Department of Electrical Engineering
Assignment
Date: 22/06/2020

Course Details

Course Title:	Signals and Systems	**Module:**	6th
Instructor:	Engr. Aamir Aman	**Total Marks:**	50

Student Details

Name:	Sifatullah	**Student ID:**	14200

Q1.	Using the following Discrete Time Signal, Prove the two important properties in Discrete Fourier Series i.e. a) $C_{K+N0} = C_K$ b) $C_{-K} = C_{N0-K} = C_K^*$ Find Fourier coefficient and DC component while the time period $N_0 = 4$ for the following Discrete Time Signal $X[n] = \{7, 8, 4, 3, 2, 6\}$ Also plot a) Magnitude Spectrum b) Phase Spectrum	Marks 10 CLO 1
Q2.	Take your own ID # as a sequence X[n] and decompose this sequence into Impulses. Plot the decomposed sequence using their magnitudes and locations.	Marks 10 CLO 1
Q3.	Flip and drag the following sequences by using graphical convolution method until unless their products become zero. Then plot the convoluted signal. $H[n] = \{2, 1, 2, -1\}$ $X[n] = \{2, 4, 6, 2\}$	Marks 10 CLO 1
Q4.	By using a method of your own choice, find the frequency domain representation of the following Discrete Time Signal a) $X[n] = (1/2)^{n-1} U[n-1]$ b) $X[n] = \delta[n] + \delta[n-1] + \delta[n-2]$	Marks 10 CLO 2
Q5.	By using zero padding find the multiplication of Discrete Fourier Transform of the following sequences;	Marks 10 CLO 2

	$X_1[n] = \{2, 4, 6\}$ $X_2[n] = \{8, 10, 12\}$	

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☺GOOD LUCK☺

Discrete Fourier Series:-

$$x[n] = \sum_{K=0}^{N_0-1} C_K \, e^{-j\left(\frac{2\pi}{N_0}\right)Kn}$$

Fundamental Period

Harmonics

DTS

Fourier Coefficient / Spectral Coefficient.

$\boxed{\text{Time Domain}} \leftarrow \boxed{\text{Frequency Domain}}$

$$C_K = \frac{1}{N_0} \sum_{n=0}^{N_0-1} x[n] \, e^{-j(2\pi/N_0)Kn}$$

Fourier Coefficient

Time Domain to Frequency Domain | Analysis Equation & Synthesis Equation

Two Important Properties:-

1. $C_{K+N_0} = C_K$
2. $C_{-K} = C_{N_0-K} = C_K^*$ → Conjugate

$$C_1 = \frac{1}{4}\{(-j)^0 x[0] + (-j)^1 x[1] + (-j)^2 x[2] +$$
$$(-j)^3 x[3]\}$$

$$C_1 = \frac{1}{4}\{0 + (-j)(1) + j^2(2) + (-j^3)(3)\}$$

$$C_1 = \frac{1}{4}\{-j - 2 + 3j\}$$

$$C_1 = \frac{1}{4}\{-2 + 2j\}$$

$$C_1 = -\frac{1}{2} + j/2$$

Also solve for C_2 & C_3 we find coefficient upto time period range. Here time period is 4.

$$C_2 = -1/2$$

$$C_3 = -\frac{1}{2} - \frac{1}{2}j$$

(4) 1st Property.-

$$C_{k+N_0} = C_k$$

$$C_{1+4} = C_1$$

$$C_5 = C_1$$

(5) 2nd Property.-

$$C_{-k} = C_{N_0-k} = C_k^*$$

$$\Rightarrow C_{4-1} = C_1^*$$

$$C_3 = C_1^*$$

$$-\frac{1}{2} - \frac{1}{2}j = -\frac{1}{2} + \frac{1}{2}j$$

conjugate of C_3

ID = 14 200 Sifatulean

Q3

Ans.

$H(n) = [2, 1, 2, -1]$

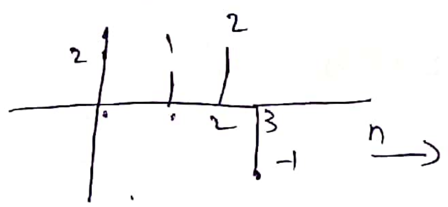
$x(n) = [2, 4, 6, 2]$

convoletion:

$$y(n) = \sum_{K=\infty}^{\infty} x[n-K] h[K] = x) + h$$

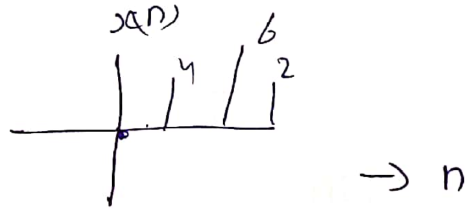
h(n)

h (n)

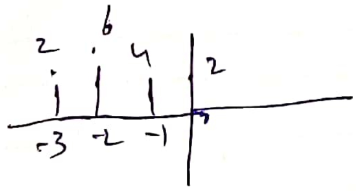


x(n)

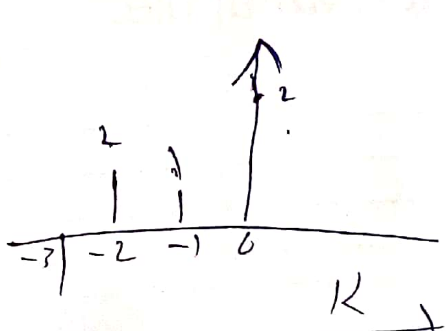
x(N)



x (-n)



h(-K)



