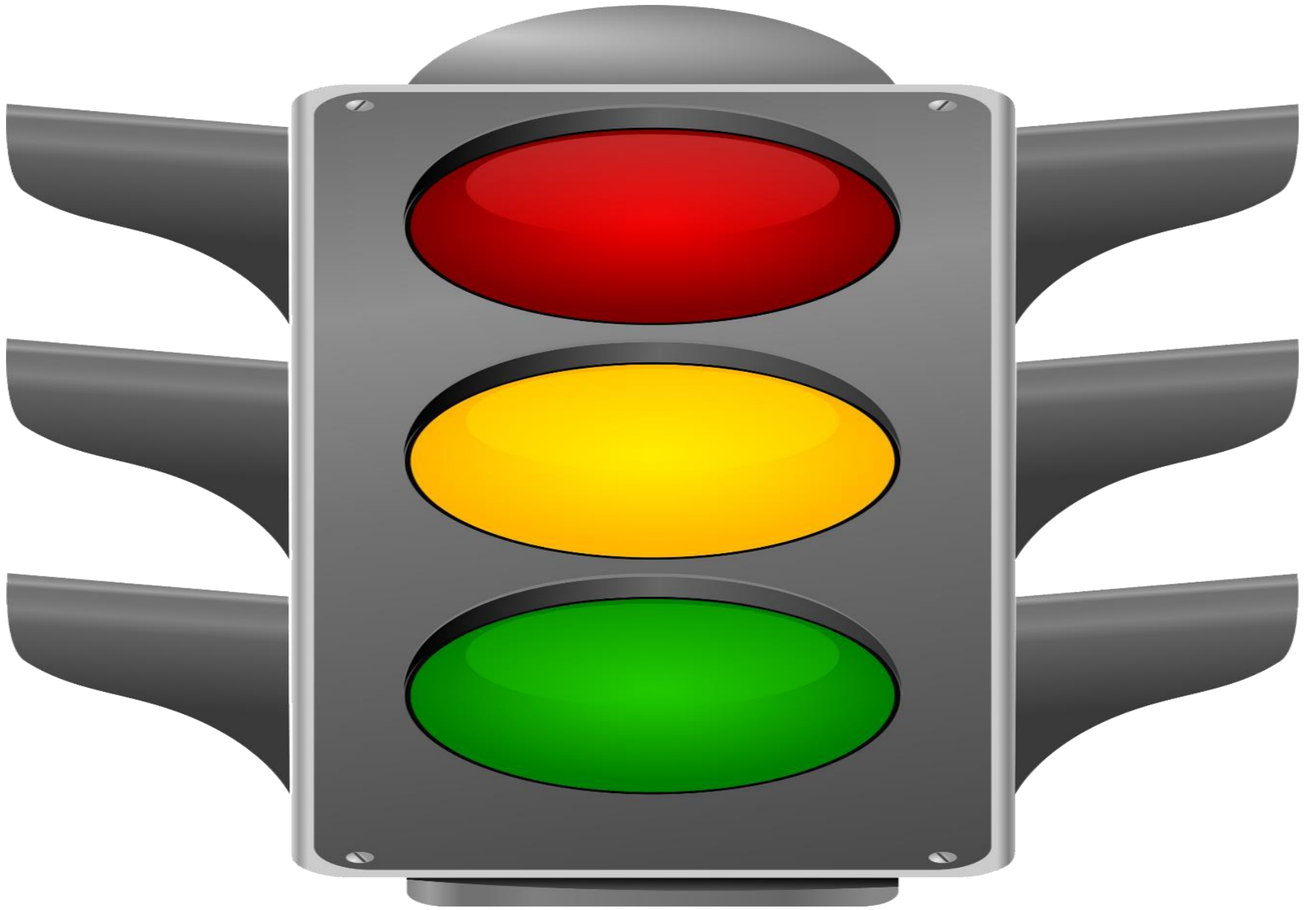
23ECT202 – SIGNALS AND SYSTEMS

II YEAR/ III SEMESTER

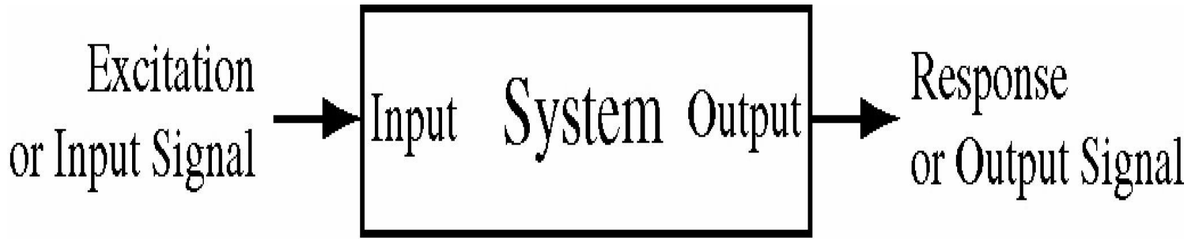
UNIT 1 – CLASSIFICATION OF SIGNALS AND SYSTEMS

TOPIC – SIGNALS AND ITS CLASSIFICATION

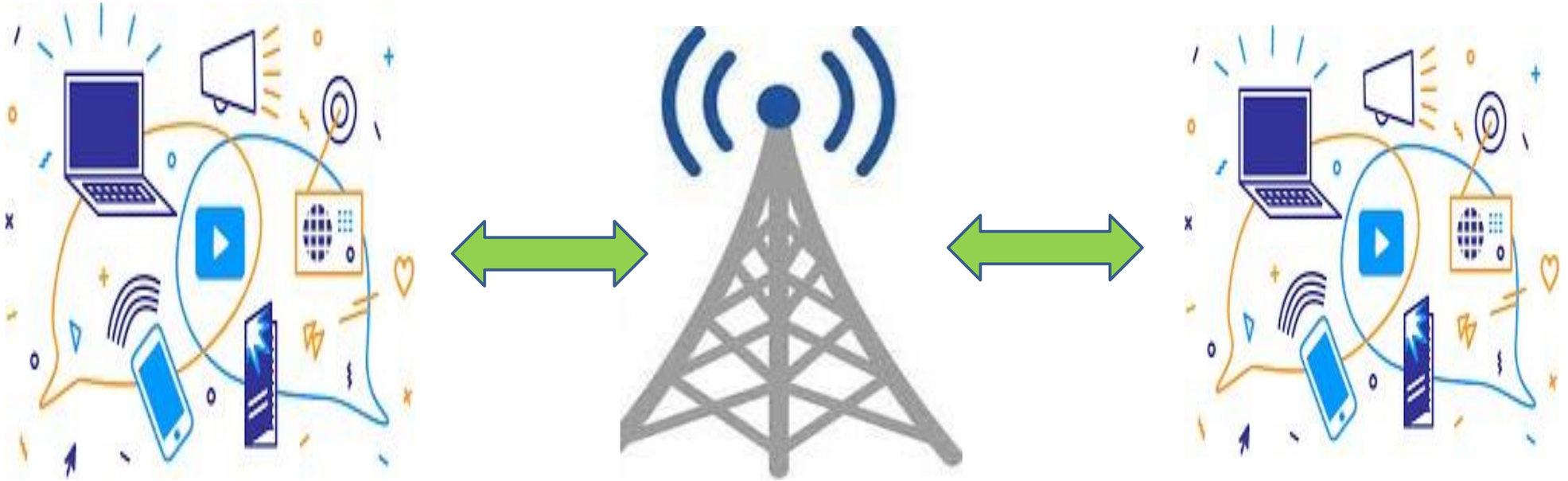
WHAT DO YOU INFER FROM THIS



- **Signal:** A function of one or more independent variables which contains some information
- Radio Signal & TV Signal are **Electrical Signals**
- Sound Signal & Pressure Signal are **Non Electrical Signals**
- **Noise Signal:** Doesn't contains any information
- **Excitation** signals are applied at system **inputs** and **response** signals are produced at system **outputs**

