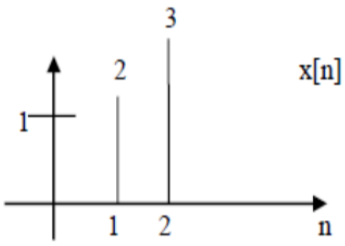
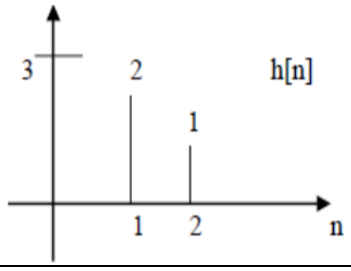
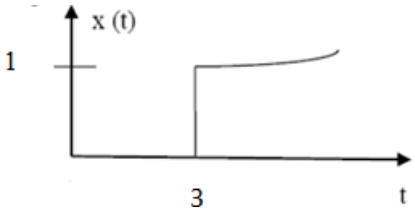
Department of Electrical Engineering
Assignment
Date: 20/04/2020

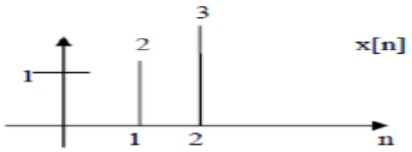
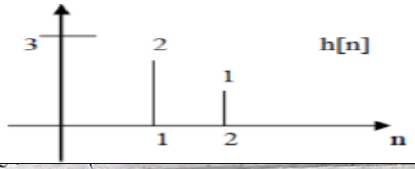
Course Details

Course Title: Signals & Systems **Module:** 04
Instructor: **Eng Mujtaba Ihsan** **Total Marks:** 30

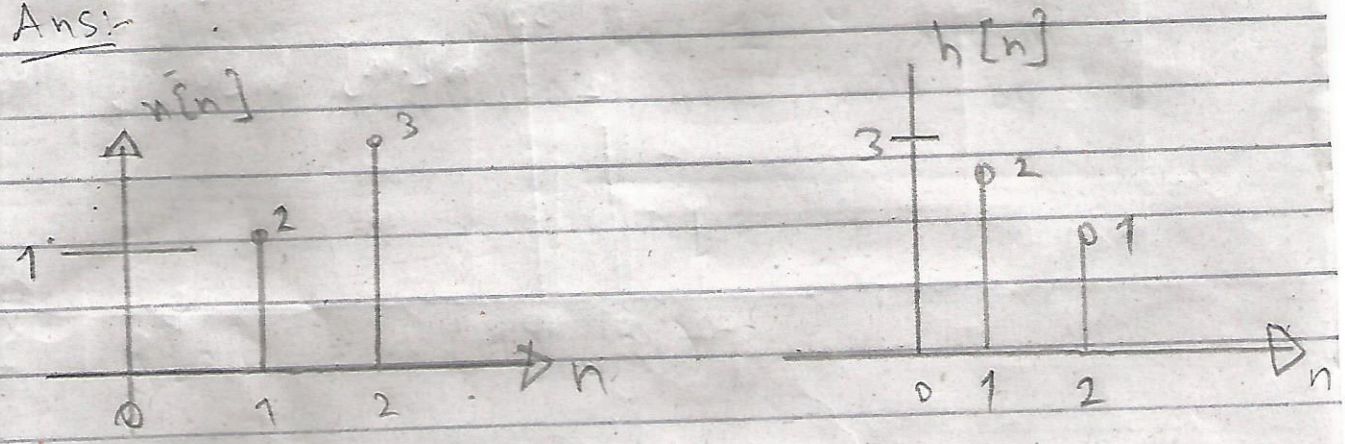
Student Details

Name: **M.Salman shahid** **Student ID:** **15006**

Q1.	(a)	**Evaluate** y[n] using convolution summation.  	Marks 08 CLO 2
	(b)	**Sketch** block diagram for the given system. $y[n] = x[n] + x[n-2]$	Marks 06 CLO 2
Q2.	(a)	**Sketch** the transformed versions for the signal x (t) mentioned in i. and ii.  i. $x(t+5)$ and $x(3t)$ Marks 08 ii.	Marks 08 CLO 1
	(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. $y[n] = x^2[n]$ ii. $y[n] = x[n+2]$	Marks 06 CLO 1
Q3.		Fill in the blank. If a time shift in the input signal results in an identical time shift in the output signal, the system is said to be Time invariant	Marks 02 CLO 1

