



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

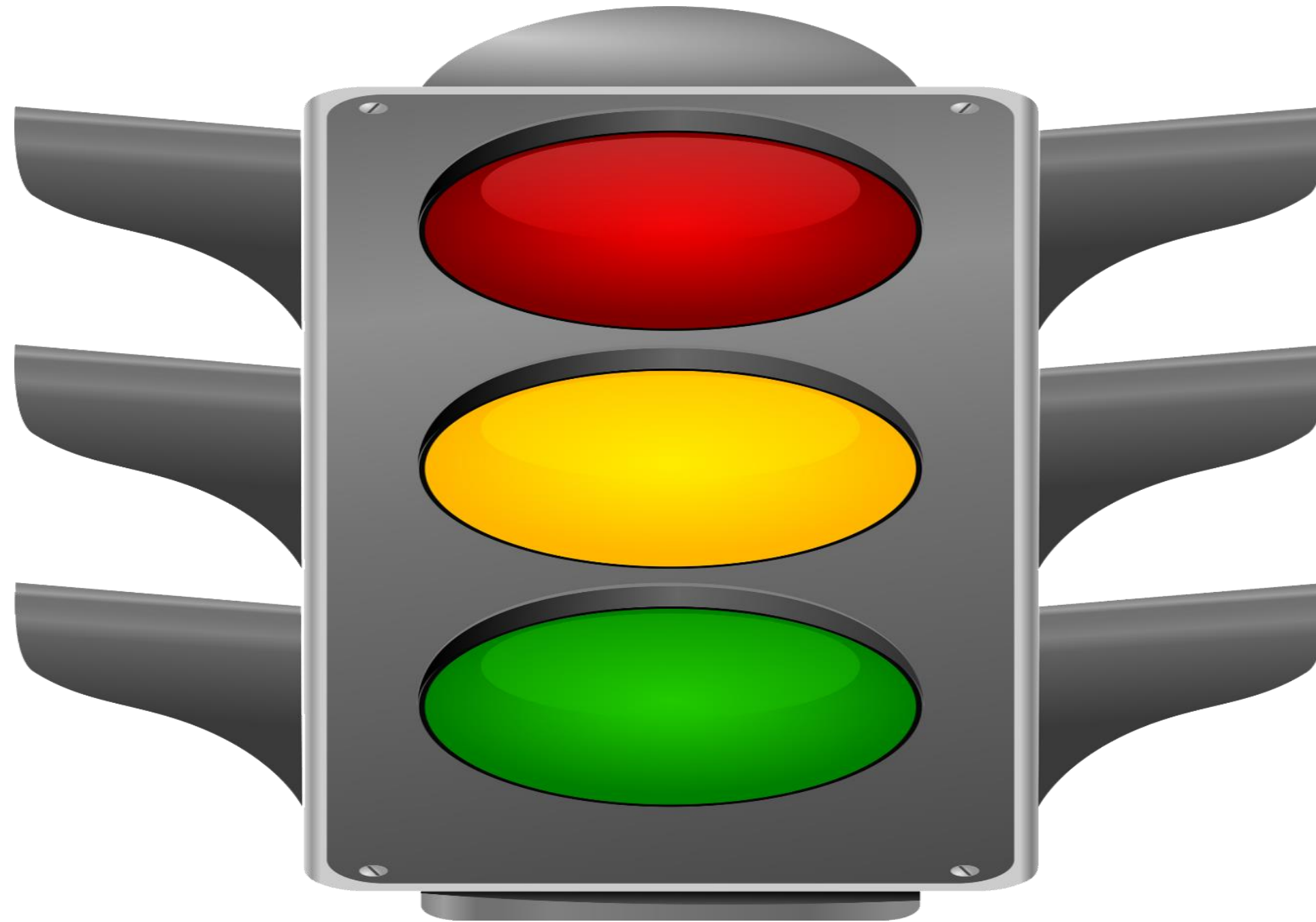
II YEAR/ III SEMESTER

UNIT 1 – CLASSIFICATION OF SIGNALS AND SYSTEMS

TOPIC – SIGNALS AND ITS CLASSIFICATION



WHAT DO YOU INFER FROM THIS

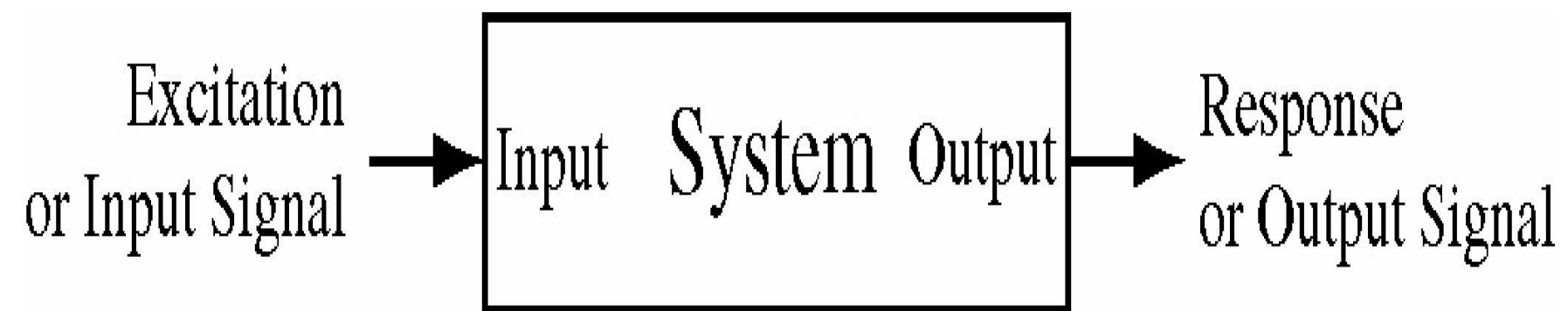




SIGNALS AND SYSTEMS

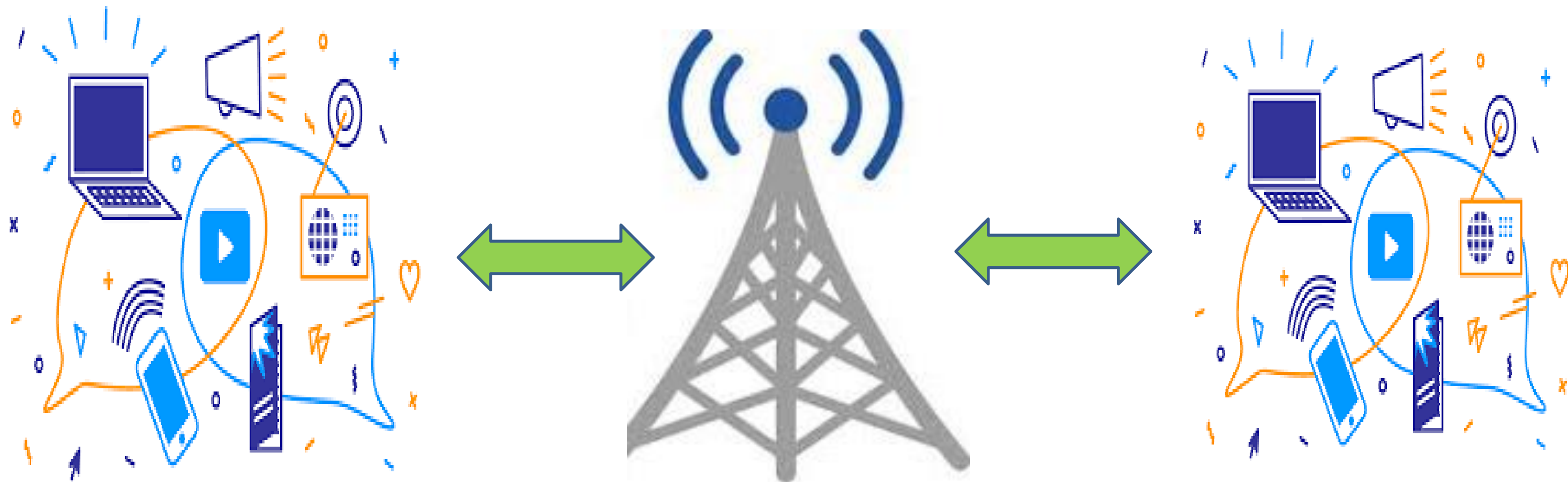


- **Signal:** A function of one or more independent variables which contains some information
- Radio Signal & TV Signal are **Electrical Signals**
- Sound Signal & Pressure Signal are **Non Electrical Signals**
- **Noise Signal:** Doesn't contains any information
- **Excitation** signals are applied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





