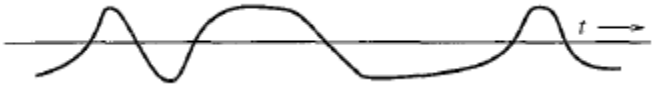
Chapter – 1 :- Communication system and signal.

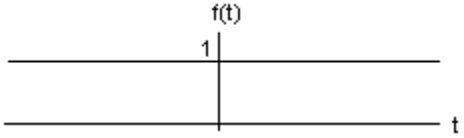
1.1 Signals and spectra

Signal is defined as the function that depends on one or more variable. In communication system signal of interest ate those which contain some information. These signals are generally voltage or current signal.



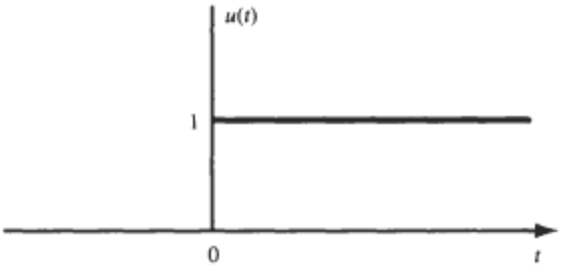
- ***Basic continuous time signal***

1. DC signal: - Signal which is constant with respect to time.



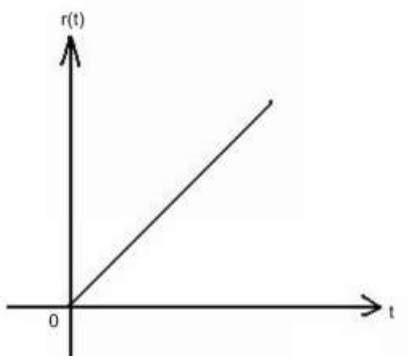
2. Unit step signal

$$u(t) = \begin{cases} 1, t \geq 0 \\ 0. t < 0 \end{cases}$$



3. Unit ramp signal

$$r(t) = \begin{cases} t, t \geq 0 \\ 0. t < 0 \end{cases}$$

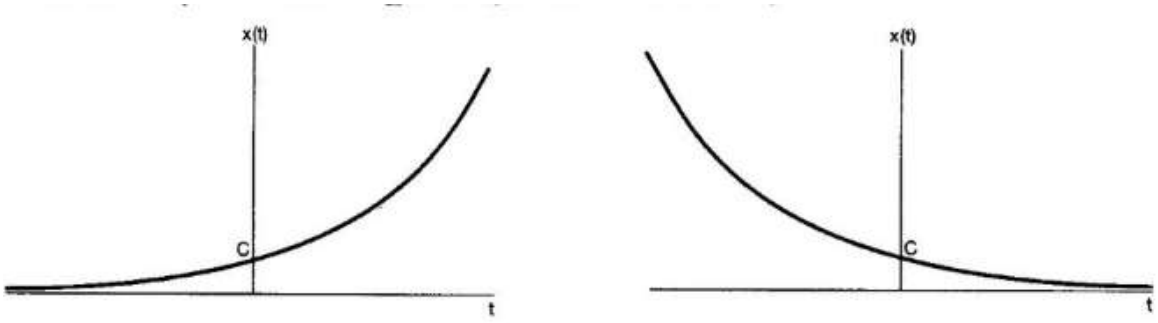


4. Exponential signal

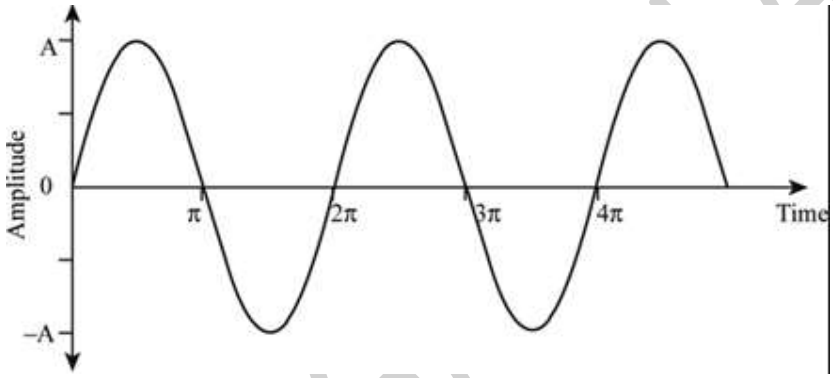
   $x(t) = e^{at}$

   Case1: if a > 0 x(t) grow exponentially