Q1.	(a)	**Evaluate** y[n] using convolution summation.	Marks 08
		 	CLO 2

Ans:-

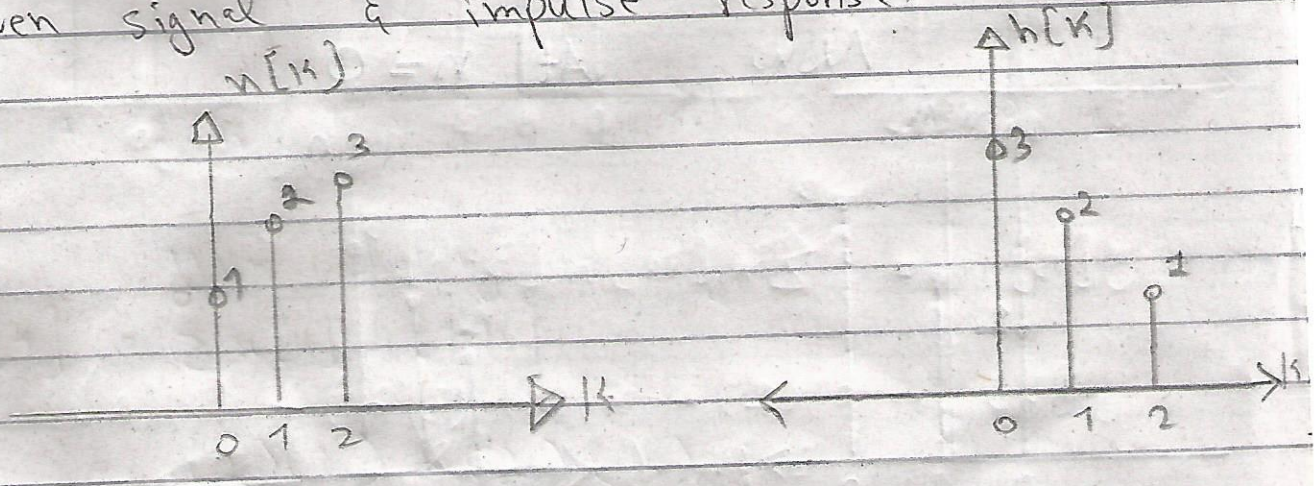


From Convolution summation formula

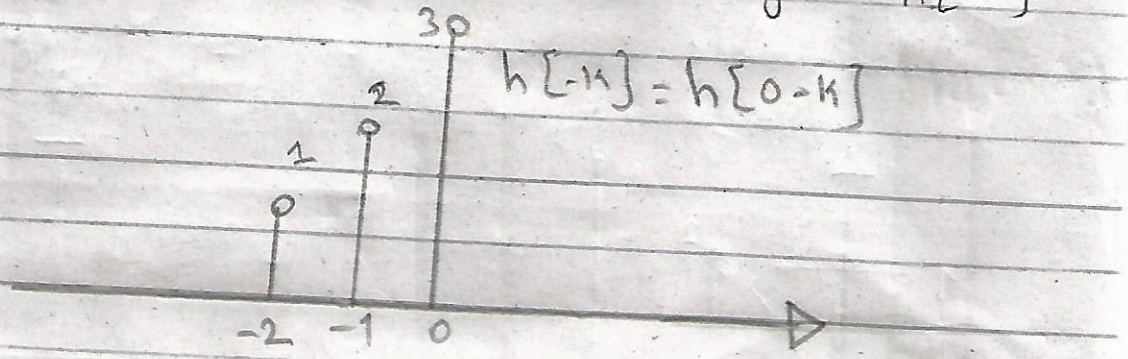
$$y[n] = x[n] \times h[n]$$

$$y[n] = \sum_{k=-\infty}^{\infty} x[k]\, h[n-k]$$

Step ① Replace "n" with "k" in given signal & impulse response.