IS IT RELATED WITH COMMUNICATION

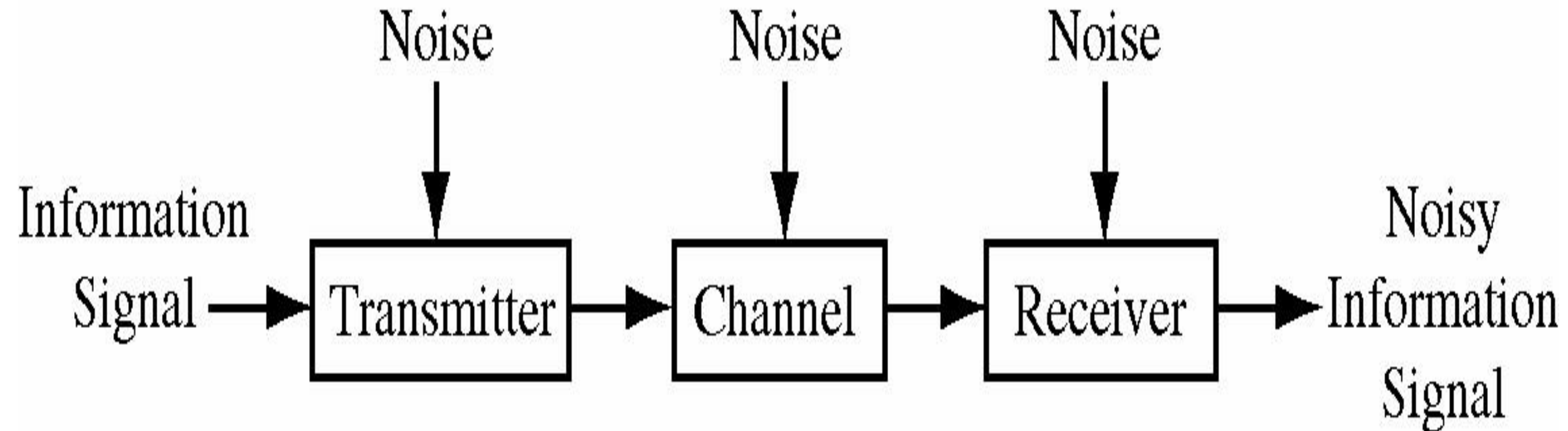




COMMUNICATION SYSTEM



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





CLASSIFICATION OF SIGNALS



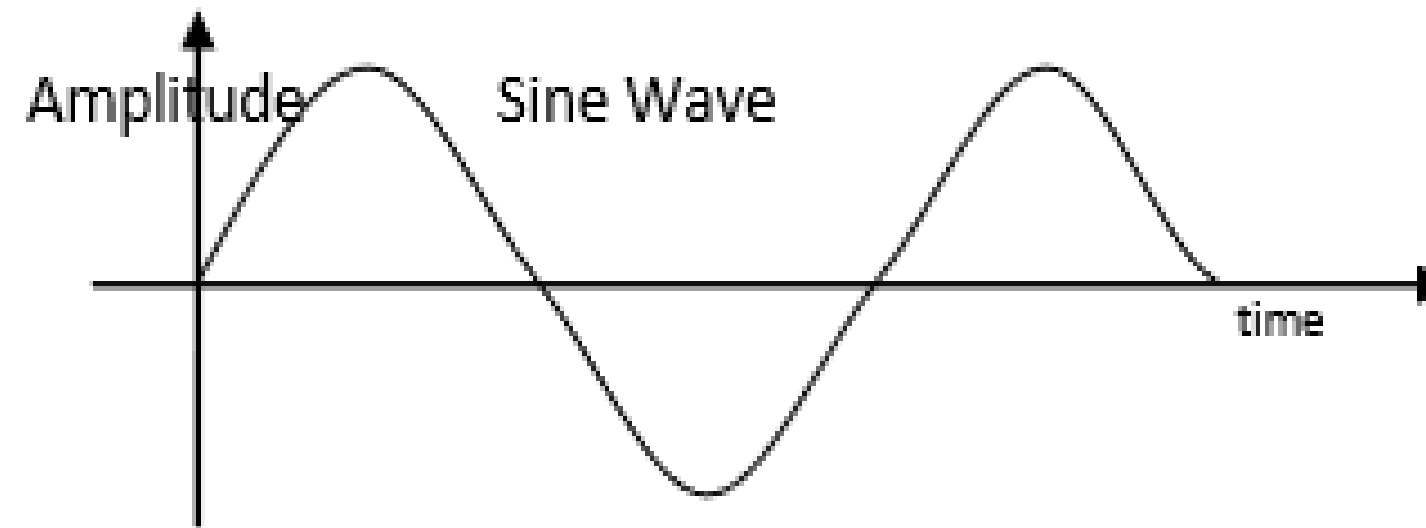
- It can be classified into two types
 - Continuous time signal
 - Discrete time signal
- It can be further classified into four types
 - Periodic & Aperiodic Signal
 - Even and Odd Signal
 - Energy and Power Signal
 - Deterministic and Random Signal



