Department of Electrical Engineering

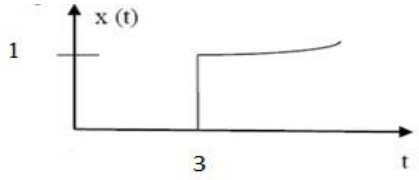
Mid term exam

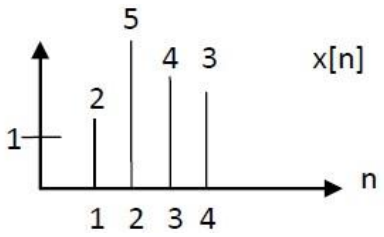
Date: 19/08/2020

Course Details

Course Title: Signals & Systems **Module:** 04

Instructor: **Sir Mujtaba Ihsan** **Total Marks:** 30

Q1.	(a)	**Differentiate** between systems with & without memory using examples.	Marks 05+04
	(b)	**Identify** the basic difference between a deterministic and a random signal.	CLO 1
Q2.	(a)	**Sketch** the transformed versions for the signal x (t) mentioned in i. and ii.  	Marks 08+06
	i.	$x(t+4)$ and $x(2t)$ x	CLO 1
	ii.	$(t/5)$ and x(t-3)	
	(b)	**Outline** the given system as invertible or non-invertible, linear or non-linear, causal or non-causal. Give the reason for you answers too.	
	i.	$y[n] = x^2[n]$ $y[n]$	
	ii.	$= x[n+2]$	
Q3.		Let x[n] be a signal with 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.	Marks 04

	i.	x[n+5]  	CLO 1

Student Details

Name: Talha Khan **Student ID: 13845**

Q1. (a)

Ans:- 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."

Example:-

(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 on the value of $x[n]$ at that time.

(2) A Resistor is a memoryless System:-

Let,

$x(t)$ = 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) Identify System:-

An identify system is a simple memoryless system. Its output is identical to its input. The input-output relationship for an identify system is geven by:

For Continuos-time Identify System:-

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

For Discrete-time Identify system:-

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

* System with memory:- "Memory in a system corresponds to the Presence of a mechanism in the system that retains or stores information about input value at times other than the current time."

Example :-

(1) Accumulator or Summer :-

Accumulator or Summer is a descrete time system with memory

$$y(n) = \sum_{k=-\infty}^{n} x(k)$$

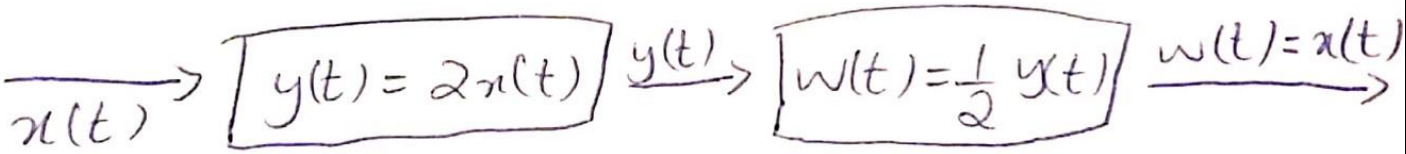
An accumulator must "remember" or Store information about past input the accumulator computes the running sum of all inputs upto the current time, and thus, at each instant of time, the accumulator must add the current input value.

Example of Invertible System:-

$$y(t) = 2x(t)$$

Because the inverse system also exists i.e

$$w(t) = \frac{1}{2} y(t)$$



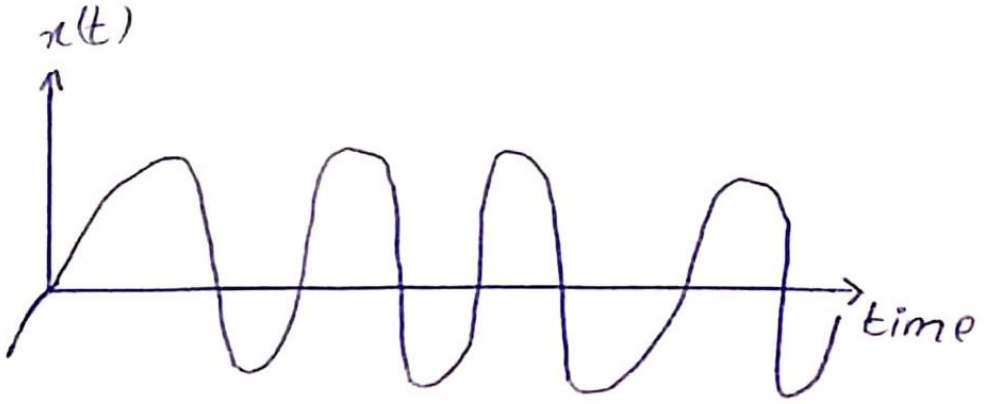
Example of Non-Invertible Systems:-

The System which produces the zero output sequence for any input sequence is a non invertible system.