Step # 2:- Reflect the signal (i.e) impulse response $h[k]$ to get $h[-k]$



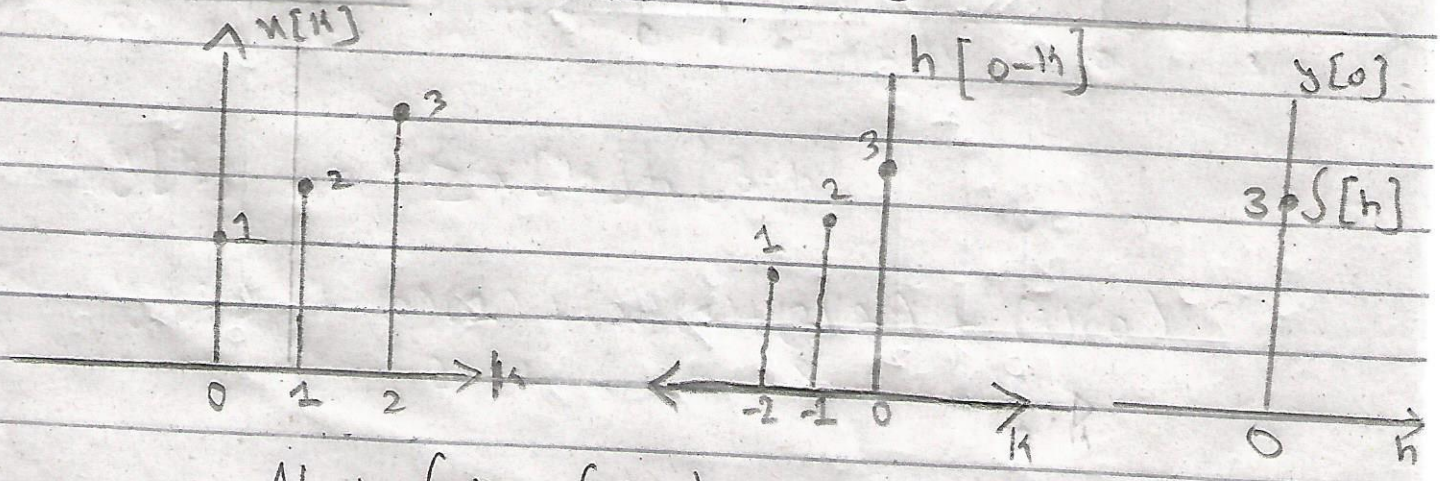
Step # 3:- for the interval

$$-\infty < n < 0$$

$h(n-k)$ is a value b/w $-\infty$ & 0 so when $h(n-k)$ is multiplied by $x[k]$ the output is zero.

for $n \geq 0$

Now At $n = 0$



Now from formula

At

$$y[0] = \sum_{k=-\infty}^{\infty} x[k]\, h[0-k]$$

= So at signal at 0 there will be "1" & in impulse response at "0" there will be "3"