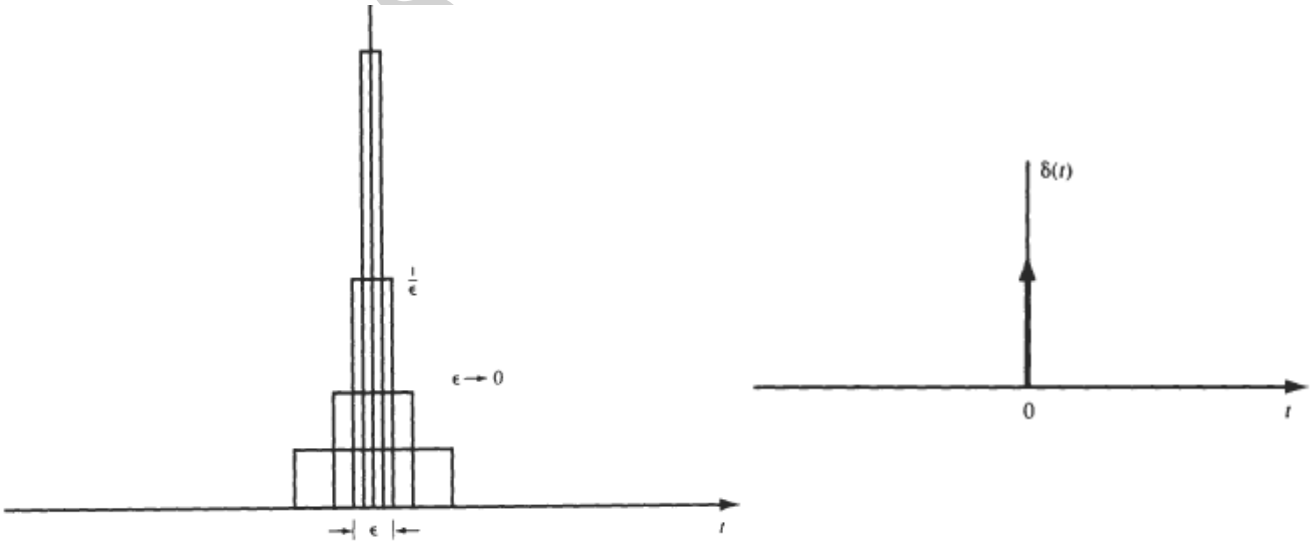
Case1: if a < 0 x(t) decay exponentially



5. Sinusoidal signal
   $x(t) = A\cos(\omega t + \phi)$
   where A = amplitude. ω = angular frequency, ϕ = phase

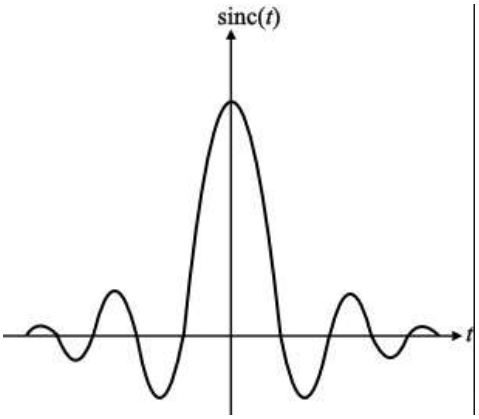


6. Impulse signal(δ(t)) :- δ(t) is a signal which is ∞ at t = 0 and 0 elsewhere, but with unit area under it.

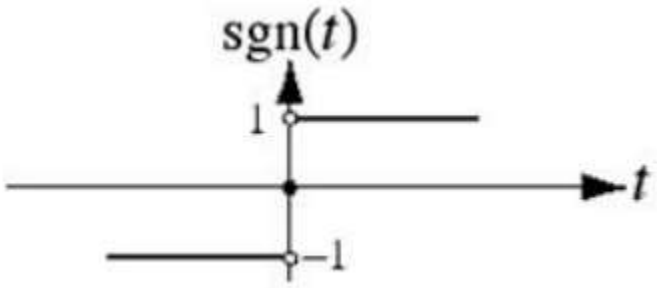


7. Sinc function :-

$$Sinc(\lambda) = \frac{Sin(\pi\lambda)}{\pi\lambda}$$



8. Signum function



$$x(t) = \begin{cases} 1, t > 0 \\ -1, t < 0 \\ 0, t = 0 \end{cases}$$

- ***Fourier transform of signals***

  Fourier transform of the signals gives the frequency component of the signal.

  Fourier transform of the signal x(t) is given by

$$X(\omega) = \int_{-\infty}^{\infty} x(t)\, e^{-j\omega t} dt$$

  Inverse Fourier transform is given by

$$x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(\omega)\, e^{j\omega t} d\omega$$