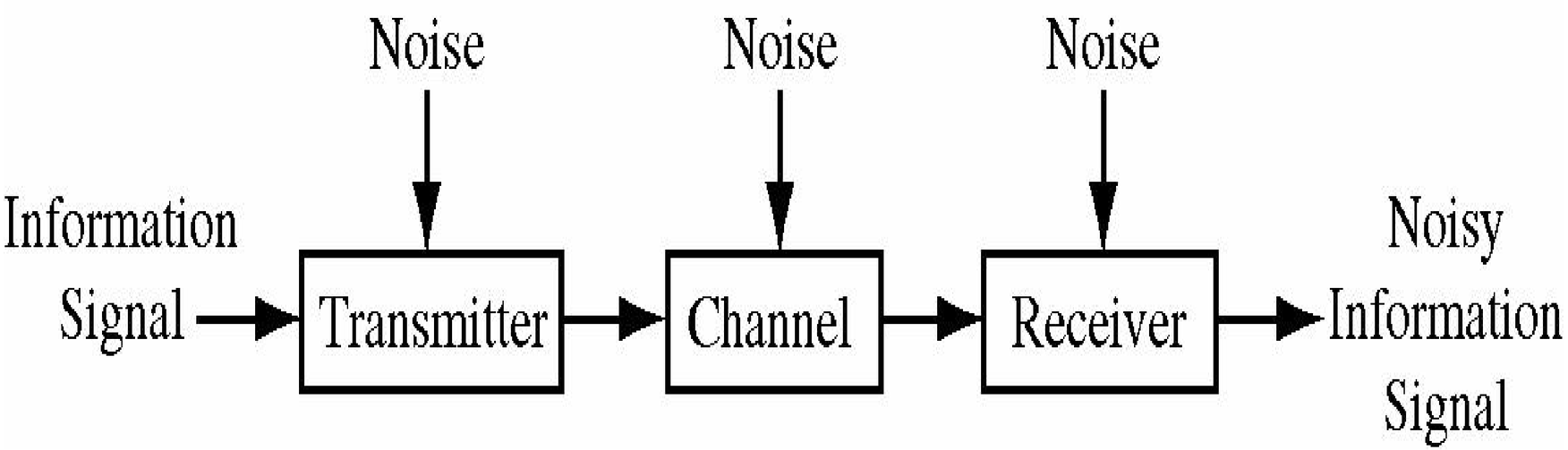


IS IT RELATED WITH COMMUNICATION



COMMUNICATION SYSTEM

- A communication system has an information signal plus noise signals
- It consists of an interconnection of smaller systems