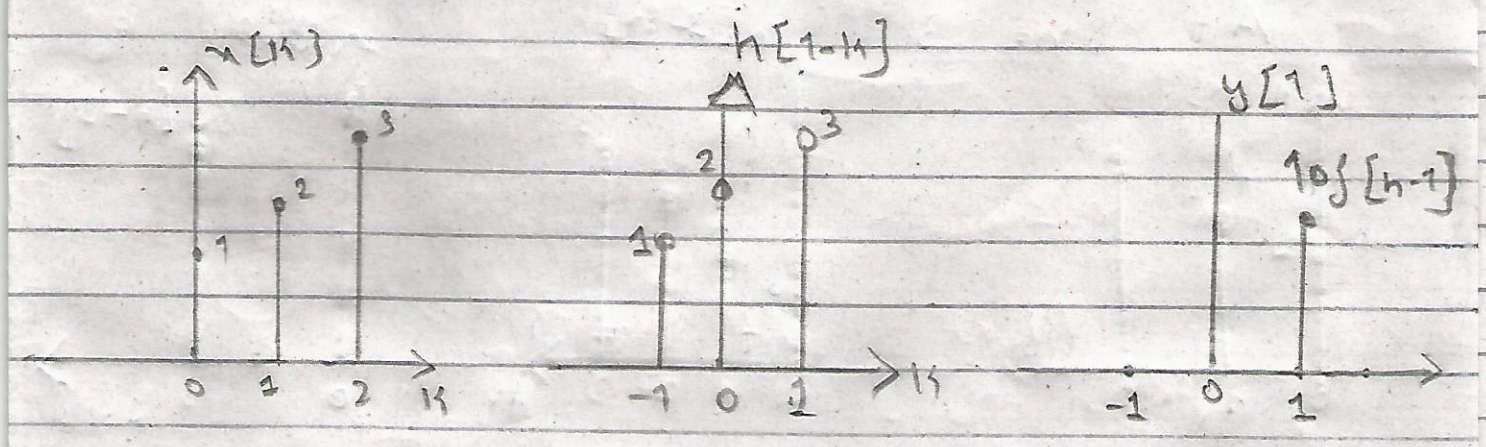
$$y[0] = \sum x[k]\, h[0-k]$$

$$y[0] = (1)(3)$$

$$y[0] = 3$$

$$y[0] = 3\delta[n] \quad \text{—(i)}$$

Now at $n = 1$



again looking at signal & impulse respons

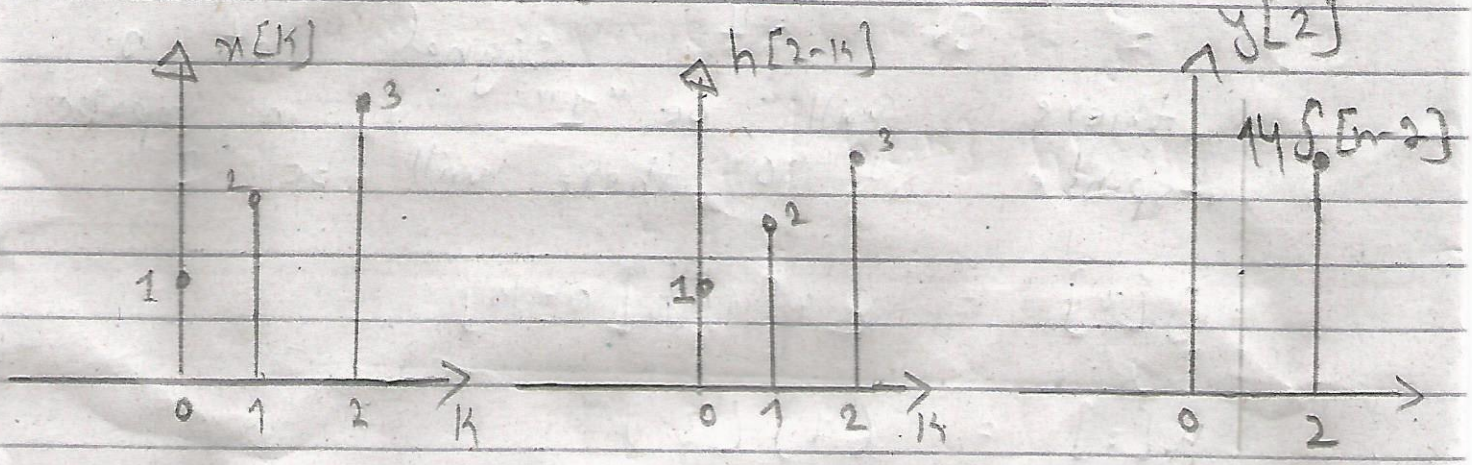
$$y[1] = \sum_{-\infty}^{\infty} x[k]\, h[1-k]$$