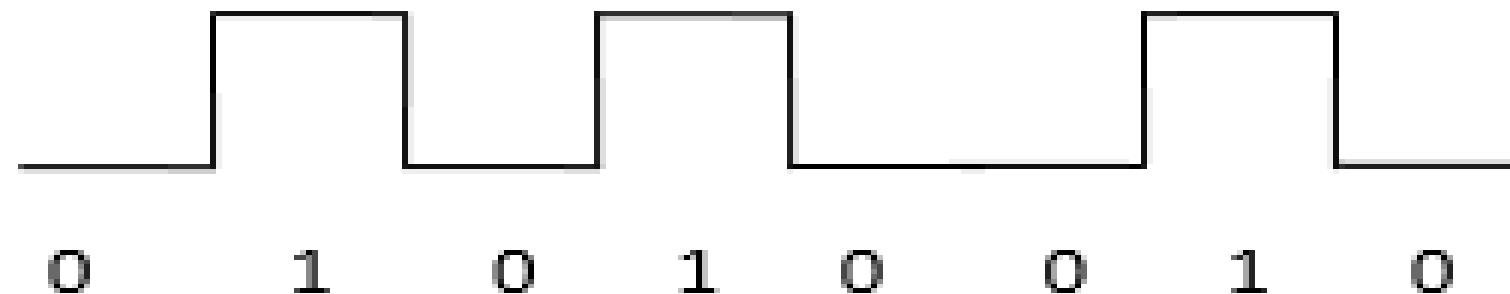
ANALOG AND DIGITAL SIGNAL



- **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





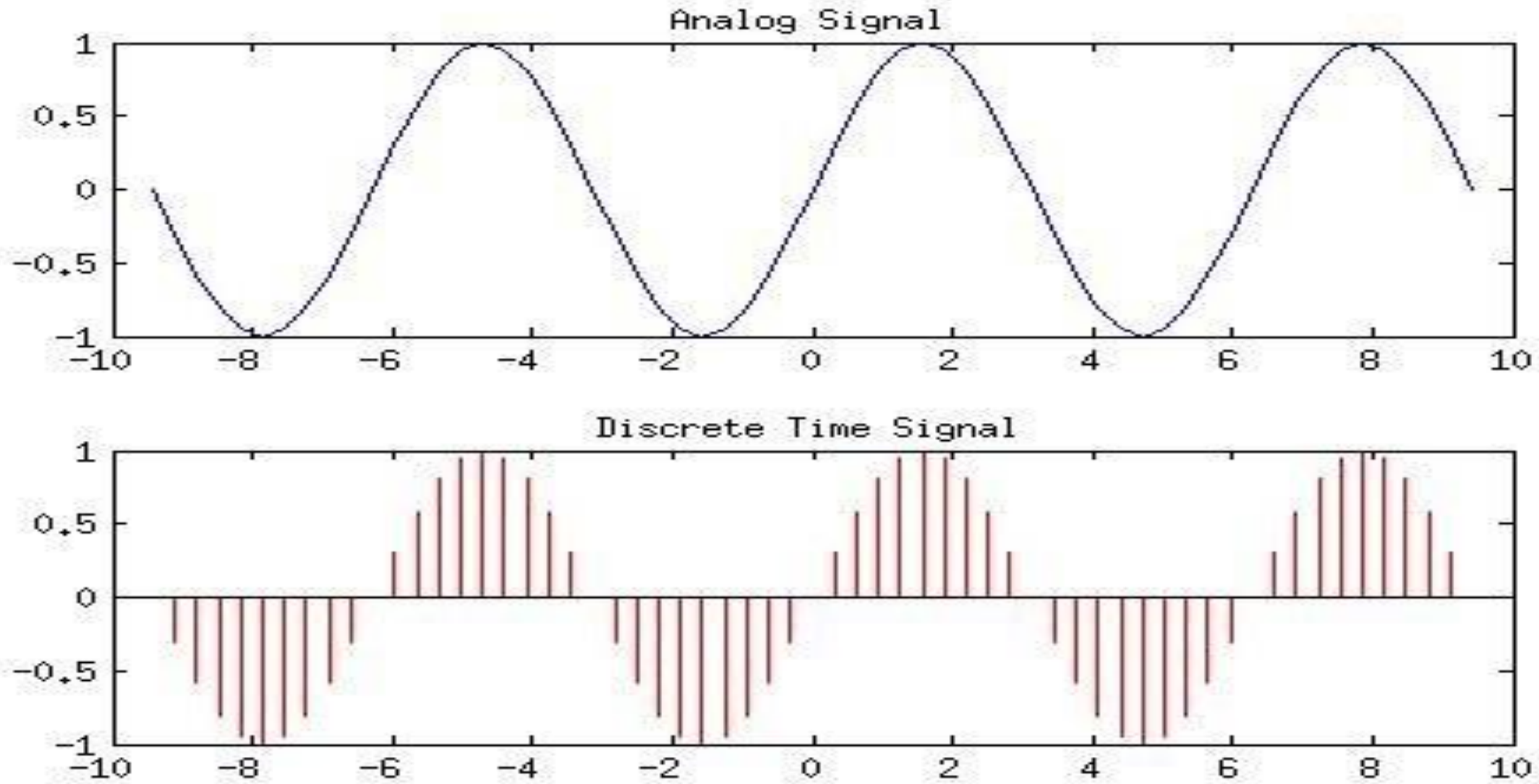
CONTINUOUS & DISCRETE TIME SIGNAL



- **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 $\mathbf{x(t)}$
- **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 $\mathbf{x(n)}$



