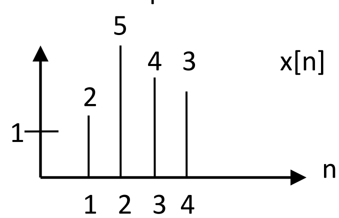
Department of Electrical Engineering
Sessional Assignment
Date: 05/05/2020

Course Details

Course Title: Signals & Systems **Module:** 04
Instructor: ____________________ **Total Marks:** 20

Student Details

Name: ____________________ **Student ID:** ____________

Q1.		**Evaluate** the even and odd components for the given function.  	Marks 05 CLO 1
Q2.		**Calculate** the inverse Laplace transform of the given equation. $$\mathbf{Y(s)} = \frac{\mathbf{s+4}}{\mathbf{s^2 + 4s - 12}}$$	Marks 07 CLO 3
Q3.	i. ii.	**Discuss** the procedure of converting an analog signal into a digital one. Suppose an analog signal has a highest frequency of 60Hz. **Outline** the steps that will ensure that no aliasing occurs.	Marks 02+02 CLO 2
Q4.		**Show** that: $x[n] * [h_1[n] * h_2[n]] = [x[n] * h_1[n]] * h_2[n]$	Marks 04 CLO 2

Department of Electrical Engineering

Course Title: Signals & Systems

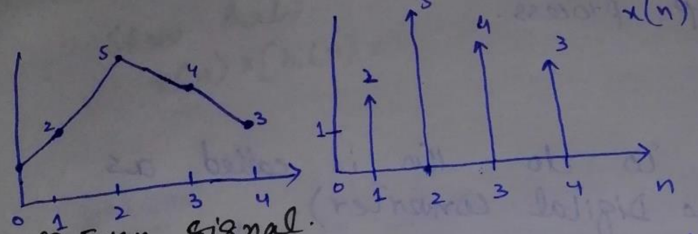
Module: 4^{th} semester

Student Detail

Name : Muhammad Ahmad

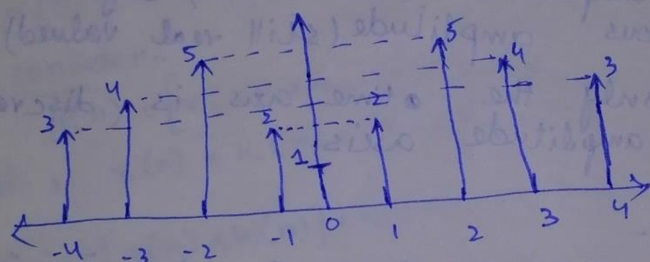
Roll No :14563

QNO 1 Evaluate the even and odd components for the given function.



① Even signal.

① If a signal is symmetric about y-axis then that signal is Even signal.



① Symmetric about y-axis.

$x[n]$ is Even signal.

① If $x(-t) = x(t)$.

then $x(t)$ is Even signal.

e.g ① $x(t) = \cos t \rightarrow x(-t) = \cos(-t) = \cos t = x(t)$

② $x(t) = t^2 \rightarrow x(-t) = (-t)^2 = (-t)^2 = t^2 = x(t)$.

Both example were same resultant.

② Odd signal :-

if $x(-t) = -x(t)$.

than $x(t) =$ ODD signal.

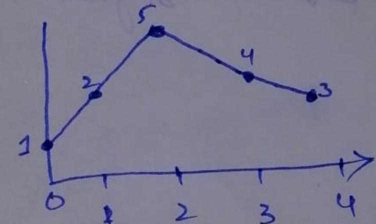
If time reflection of a signal is minus of the orignal, then signal is ODD signal.

Example

① $x(t) = \sin t \longrightarrow \underline{x(-t)} = \sin(-t) = -\sin t / \underline{-x(t)}$

② $x(t) = t^3 \longrightarrow \underline{x(-t)} = (-t)^3 = \underline{-t^3}$ same.

$= \underline{-x(t)}$



* If a signal is symmetric about the origin, then it is ODD signal.