$$= (2)(2) + (2)(3)$$

$$= 4 + 6$$

$$y[1] = 10$$

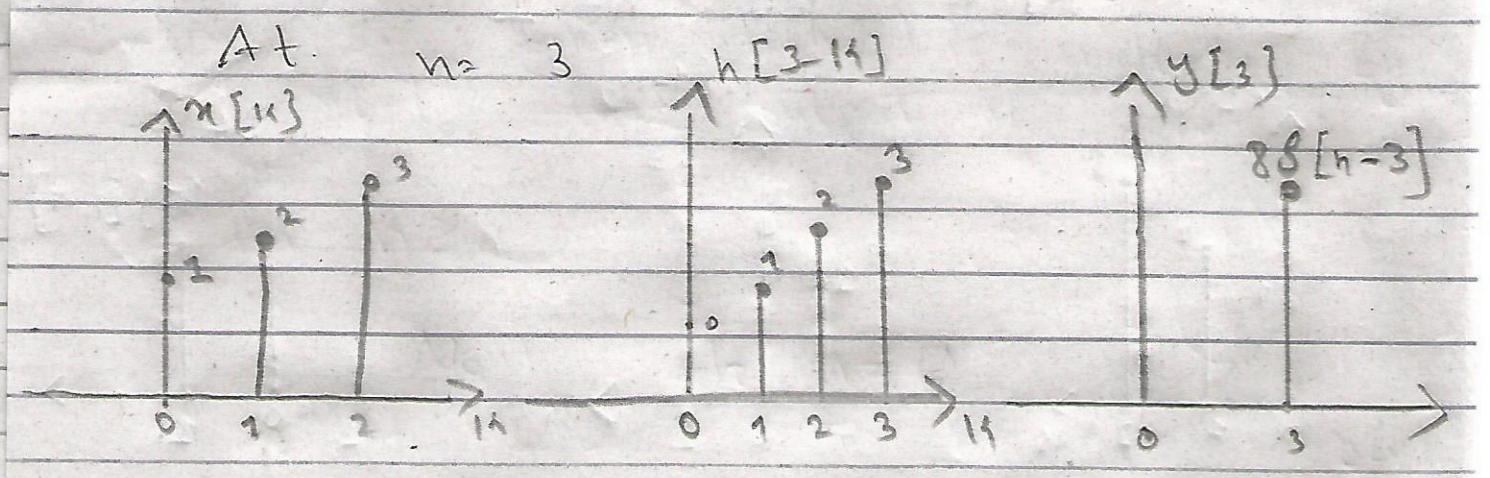
At $n = 2$



$$y[2] = \sum_{-\infty}^{\infty} x[k]\,h[2-k]$$

$$y[2] = (1)(1) + (2)(2) + (3)(3)$$
$$= 1 + 4 + 9 = 14$$

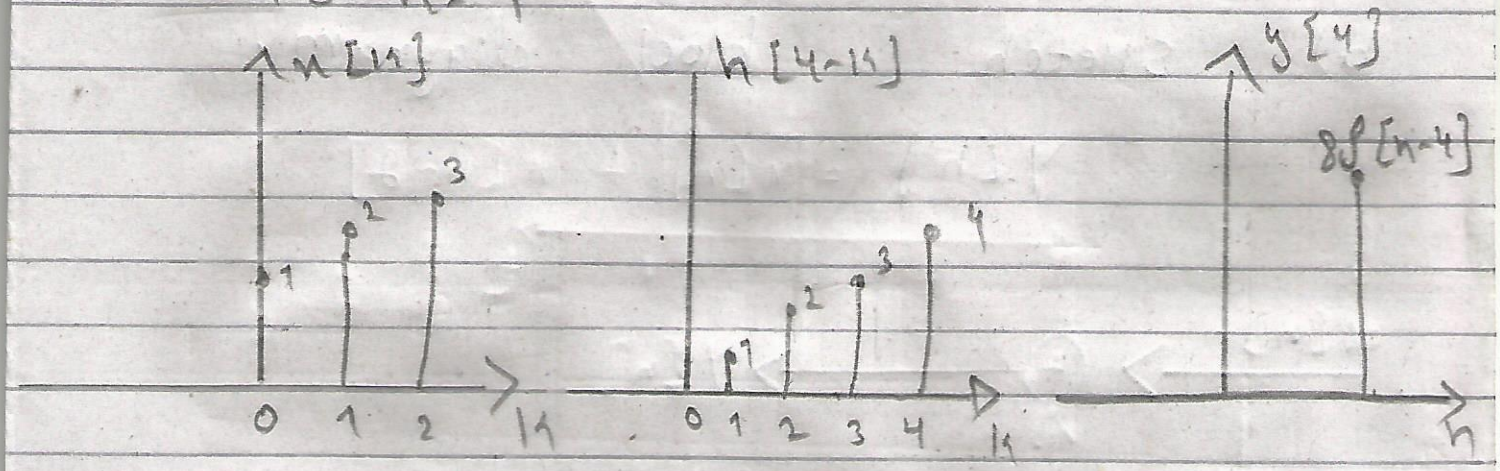
At $n = 3$



$$y[3] = \sum x[k]\,h[3-k]$$

$$y[3] = (0)(1) + (2)(1) + (3)(2) + (3)(0)$$
$$= 2 + 6 = 8$$

