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

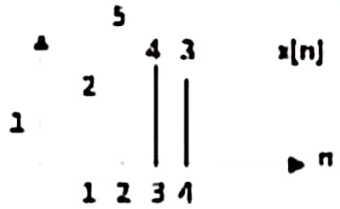
Course Details

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

13746

Student Details

Name: mohsin ali **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. **Discuss the procedure of converting an analog signal into a digital one.**		Marks 02+02 CLO 2
	II. **Suppose an analog signal has a highest frequency of 60Hz. Outline the steps that will ensure that no aliasing occurs.**		
Q4.	**Show that:** $x[n] * [h_1[n] * h_2[n]] = [x[n] * h_1[n]] * h_2[n]$		Marks 04 CLO 2

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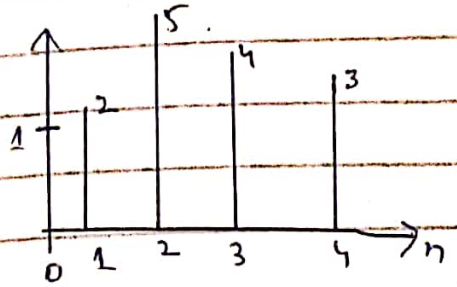
Assignment Signal and System
Submitted to Sir Mujtaba Ihsan
Dated: 3/6/2020

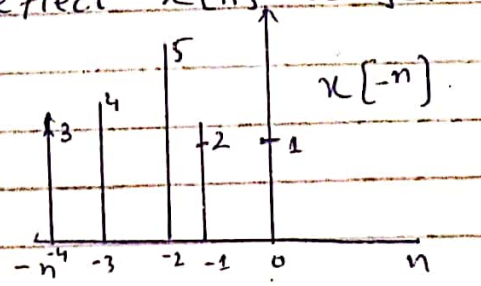
Q1: Evalute The even and odd Components for the given Function:

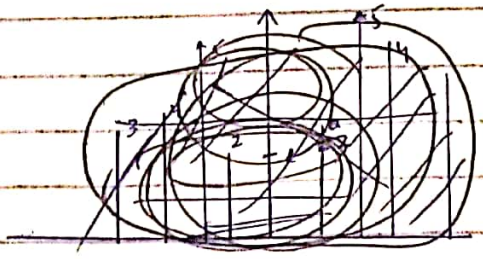


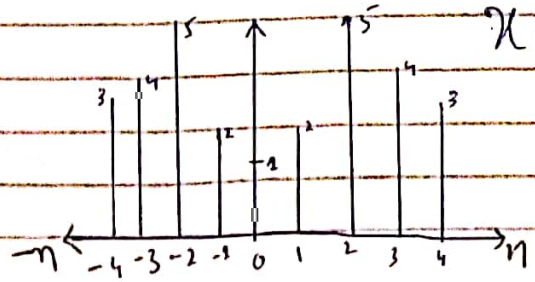
Sol: As we know that The even Componants of a function can be written as

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

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







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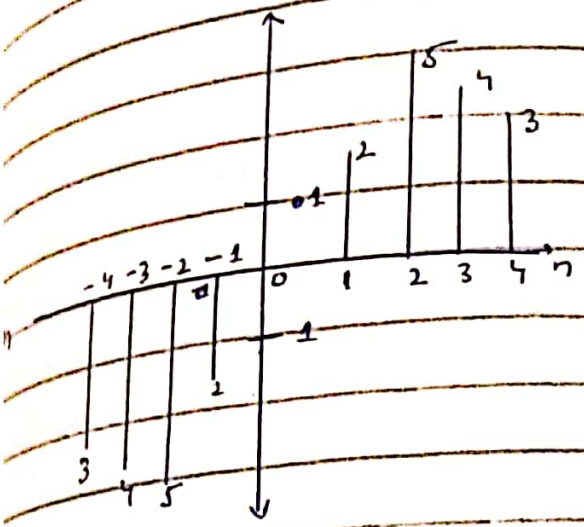
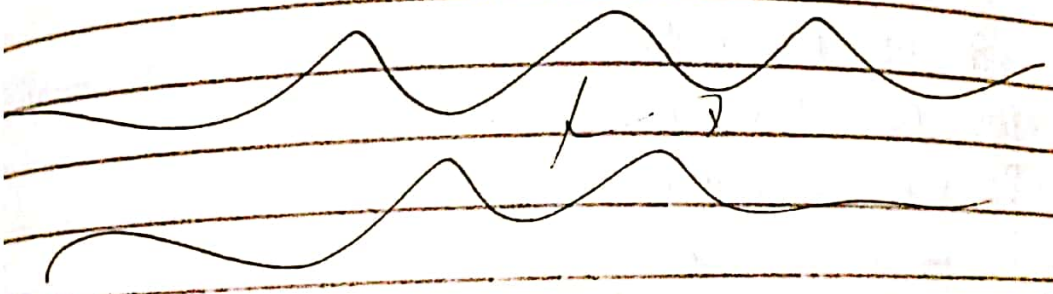
odd Components of a function can be written as: $X_o[n] = \frac{x[n] - x[-n]}{2}$





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Q2: $y(s) = \frac{s+4}{s^2+4s-12}$

