

Signal & System

(1)

2.1) Differentiate b/w systems with & without memory using examples.

A system is said to be memoryless if its output for each value of the independent variable at a given time is dependent only on the input at that same time.

e.g. :- $y(n) = (2x(n) - x^2(n))$

it is also called static system.

System with a memory :-

A system is said to have memory if the output from the system is dependent on past inputs (or future) inputs to the system.

e.g. :- a system with memory a

Delay :-

$$y(n) = x[n-1]$$

$y[0] = x[-1]$ [output depends on previous value of input memory is required.]

(2)

A system with a memory is called a dynamic system.

As Accumulator or summer also example of system with memory.

$$y[n] = \sum_{k=-\infty}^n x[k]$$

As accumulator must "remember" or store information about past inputs.

The accumulator computes the running sum of all inputs upto the current time and thus at each instant of time the accumulator must add the current input value.

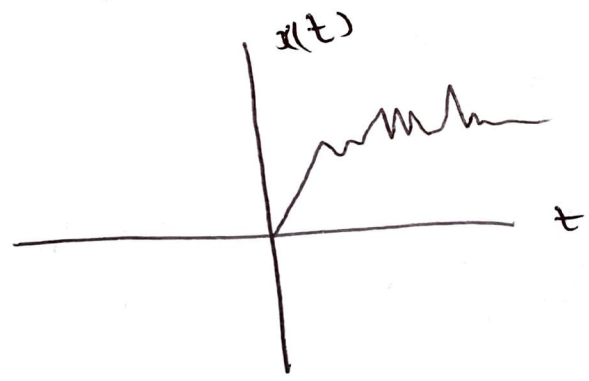
b) Identify the basic difference b/w a deterministic and random signal.

A signal is deterministic if it is completely and (can be $x(t)$) mathematically described.

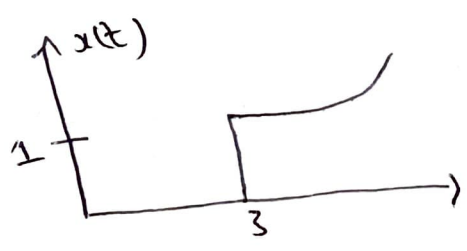


Random signal can be describe only by terms of probabilistic ~~the~~ description e.g. distribution, mean value, std dev

A non deterministic signal or random signal is one where there is uncertainty at any particular time.



Q2) a) sketch the transformed version for signal $x(t)$ marked in i and ii.



i) $x(t+4)$ and $x(2t)$

(4)

ii) $x(t/5)$ and $x(t-3)$

i) $x(t+4)$

At $t=3$

$x(t)=1$

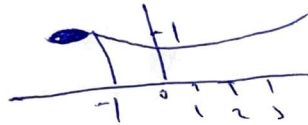
$t+4=3$

$x(t+4)=1$

$t=3-4$

$t=-1$

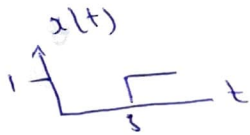
whole function will be shifted to left



$x(2t)$

At $t=3$

$x(t)=1$



$2t=3$

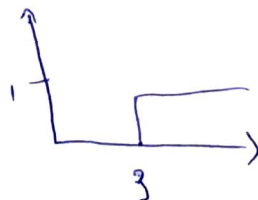
$x(2t)=1$

$t=3/2$

$t=1.5$



ii) $x(t/5)$

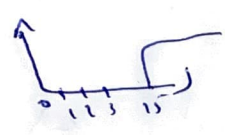


At $t=3$

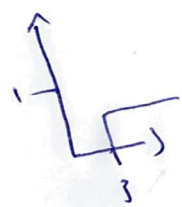
$$t/s = 3$$

$$x(t) = 1$$

$t=15$



$x(t-3)$



At $t=3$

$$x(t) = 1$$

$t-3=3$

$$x(t-3) = 1$$

$t=6$



(b)

b) outline the time system as

non-invertible, linear or non linear causal or non-causal. Give the reason for your answer too.

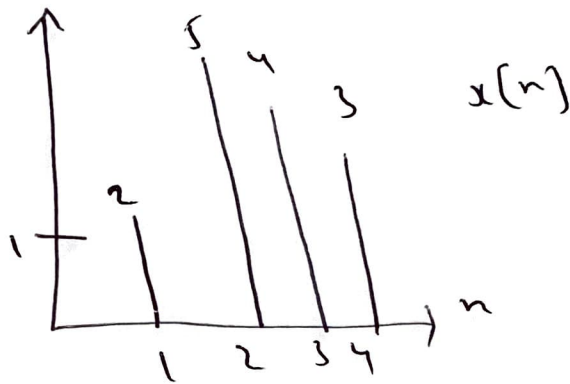
i) $y[n] = x^2[n]$ Non linear

A non linear signal is generally defined as the signal generated by the system that does not obey superposition and scaling properties.

ii) $y[n] = x[n+2]$ Non causal

non causal signal is for $t > 0$, it means that the response of the system need to start before excitation for example if you add an impulse to the input at a certain time T a normal (causal) system will start responding from $T, T+1, T+2, \dots$. it also depends upon future inputs.

Q3: Let $x(n]$ be a signal with $\textcircled{7}$
 $x(n) = 0$ for $n < 1$ and $n > 4$ for the
 signal given below determine value of
 "n" for which the signal is
 guaranteed to be zero.



i) $x[n+5]$

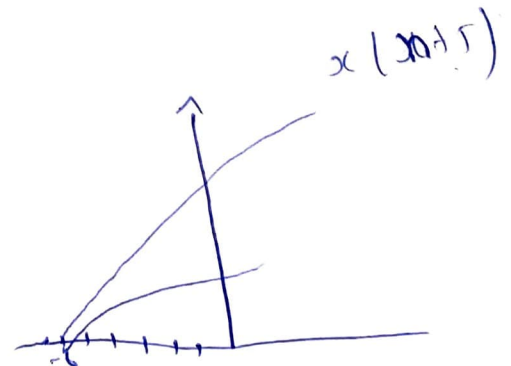
this signal can be shown as

at $n=1$, $x(n)=2$

at $n+5=1$ $x(n+5)=2$

$n = -5 - 1$

$n = -6$



similarly

At $n=1$, $h[n]=3$

At $n+5=4$, $h[n+5]=3$

At $n+5=4$

the signal is generated

Q4:- State the correct answer:-

(9)

if a time shift in the input signal does not result in an identical time shift in the output signal, the system is said to be time variant.