At $n = 4$



$$y[4] = (0)(1) + (2)(1) + (3)(2) + (3)(0) + (4)(0)$$

$$= 2 + 6 = 8$$

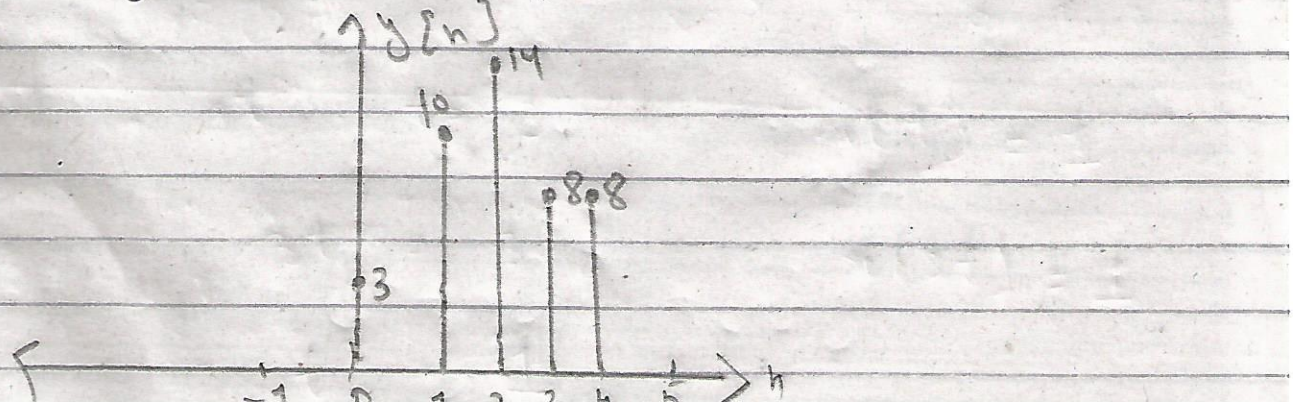
for $n > 4$

there is no overlaping of the signal & impulse response

So $y[n] = 0$

overall output can be written

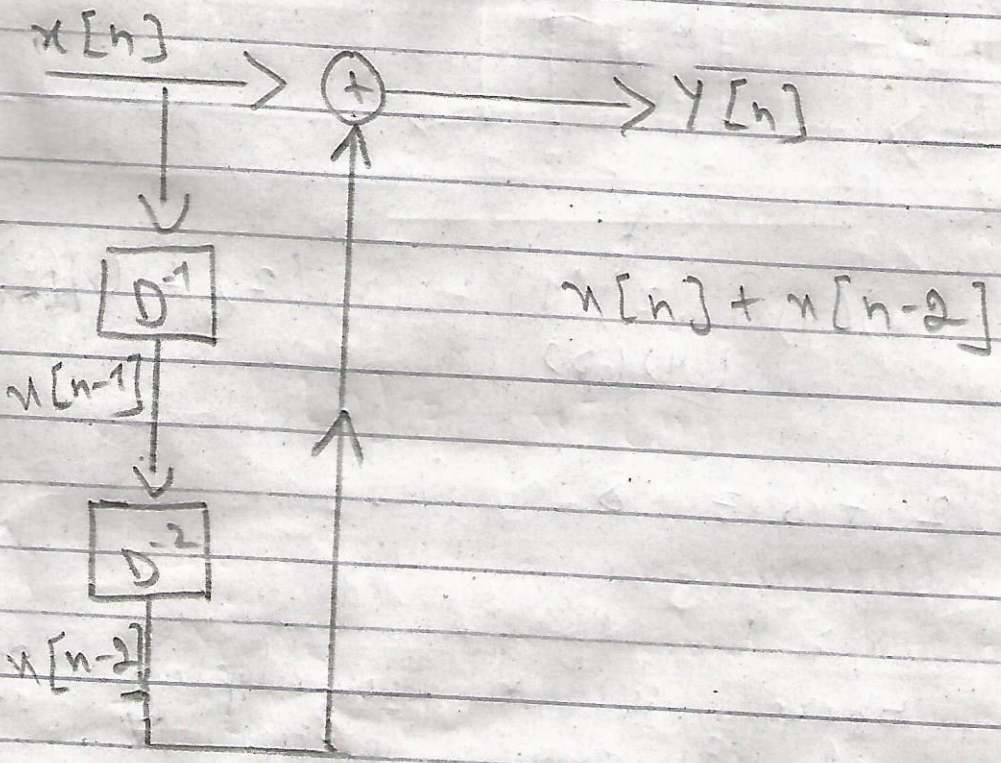
$$y[n] = 3\delta[n] + 10\delta[n-1] + 14\delta[n-2] + 8\delta[n-3] + 8\delta[n-4]$$