CONTINUOUS & DISCRETE TIME SIGNAL



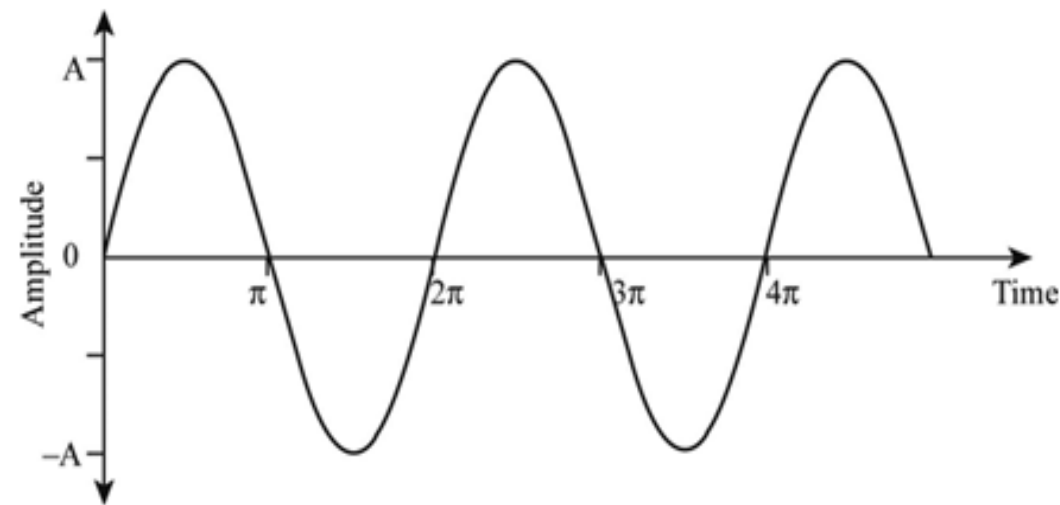


PERIODIC AND APERIODIC SIGNAL



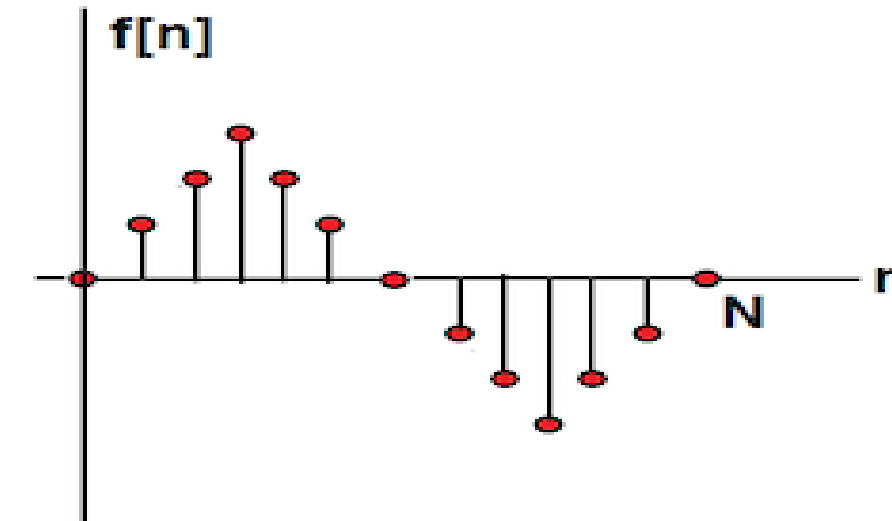
CT Periodic Signal

$$x(t) = x(t+T)$$

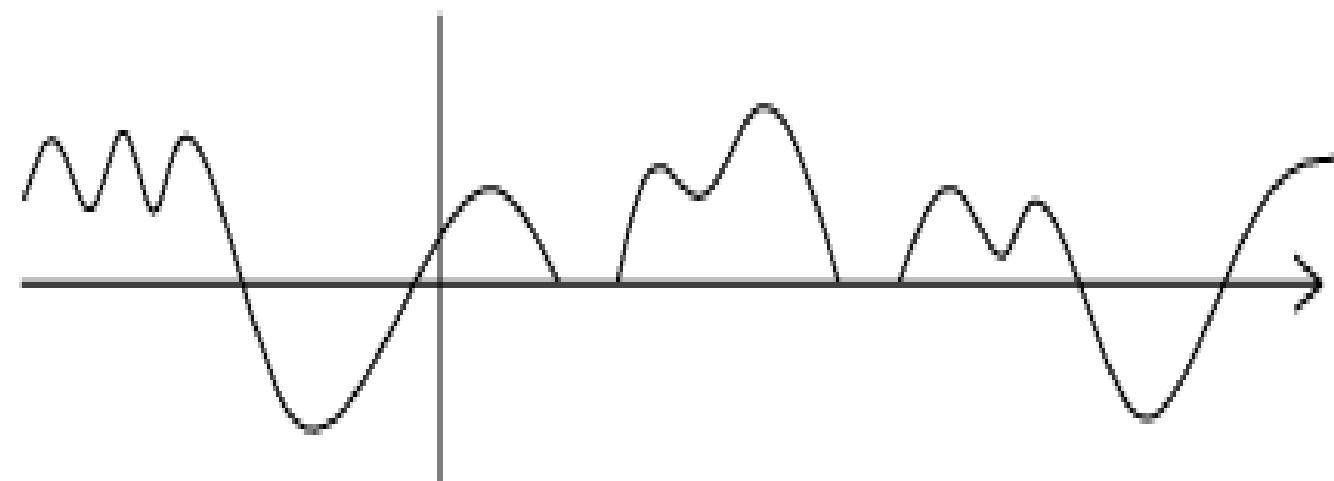


DT Periodic Signal

$$x(n) = x(n+N)$$



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: $\text{Cos}(-\theta) = \text{Cos } \theta$**

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

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

- **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: $\text{Sin}(-\theta) = -\text{Sin } \theta$

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

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



ENERGY AND POWER SIGNAL



- **Energy Signal:** The signal which has finite energy and zero average power.

