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

$$P_{\mathrm{x}} = \frac{1}{T}\int_{T} \left|\mathrm{x}(t)\right|^{2} dt$$

- *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

$0<E<\infty$ 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

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

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