Date: 1

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BE(ELECTRICAL)
INU

Qust (1)

Part (a)

$x_a(t) = 3\cos 100\pi t + 4\sin 200\pi t$

(i)

Minimum sample rate :.

$F(s) \geq 2f_{max}$

$f = \omega / 2\pi$

$f_1 = \frac{\mu r \pi}{2\pi}$

$f_2 = \frac{200\pi}{2\pi}$

$f_2 = 100\,Hz$

so

f_2 is max (greater than f_1)

$f_s \geq 2 \times 100\,Hz$

Sampling frequence to avoid aliasing

Abdul Wahab Paper

(ii)

we have

$F_s = 100\,Hz$

so

f_1 becomes

$$f_1' = f_1/f_s = \frac{50}{100} = 0.5\,Hz$$

f_2 becomes

$$f_2' = f_2/_{100} = 100/_{100} = 1\,Hz$$

so

$\omega_1' = 2\pi f_1'$ $\quad\quad$ $\omega_2' = 2\pi f_2'$

$\omega_1' = 2\pi \times 0.5$ $\quad\quad$ $\omega_2' = 2\pi \times 2$

$\omega_1' = \pi$ $\quad\quad$ $\omega_2' = 2\pi$

$x[n] = 3\cos 100\pi n + 4\sin 200\pi n$

the signal becomes

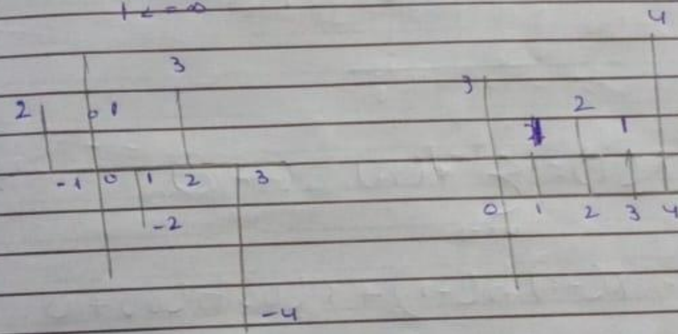
$x[n] = 3\cos\pi n + 4\sin 2\pi n.$

$x[n] = \{2, \underset{\uparrow}{1}, -2, 3, -4\}$

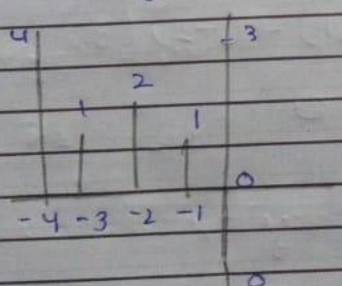
$h[n] = \{\overset{\circ}{3}, 1, 2, 1, 4\}$

Response of system:→

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



h(-k) folded signal



$$y \wedge [0] = \sum_{k=1}^{0} x(-1)\,h(-1) + x(0)\,h$$

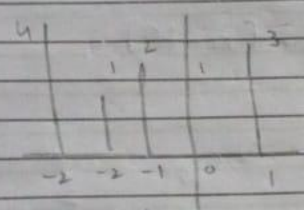
Date:

$y(0) = 2(1) + (1)(3)$

$2 + 3 = 5$

for $n = 1$

$n(1-k)$



$x(1) = \sum_{n=-1}^{1} x(n)\, h(1-k)$

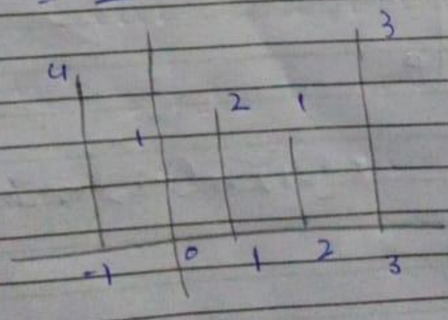
$= x(-1)h(-1) + x(0)h(0) + 0$

$x(1)h(1)$

$= (2)(2) + (1)(1) + (-2)(3)$

$= 9 + 1 - 5 = 0$

$= 2$



$x(2) = \sum_{k=-1}^{3} x(x)h(2-k)$

$y(2) = x(-1)h(-1) + x(0)h(0)$

$+ x(1)h(1) + x(2)h(2) + 6x(3)$

$h(3)$

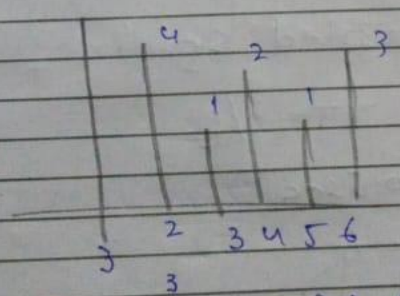
$y(2) = (2)(4) + (1)(1) + (-2)(2) + (3)(1)$