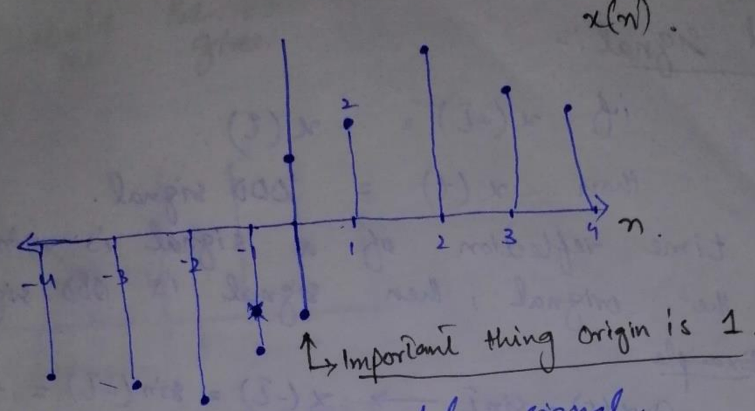
* ODD signal always passes through the origin.

Mathimatically

(*) $x(t) = 0 \longrightarrow$ for $t = 0$

(for each and every signal).

* Here we have 1 at origin.



So this is NOt odd signal.
this is only Even signal.

QNo2:- Calculate the Inverse Laplace Transform of the given Equation.

$$Y(s) = \frac{s+4}{s^2+4s-12}.$$

Solution:-

$$= s^2+4s-12$$

$$= s^2+6s-2s-12.$$

$$= (s+6)(s-2).$$

$$= \frac{s+4}{(s-2)(s+6)}.$$

$$\frac{s+4}{(s-2)(s+6)} = \frac{A}{s-2} + \frac{B}{s+6}.$$

$$s+4 = A(s+6) + B(s-2).$$

$s-2=0 \Rightarrow s=2$ Put the value.

$$2+4 = A(2+6) + B(2-2).$$

$$6 = 8A + B(0).$$

$$\frac{3}{4}\cancel{\frac{6}{8}} = \cancel{\frac{8A}{8}} \qquad \boxed{A = 3/4}.$$

$$s+4 = A(s+6) + B(s-2).$$ ∴ Now $s+6=0 \Rightarrow \boxed{s=-6}$!

$$-6+4 = A(-6+6) + B(-6-2).$$

$$-2 = A(0) - 8B.$$

$$\frac{+\cancel{2}^{1}}{\cancel{8}4} = \frac{+\cancel{8}B}{\cancel{8}} = \boxed{B = \frac{1}{4}}$$

So

$$Y(s) = \frac{3}{4}\left(\frac{1}{s-2}\right) + \frac{1}{4}\left(\frac{1}{s+6}\right).$$

$$= \frac{3}{4} L^{-1}\left(\frac{1}{s-2}\right) + \frac{1}{4} L^{-1}\left(\frac{1}{s+6}\right).$$

$$= \boxed{\frac{3}{4} e^{2t} + \frac{1}{4} e^{-6t}}$$ Ans.

QNo3 (a) Discuss the procedure of converting an analog signal into a digital one.

Ans:- Analog signal is converted to a digital signal using a two step process.

① Sampling
② Quantization.

The device used to do this is called as ADC (Analoge to Digital converter).

Sampling:-
Sampling converts a continuous time. continuous amplitude (real valued) signal to discrete time continuous amplitude (still real valued) signal.
(a) Remember only the time axis is discretized & not the amplitude axis.

Quantization:-
It converts the discrete time continuous amplitude signal to discrete time and discrete valued (from a set of finite values, so that it can be represented by finite bits and can be stored on a computer).

QNo4 Show that.

$$x(n) \times [h_1(n) \times h_2(n)] = [x[n) \times h_1(n)] \times h_2(n).$$

Solution:-

This is associative property holds true in this case.

$$x[n] \times [h_1(n) \times h_2(n)] = [x[n) \times h_1(n)] \times h_2(n).$$

Let consider:-

$$y(n) = [x(n) \times h_1(n)] \times h_2(n).$$

let, $x(n) + h_1(n) = W_1(n)$.

So

$$y(n) = [x(n) \times h_1(n)] \times h_2(n) \longrightarrow (1).$$

$$y(n) = W_1(n) \times h_2(n).$$

$$x(n) \longrightarrow \boxed{h_1(n)} \xrightarrow{W_1(n)} \boxed{h_2(n)} \longrightarrow y(n).$$

Now Consider that.

$$W_2(n) = h_1(n) \times h_2(n).$$

$$y(n) = x(n) \times [h_1(n) \times h_2(n)].$$

$$= x(n) \times W_2(n).$$

$$x(n) \longrightarrow \boxed{W_2(n)} \longrightarrow y(n).$$

Both block diagrams give the same Response.

Hence.

$$[x(n) \times h_1(n)] \times h_2(n) = x(n) \times [h_1(n) \times h_2(n)]$$

Proved.