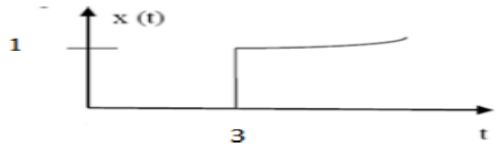


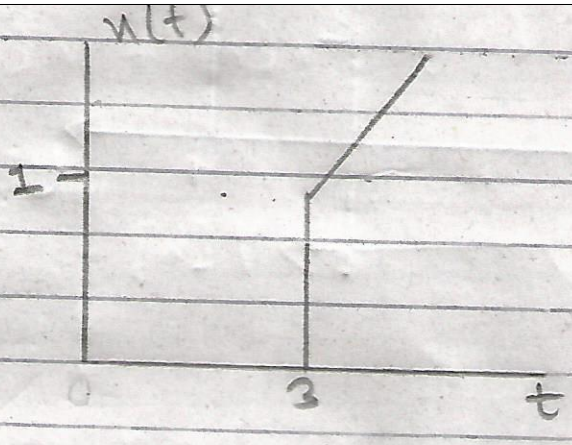
(b)	**Sketch** block diagram for the given system. $y[n] = x[n] + x[n-2]$	Marks 06 CLO 2

b) Sketch a block diagram.

$$Y[n] = x[n] + x[n-2]$$



Q2.	(a)	**Sketch** the transformed versions for the signal x (t) mentioned in i. and ii.	Marks 08
			CLO 1
	i. ii.	x (t + 5) and x (3t)	Marks 08



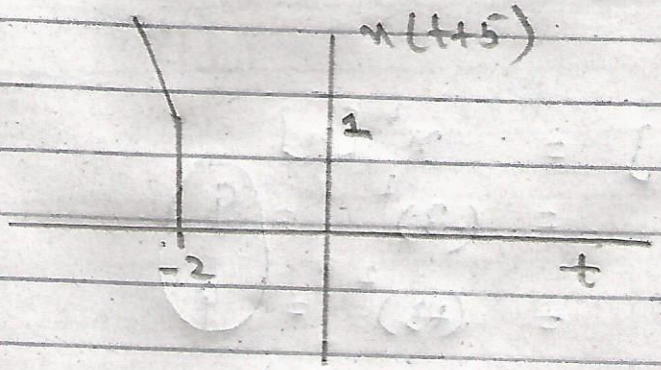
i) $x(t+5)$

ii) $x(3t)$

(i) at $t = 3$ $\quad x(t) = 1$

$t + 5 = 3$ $\quad x(t+5) = 1$

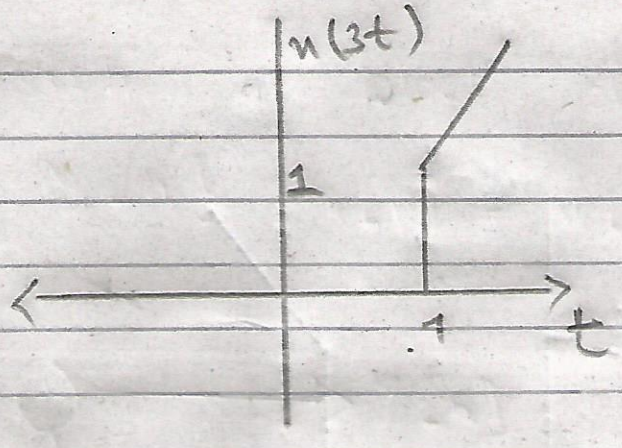
$t = -2$



(ii) at $t = 3$ $\quad x(t) = 1$

$3t = 3$ $\quad x(3t) = 1$

$t = 1$



(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.	Marks 06
i.	$y[n] = x^2[n]$	CLO 1
ii.	$y[n] = x[n + 2]$	

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

"It is a non-invertible system because we cannot determine the sign of the input from the knowledge of the output"

e.g :-

$$Y[n] = x^2[n]$$
$$= (-3)^2 = 9$$
$$= (+3)^2 = 9$$

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

It is non-causal because it depends on the future value

$$y[n] = x[n+1] + x[n+2]$$

etc