# UNIT-1

# (Lecture-4)

## Energy & Power Signals

# Classification of Signals

- Deterministic & Non Deterministic Signals
- Periodic & A periodic Signals
- Even & Odd Signals
- **Energy & Power Signals**

# Energy and Power Signals

## Energy Signal

- A signal with finite energy and zero power is called Energy Signal i.e.for energy signal

$$0<E<\infty \text{ and } P=0$$

- Signal energy of a signal is defined as the *area under the square of the magnitude of the signal*.

$$E_x = \int_{-\infty}^{\infty} |x(t)|^2 \, dt$$

- The units of signal energy depends on the unit of the signal.

# Energy and Power Signals Contd.

## Power Signal

- Some signals have infinite signal energy. In that caseit is more convenient to deal with **average signal power.**
- For power signals

$$0<P<\infty \text{ and } E = \infty$$

- Average power of the signal is given by

$$P_x = \lim_{T\to\infty} \frac{1}{T} \int_{-T/2}^{T/2} \left|x(t)\right|^2 dt$$

# Energy and Power Signals Contd.

- For a periodic signal x($t$) the average signal power is

$$P_x = \frac{1}{T}\int_T \left|x(t)\right|^2 dt$$

- $T$ is any period of the signal.
- Periodic signals are generally power signals.

# Signal Energy and Power for DT Signal

- **A discrtet time signal with finite energy and zero power is called Energy Signal i.e. for energy signal**

$$0<E<\infty \text{ and } P=0$$

- **The signal energy of a for a discrete time signal x[*n*] is**

$$E_x = \sum_{n=-\infty}^{\infty} \left|x[n]\right|^2$$

# Signal Energy and Power for DT Signal Contd.

**The average signal power of a discrete time power signal x[*n*] is**

$$P_x = \lim_{N\to\infty} \frac{1}{2N} \sum_{n=-N}^{N-1} \left|x[n]\right|^2$$

**For a periodic signal x[*n*] the average signal power is**

$$P_x = \frac{1}{N} \sum_{n=\langle N\rangle} \left|x[n]\right|^2$$

$\left(\text{The notation } \sum_{n=\langle N\rangle} \text{ means the sum over any set of consecutive } n\text{'s exactly } N \text{ in length.}\right)$