CLASSIFICATION OF SIGNALS

- It can be classified into two types

➢ Continuous time signal

➢Discrete time signal

- It can be further classified into four types

➢ Periodic & Aperiodic Signal

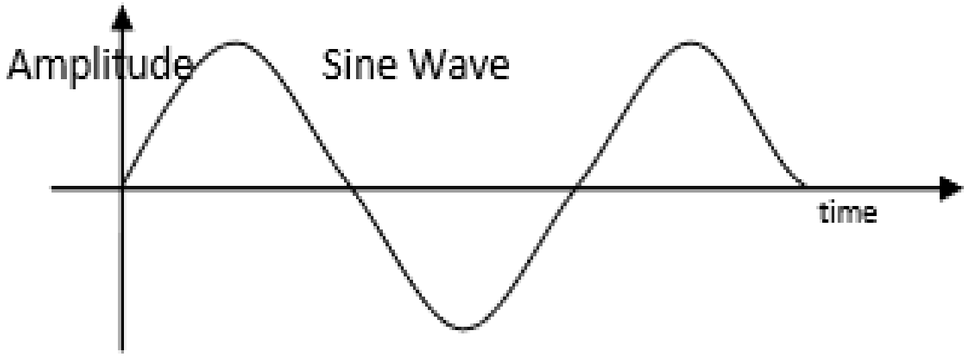
➢ Even and Odd Signal

➢ Energy and Power Signal

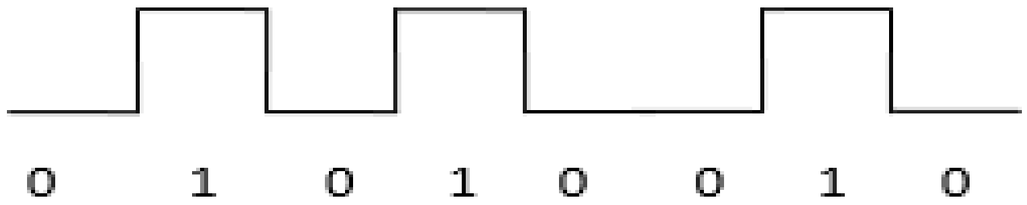
➢Deterministic and Random Signal

ANALOG AND DIGITAL SIGNAL

- **Analog Signal:** A signal that is defined for every instants of time is known as analog signal



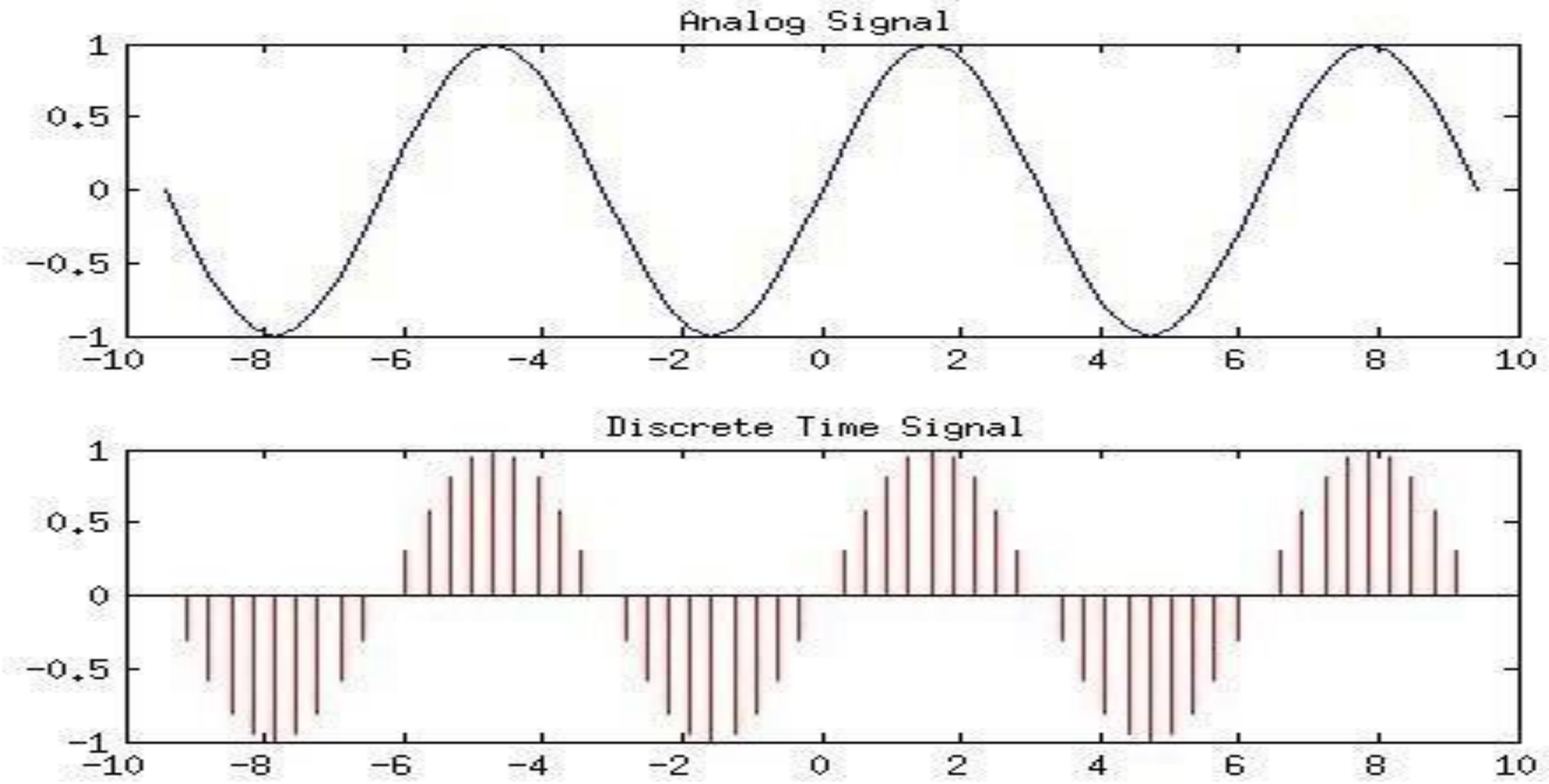
- **Digital Signal:** The signals that are discrete in time and quantized in amplitude is called digital signal