Sol: $y(s) = \frac{s+4}{s^2+4s-12}$

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

$= \frac{s+4}{s^2+6s-2s-12}$

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

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

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

Multipling both side by $(s-2)(s+6)$
Or taking LCM R.S

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

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

$(-6+4)$

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

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

$-2 = B(-8) \Rightarrow B = \frac{+2}{+8} = \frac{1}{4}$

$\boxed{B = \frac{1}{4}}$

P.T.O

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let $s = 2$ in eq (1)

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

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

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

$6 = A(8)+0$

$6 = A(8)$

$A = 6/8 = 2/4 = 1/2$

$$\boxed{A = \frac{1}{2}}$$

$$y(s) = \frac{\frac{1}{2}}{(s-2)} + \frac{4}{(s+6)}$$

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

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

$$y(s) = \frac{1}{2}e^{2t} + 4e^{-6t} \quad \text{Ans.}$$

inver laplace Transform

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Q: 3

Ans:

Analog signal is converted to a digital signal using Two step process.

1) Sampling.
2) Quantization.

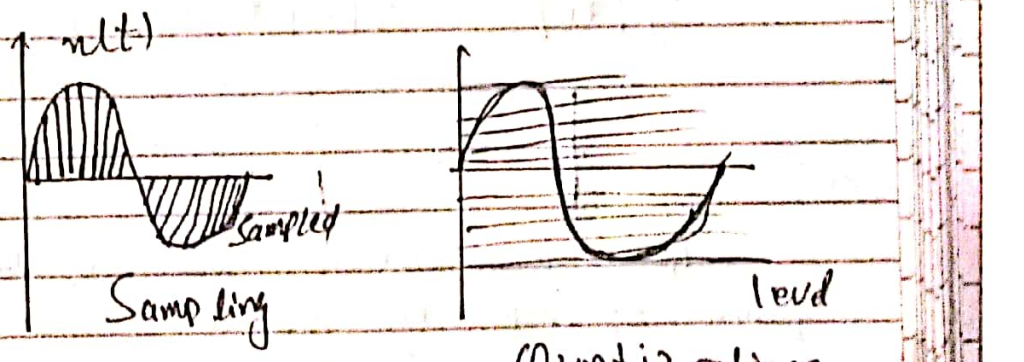
The device used to this is called ADC (Analog to digital converter.

Step 1

Sampling converts a continuse time continuse amplitude (real valued) signal to discret time continuse amplitude (still real valued) signal Remember only time axis is discritized and not the amplitude axis.

Step 2

Quantization converts the discret time continuse amplitude signal to set of finil values, so that it can be represented by finite ~~values~~ bits and can be stored on computer.



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written as

$x_o[n] = x[n] - x[n-\ldots]$

(b)

Q: 4 Show that $x[n] * [h_1[n] * h_2[n]] = [x[n] * h_1[n]] * h_2[n]$

Consider:

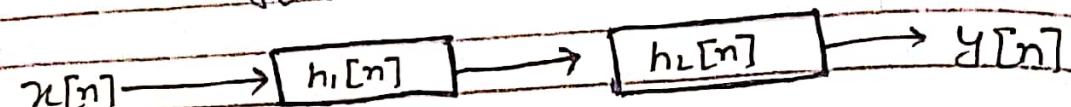
$$y[n] = [x[n] * h_1[n]] * h_2[n]$$

$$x[n] * h_1[n] = w_1[n]$$

Now:

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

$$y[n] = w_1[n] * h_2[n]$$

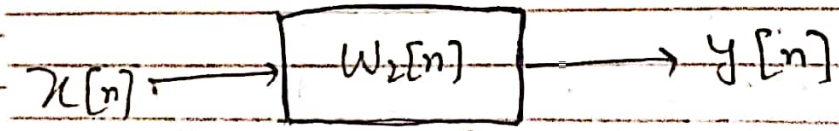


Now Consider that:

$$w_2[n] = h_1[n] * h_2[n]$$

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

$$y[n] = X[n] * w_2[n]$$



As Both block diagram give the same Response we can write:

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

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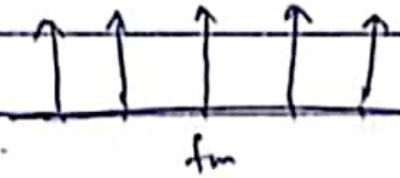
Q: 3 (ii)

$f = 60$ Hz. ensure that there is no aliasing occur.

$f_m = 60$ Hz.

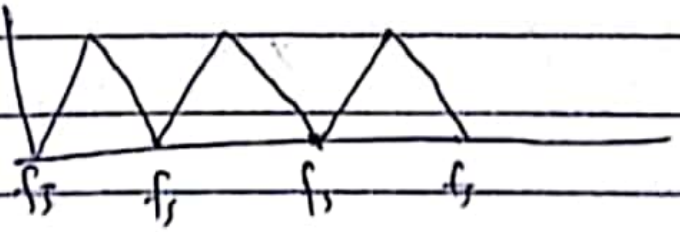
From Nyquist Criteria.

$f_s \geq 2 f_m$.



$f_s \geq 2 \times 60$

$f_s = 120$



If $f_s = 120$ Hz there will be no aliasing occurs as Nyquist criteria proves it.