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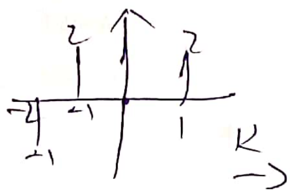
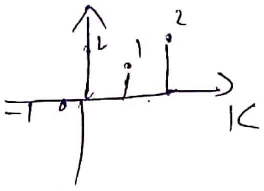
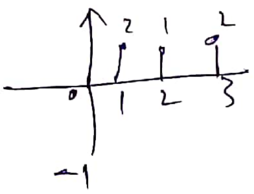
h[1-k



h[2-k



h[3-k



$y(0) = 2+2 = 4$

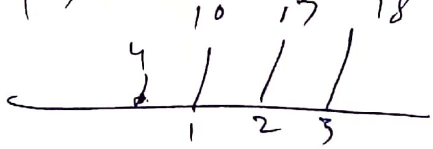
$y(1) = (1+3) + (4+2) = 10$

$y(2) = (2+7) + (1+4) + (2+6) = 17$

$y(3) = (1+2) + (4+2) + (6+1) + (R+2) = 18$

$y=(n) = [4, 10, 17, 18)$

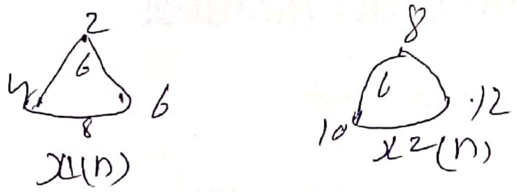
(y0)



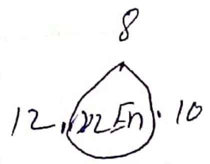
Q5)

Ans $x1(n) = \{2, 4, 6\}$

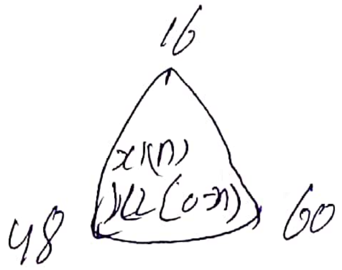
$x2(n) = \{2, 10, 12\}$



① Foldiny we take concalute mirror image of one sequence.

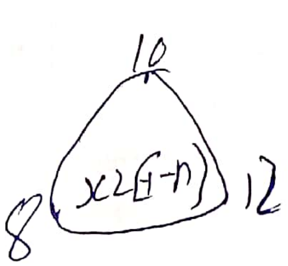


② Multiplication

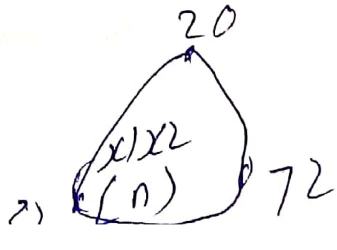


Sum 124

shift are tired by Anticlock wise

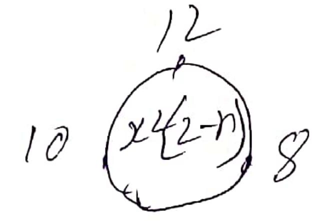


Mutiplication



$y(1) = 124$

Second shift



$y[2] = 112$ $\boxed{\text{solution: } y(n) = \{124, 124, 12\}}$

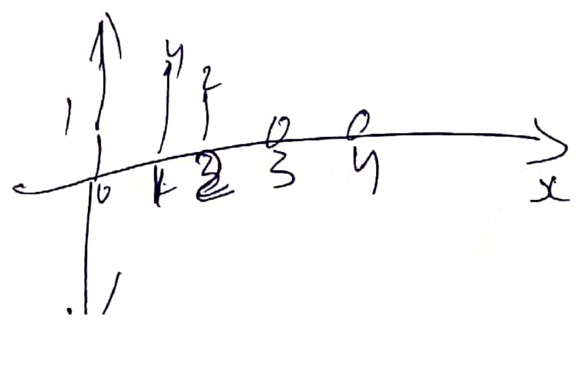
Q2

Ans: My id 14200

$x(n) = \{1, 4, 2, 0, 0\}$

plot the signal

$x(n)$



Q4)

Ans. a) $x(n) = (1/2)^{n-1} \; u[n-1]$

$$X(\Omega) = \sum_{n=-\infty}^{\infty} x(n) e^{-j\omega n}$$

$$X(\Omega) = \sum_{k=-\infty}^{\infty} (1/2)^{k-1} \cdot u(n-1) e^{j\omega k}$$

$$= \sum_{k=1}^{\infty} (1/2)^{k-1} {}^{-j\omega k}$$

$$= \sum_{n=1}^{\infty} (\tfrac{1}{2})^{k} (1/2)^{-1} e^{-j\omega k}$$

$$= \frac{1}{(1/2)} \sum_{n=1}^{\infty} (1/2 e^{-j\omega k})$$

$$X(\Omega) = 2 \sum_{k=1}^{\infty} (1/2 e^{-j\omega k})^{k}$$

As

$$\sum_{n=0}^{\infty} a^n = \frac{1}{1-a}$$

$$\boxed{X(\Omega) = 2\left(\frac{1}{1-(1/2)e^{j\omega k}}\right)}$$

part B

$x(n) = \delta(n) + \delta(n-1) + \delta(n-1)$

Solution using properties of table.

$\boxed{X(e^{j\omega}) = 1 + e^{j\omega} + e^{j\omega(2)}}$

Time	Frequency
$n \in n) \delta(n)$	$x(e^{j\omega}) - 1$
$\delta(n - n_0)$	$x\, e^{j\omega}\, e^{j\omega n_0}$