CONTINUOUS & DISCRETE TIME SIGNAL

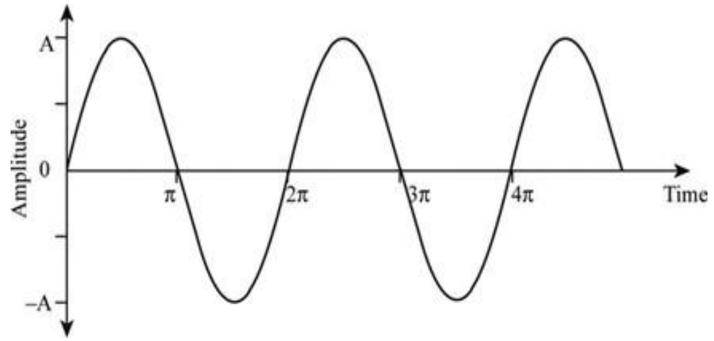
- **Continuous Time Signal:** A signal that is defined for every instants of time is known as continuous time signal
- Continuous time signals are continuous in amplitude and continuous in time. It is denoted by **x(t)**
- **Discrete Time Signal:** A signal that is defined for discrete instants of time is known as discrete time signal. Discrete time signals are continuous in amplitude and discrete in time.
- It is also obtained by sampling a continuous time signal. It is denoted by **x(n)**

CONTINUOUS & DISCRETE TIME SIGNAL

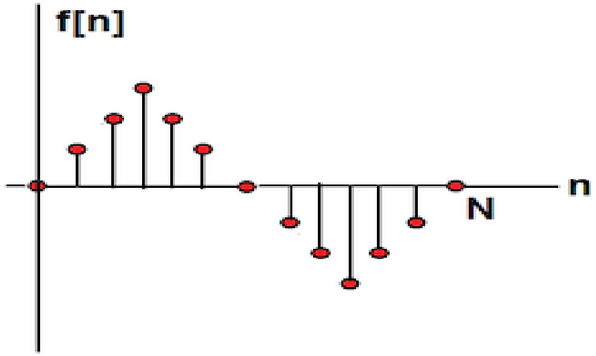


PERIODIC AND APERIODIC SIGNAL

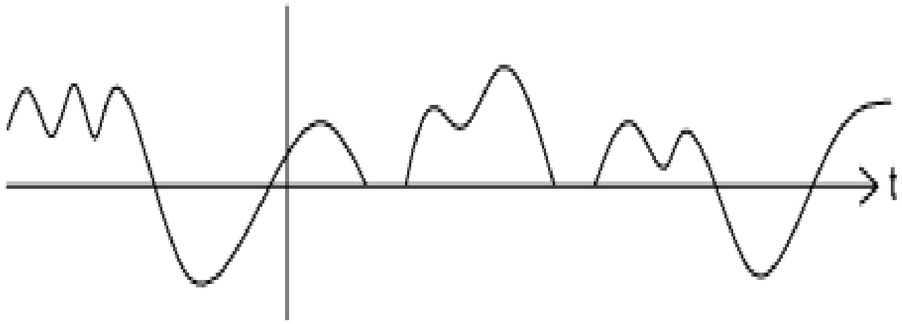
CT Periodic Signal
x(t) = x(t+T)