$$0 < E < \infty$$

$$\text{Energy } E = \lim_{T \rightarrow \infty} \int_{-T}^T |x(t)|^2 dt$$

$$\text{Energy } E = \lim_{N \rightarrow \infty} \sum_{n=-N}^N |x(n)|^2$$

- **Power Signal:** The signal which has finite average power and infinite energy.

$$0 < P < \infty$$

$$P = \lim_{T \rightarrow \infty} \frac{1}{2T} \int_{-T}^T |x(t)|^2 dt$$

$$P = \lim_{N \rightarrow \infty} \frac{1}{2N + 1} \sum_{n=-N}^N |x(n)|^2$$

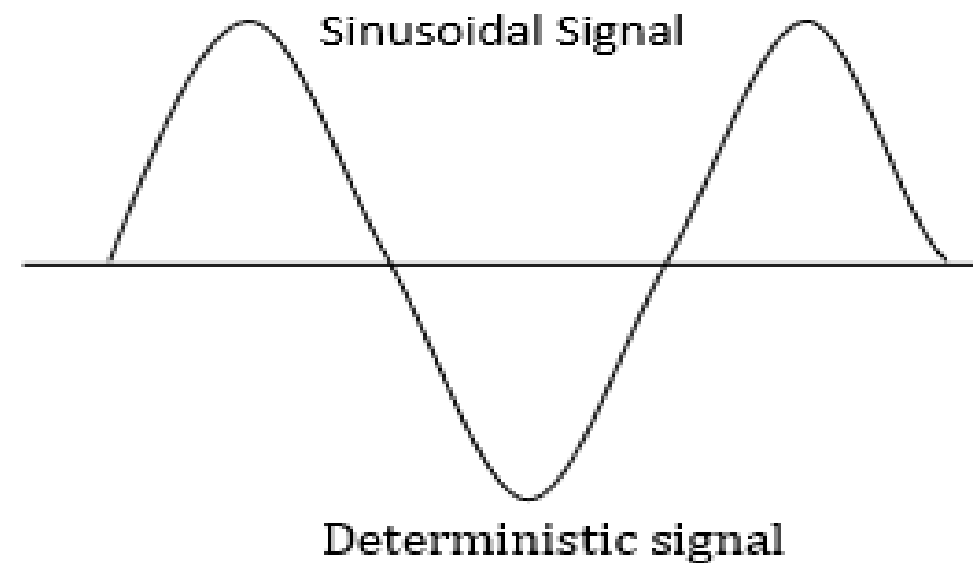


DETERMINISTIC AND RANDOM SIGNAL



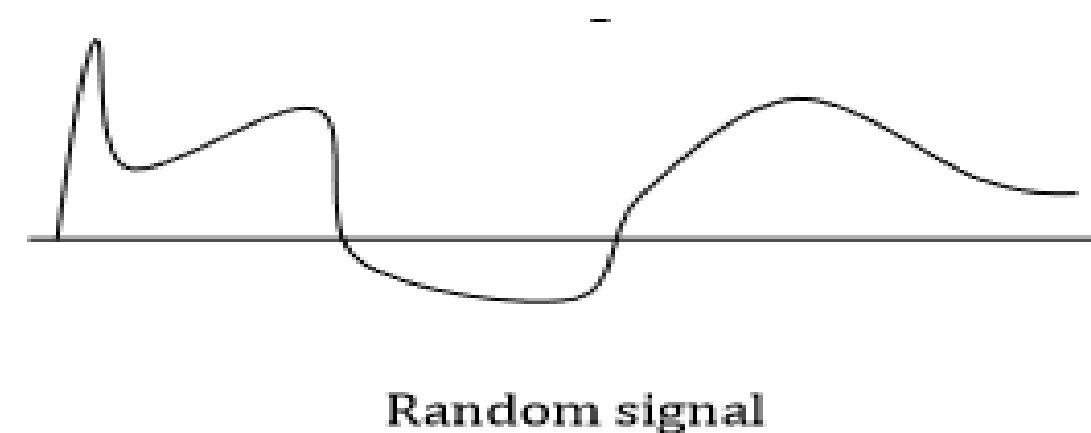
- **Deterministic signal:** A signal which can be completely represented by any mathematical equation

Eg: Sinusoidal Signal



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

Eg: Noise 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