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SUBJECT # SIGNAL AND  
SYSTEM

DEPARTMENT # BEE

SEMESTER # 8<sup>TH</sup>

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Question NO 1Part AAnswer

Ans System With AND With out Memory:-

Memoryless System :-

"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."

Examples of Memoryless Systems:-

$$1) y[n] = (2x[n] - x^2[n])^2$$

⇒ The above system is a memoryless system as the value of  $y[n]$  at any particular time no depends only and the value of  $x[n]$  at that time.

2) A Resistor Is A Memoryless System:-

⇒ So,  $x(t)$  = Input taken as the Current.

$y(t)$  = Voltage taken as output.  
Then Input-output relationship of a resistor is

$$y(t) = R x(t)$$

where,

$R$  is the resistance.

### 3) Identity System:-

An identity system is a simple memoryless system. Its output is identical to its input. The input-output relationship for an identity system is given by

⇒ For Continuous-time Identity System:

$$y(t) = x(t)$$

⇒ For Discrete-time Identity System:

$$y[n] = x[n]$$

### 2) SYSTEM WITH MEMORY:-

"Memory in a system corresponds to the presence of a mechanism in the system that retains or stores

information about input values at times other than the current time.

## ⇒ SYSTEM WITH MEMORY EXAMPLES:-

### 1) ACCUMULATOR OR SUMMER:-

⇒ Accumulator or summer is discrete time system with memory

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

An 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.

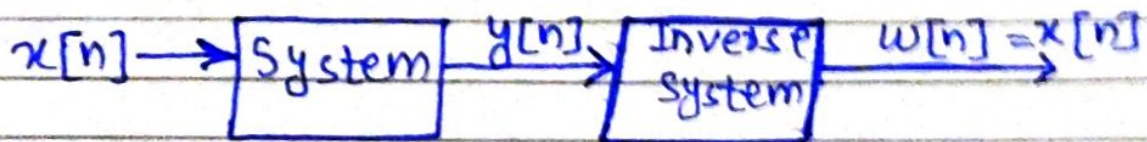
### 2) Invertibility AND Inverse System:-

"A system is said to be invertible if distinct inputs lead to distinct outputs".

Explanation:-

For a discrete-time

Case, if a system is invertible, then inverse system exists that, when cascaded with the original system, yields an output  $w[n]$  equal to the input  $x[n]$  to the first system.



The above series interconnection has an overall input-output relationship which is the same as that for the identity system.



Question No 1PART B

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

1) Deterministic Signal:-

A signal is deterministic if it is completely known and can be described mathematically.

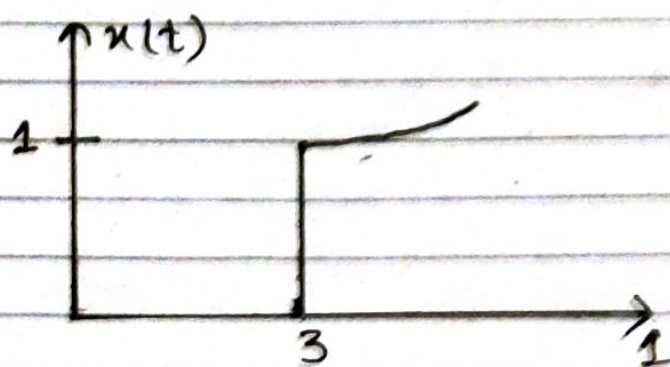
2) Random Signal:-

Random signal can be described only by terms of probabilistic description, e.g. distribution, mean value, standard deviation.

## Question NO 2

## Part A

- A) Sketch the transformed versions for the signal  $x(t)$  mentioned in i and ii.

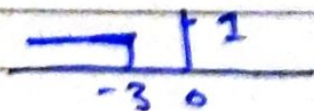


i)  $x(t+4)$  and  $x(2t)$

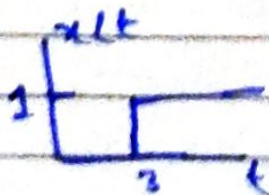
ii)  $x(t/5)$  and  $x(t-3)$

$$x(t+4)$$

$$\begin{aligned} \text{At } t=3, \quad x(t) &= 1 \\ t+4 &= 3 & x(t+4) &= 1 \\ t &= 3-4 \\ t &= -1 \end{aligned}$$



$$x(2t)$$



$$\text{At } t = 3$$

$$2t = 3$$

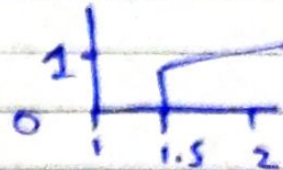
$$t = \frac{3}{2}$$

$$2$$

$$t = 1.5$$

$$x(t) = 1$$

$$x(2t) = 1$$





Question NO 2Part B

b) Outline the given system as invertible, linear or non-linear, causal or non-causal, Give the reason for your answer too.

i)  $Y[n] = x^2[n]$

ii)  $Y[n] = x[n+2]$

1)  $Y[n] = x^2[n]$

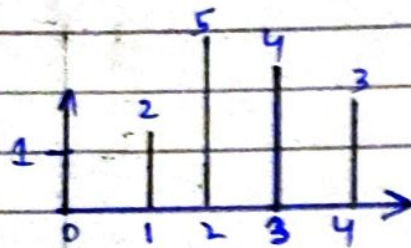
The system is non-invertible because we cannot determine the sign of the input from knowledge of output.

ii)  $Y[n] = x[n+2]$

The system is non-causal because its output involves future of the input so it's non-causal.

Question No 3AnswerSOLUTION :-

$$x(n) = 0 \text{ for } n < 1, n > 4$$



$$x(n+5)$$

$$\text{At } n=1, \quad x(n)=2$$

$$n+5=1$$

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

$$n=1-5$$

$$n=-4$$

$$\text{At } n=2, \quad x(n)=5$$

$$n+5=2$$

$$x(n+5)=5$$

$$n=2-5$$

$$n=-3$$

$$\text{At } n=3, \quad x(n)=4$$

$$n+5=3$$

$$x(n+5)=4$$

$$n=3-5$$

$$n=-2$$

At

$$n = 4$$

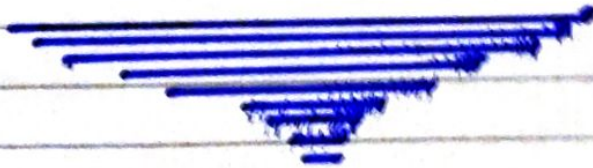
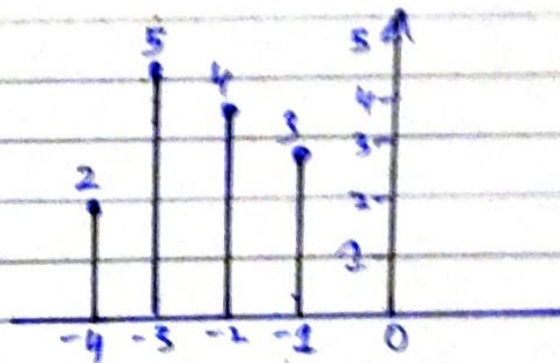
$$x(n) = 3$$

$$n + 5 = 4$$

$$x(n + 5) = 3$$

$$n = 4 - 5$$

$$n = -1$$



Question No 4Answer

Q4 State the correct Answer.

Ans 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 Even.

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