DT Periodic Signal
x(n) = x(n+N)



APeriodic Signal



EVEN AND ODD SIGNAL

- **Symmetric Signal:** A Signal is said to be an even signal if the inversion of time axis does not change the amplitude. **Eg. Cosine Wave: Cos (-θ) = Cos θ**

  Even signal satisfies the condition x(-t) = x(t)

$$\mathbf{X_e(t) = \{x(t) + x(-t)\}/2}$$

- **Anti Symmmetric Signal:** A signal is said to be an odd signal if the inversion of time axis also inverse the amplitude of the signal.

  Eg. Sine Wave: Sin (-θ)= - Sin θ

  Odd signal satisfies the condition x(-t) = - x(t)

$$\mathbf{X_o(t) = \{x(t) - x(-t)\}/2}$$

ENERGY AND POWER SIGNAL

- Energy Signal: The signal which has finite energy and zero average power. $0<E<\infty$

$$Energy\ E = \lim_{T\to\infty} \int_{-T}^{T} |x(t)|^2 dt \qquad Energy\ E = \lim_{N\to\infty} \sum_{n=-N}^{N} |x(n)|^2$$

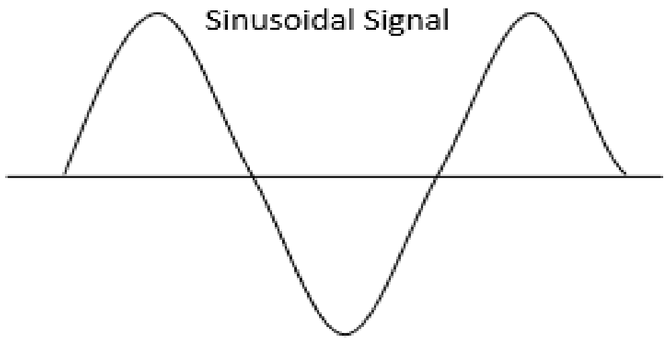
- Power Signal: The signal which has finite average power and infinite energy. $0<P<\infty$

$$P = \lim_{T\to\infty} \frac{1}{2T} \int_{-T}^{T} |x(t)|^2 dt \qquad P = \lim_{N\to\infty} \frac{1}{2N+1} \sum_{n=-N}^{N} |x(n)|^2$$

DETERMINISTIC AND RANDOM SIGNAL

- **Deterministic signal:** A signal which can be completely represented by any mathematical equation

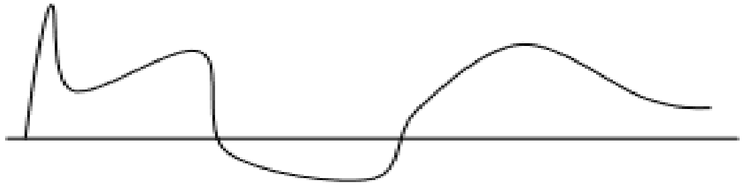
Eg: Sinusoidal Signal



Deterministic signal

- **Random signal:** A signal which cannot be completely represented by any mathematical equation

Eg: Noise Signal



Random signal

APPLICATION AREAS

- Communications
- Audio and Speech Processing
- Image, Video Processing
- Circuit Design
- Biomedical Engineering
- Military Applications

ASSESSMENT

1. A signal which contains ----------
2. The signals that are discrete in time and quantized in amplitude is called ----------
3. List the classification of signals.
4. What is meant by Periodic and Aperiodic Signal.
5. Even and Odd signals can be represented in ---------- and ---------- time.
6. Define energy and power Signal.
7. Give some applications of signals.

THANK YOU