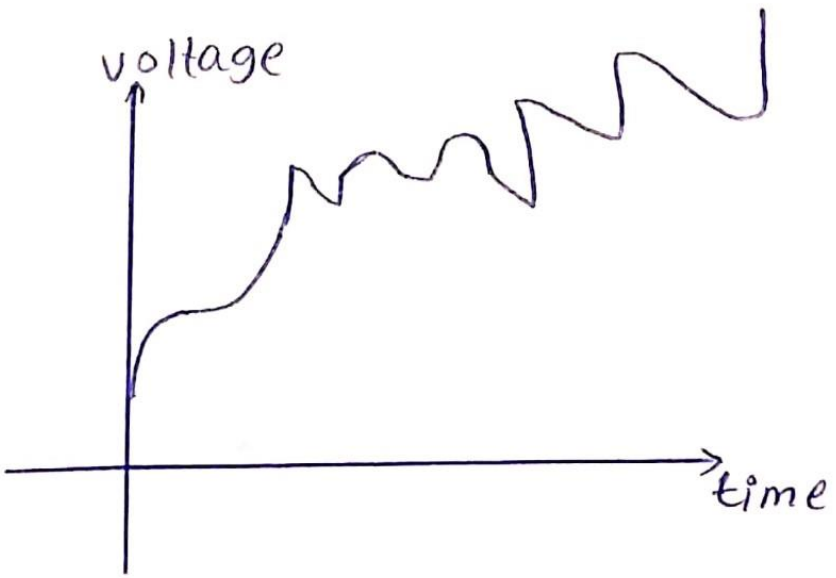
i.e $$y[n] = 0$$

Q 1. (b)

Ans:- A signal is said to be deterministic if there is no uncentainty with respect to its value at any instant of time. Or, signals which can be define exactly by a mathematical formula are known as deterministic singals.

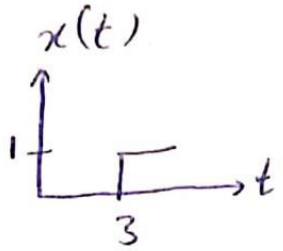


A signal is said to be non-deterministic if there is uncertainty with respect to its value at some instant of time. Non-deter-ministic signals are random in nature hence they are called random signals. Random signals cannot be described by a mathematical equation.



Q2 (a):-

(i) Solution:-



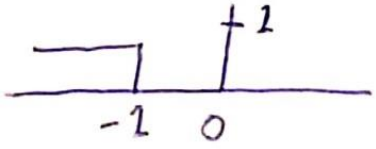
$x(t+4)$

At $t = 3$, $x(t) = 1$

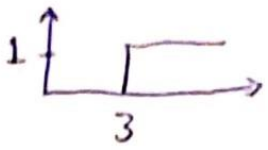
$t + 4 = 3$, $x(t+4) = 1$

$t = 3 - 4$

$t = -1$



$x(2t)$

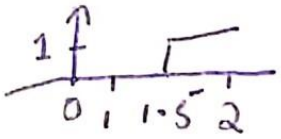


At $t=3$, $u(t)=1$

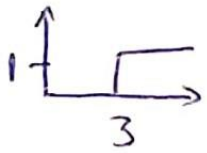
$2t=3$, $x(2t)=1$

$t=3/2$

$t=1.5^-$



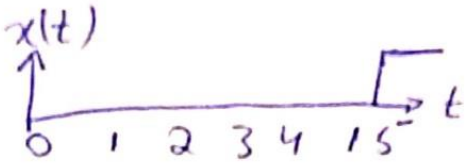
(ii) $x(t/5^-)$



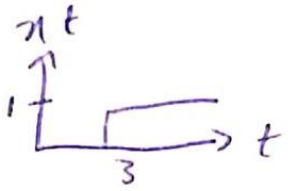
At $t=3$, $x(t)=1$

$t/5^- = 3$, $x(t/5)=1$

$t = 15^-$



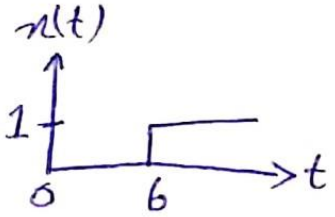
$x(t-3)$



At $t = 3$, $x(t) = 1$

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

$t = 6$



Q 2 (b)

(i) $y[n] = x^2[n]$

A system in which we can not determine the sign of the in put from the knowledge of the output is said to be non-invertable. System

$$y(n) = x^2(n)$$

(ii) $y[n] = x[n+2]$

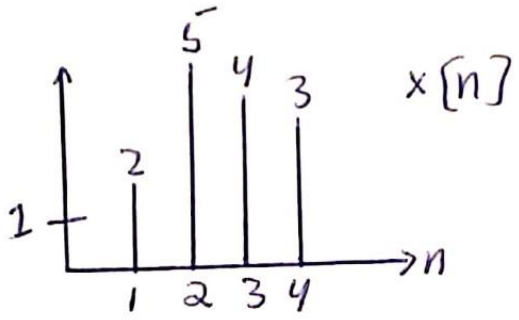
System is said to be non-causal if it anticipates the future values of the input.

$$y[n] = x[n] + x[n+1]$$

$$y[n] = x[n+2]$$

Q(3) Solution:-

According to the conditions given let the signal $x[n]$ be given as;



(i) $x[n+5^-]$

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

$n+5^-=1$, $x(n+5)=2$

$n=1-5^-$

$n=-4$

At $n=2$

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

$n=2-5$ $\quad x(n+5)=5$

$n=-3$

At $n=3$, $x(n)=4$

$n+5=3$, $x(n+5)=4$

$n=3-5$

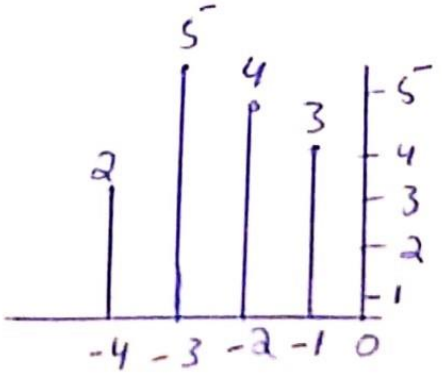
$n=-2$

At $n=4$, $x(n)=3$

$n+5=4$, $x(n+5)=3$

$n=4-5$

$n=-1$



Q(4) 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.