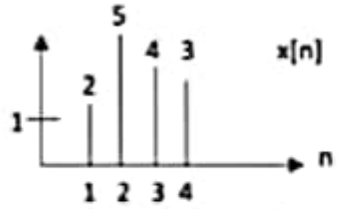
Department of Electrical Engineering
Sessional Assignment
Date: 05/05/2020

Course Details

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

Student Details

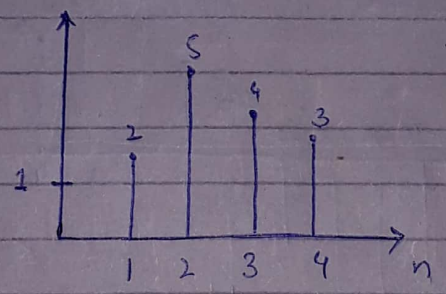
Name: _____ **Student ID:** _____

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

Name :- Muhammad Ali
ID :- 6964
Dept :- BE (Electrical)
Assign :- Sessional Assign.
Course :- Signals & Systems.

Q1:-

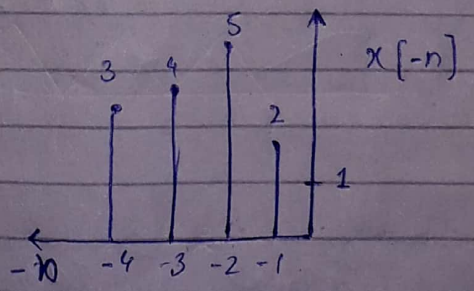
Ans:- As we are given the function :-



Even components of a ftn can be written as :-

$$x_e[n] = \frac{x[n] + x[-n]}{2} \longrightarrow (i)$$

Reflect $x[n]$ to get $x[-n]$.

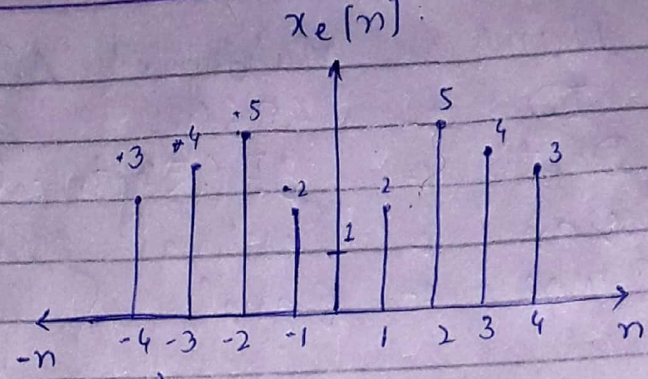


Now odd components of a ftn can be written as:-

$$x_o[n] = \frac{x[n] - x[-n]}{2} \longrightarrow (ii)$$

But

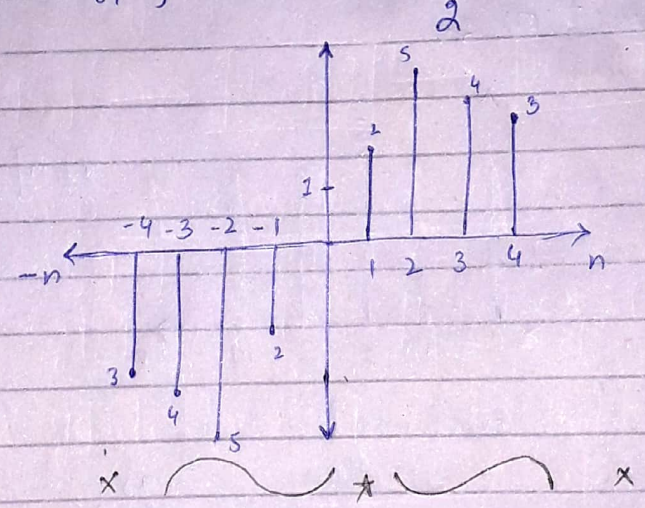
$$x_e[n] \Rightarrow \text{P.t.O}$$



Now (ii) ⇒

odd components of a ftn be written as:-

$$x_o[n] = \frac{x[n] - x[-n]}{2}$$



Q2:-

Ans:- Laplace transform :-

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

Q3:-

i)

Ans:- Analog signal can be converted into digital signal by the 2 main procedures.

i) Sampling

ii) Quantization.

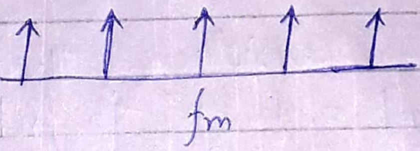
The sampling rate determines the spatial resolution of digitized image, while the quantization level determines the no. of grey levels in the digital image

x —— * —— x

Q3:-
ii).
Ans:-

F = 60 HZ.

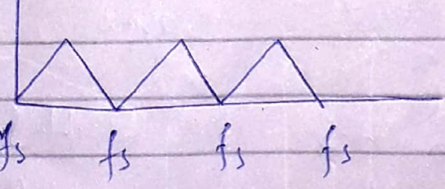
from niquist criteria



$fs \geq 2fm$.

$fs \geq 2 \times 60$

$fs = 120$



If fs = 120 HZ there will be no alaising occurs at niquist criteria proves it.

x ∿ * ∿ x

P.T.O
→

Q4:-

Ans:- As we are given :-

$$x[n] * [h_1[n] * h_2[n]]$$
$$= [x[n] * h_1[n]] * h_2[n].$$

Consider

$$Y[n] = [x[n] * h_1[n]] * h_2[n].$$
$$x[n] * h_1[n] = w_1[n].$$

Now :-

$$Y[n] = [x[n] * h_1[n]] * h_2[n].$$
$$y[n] = w_1[n] * h_2[n].$$

$x[n] \longrightarrow \boxed{h_1[n]} \longrightarrow \boxed{h_2[n]} \rightarrow Y[n]$

Now consider that :-

$$w_2[n] = h_1[n] * h_2[n].$$
$$y[n] = x[n] * [h_1[n] * h_2[n]].$$

$$y[n] = x[n] * w_2[n].$$

$x[n] \longrightarrow \boxed{w_2[n]} \longrightarrow Y[n].$

As both block diagrams given the same responce so :-

L.H.S = R.H.S

Hence proved

Q2:-

Ans:-

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

$$= s+4 \,/\, s^2+6s-2s-12$$

$$= s+4 \,/\, s(s+6)-2(s+6)$$

$$= s+4 \,/\, (s-2)(s+6).$$

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

xing b.s by $(s-2)(s+6)$.

So:-

$$y(s) = (s+4) = A(s+6) + B(s-2) \rightarrow (1)$$

Let $s=-6$ in eq (1).

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

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

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

$$B = -2/-8 = 4$$

$$\Rightarrow (B = 4)$$

Now:-

Let $s=2$ in eq (1).

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

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

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

$6 = A(8)$.

$A = \frac{6}{8} = \frac{2}{4} = \frac{1}{2}$.

$\left(A = \frac{1}{2}\right)$.

Now:-

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

$$= \frac{1}{2} L \frac{1}{s-2} + 4L^{-1} \frac{1}{s+6}.$$

$$= \frac{1}{2} e^{2t} + 4e^{-6t}$$

$$\left\{ y(s) = \frac{1}{2} e^{2t} + 4e^{-6t} \right\}$$

Inverse Laplace Transform.