$+ (-4)(3)$

$= 8 + 1 - 4 + 3 - 12 = -4$

$n = 3$

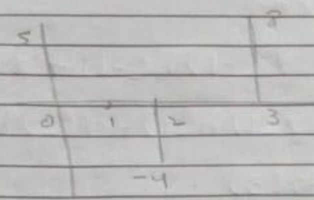
$h(3-k)$



$y(3) = \sum_{k=2}^{3} x(n)h(n-k)$

$= x(2)h(2) + x(3)h(3)$

$(3)(4) + (-4)(1) = 12 - 4 = 8$



(b)

Consider a discreate time Signal which is given.

$$x(n) = \begin{cases} 0.5^n & n \geq 0 \\ 0 & n < 0 \end{cases}$$

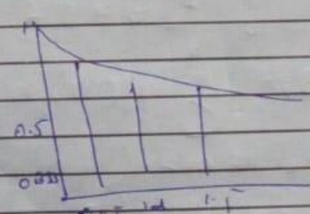
This signal is sampled at the rate $f_s = 2Hz$

Q1 Draw the Sampled Signal

$$f_s = 1/T = T = 1/f_s$$

$$1/2 = 0.5 sec$$

x_n	0.5^n
0	1
0.5	0.7071
1	0.5
1.5	0.353



ii

Ans//

$L = 2^n$

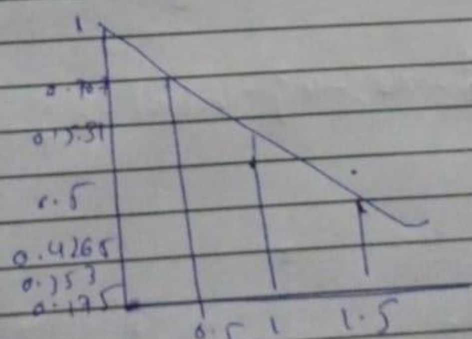
$n = bits = 3$

$L = 2^3 = 8$ level

$$\text{Resolution} = \frac{X_{max} - X_{min}}{L}$$

$$= \frac{1 - 0}{8}$$

$$= 0.125$$



	Distr Signal	Correction	Reading	Error
0	1	1.0	1.0	0.0
1	0.8535	0.8	0.9	-0.1
2	0.707	0.7	0.7	0.0
3	0.6035	0.6	0.6	0.0
4	0.5	0.5	0.5	0.0
5	0.4265	0.4	0.4	-0.1
6	0.353	0.3	0.4	-0.1
7	0.1765	0.1	0.1	-0.1

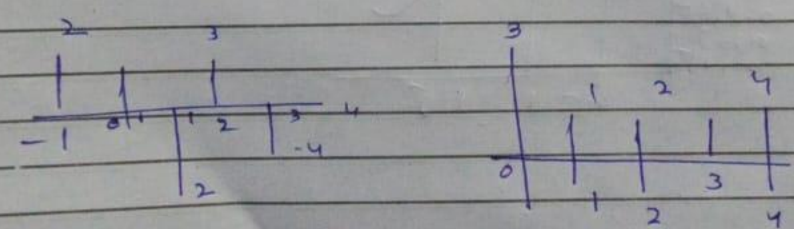
Q2

Q2 Determine the responce of the system

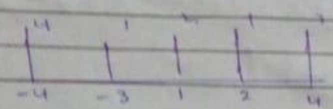
Following Signal with given Responce.

$x[n] = \{2, \underset{\uparrow}{1}, -2, 3, -4\}$ $h(n) = \{\underset{\uparrow}{3}, 1, 2, 1, 4\}$

Solution: →



$n[-K]$ = folded signal



$n[K]$

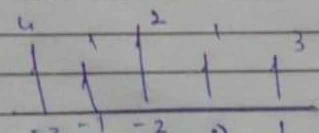
$$y[0] = \sum_{K=-1}^{0} x[-1]\, h[-1] - 1[0]\, h(0)$$

$$2 \times 1 + (1)(3)$$

$$= 5$$

For $n = 1$

$n(1-K)$



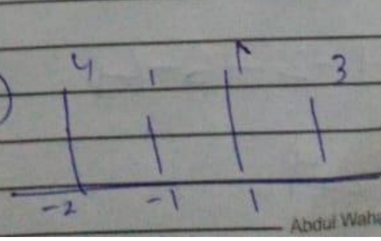
$$y[n] = \sum_{K=1}^{1} x[n] [h(1-K)$$

$$= (2)(2) + (1)(1) + (3)(-2)$$

$$= 1$$

$n = 2$

$n(2-K)$

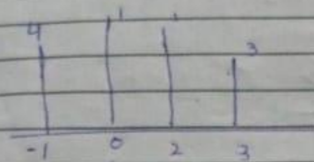


$n(2-K)$

$(2)(1)+(1)(2)+(-2)(1)+(3)(3)$

$= 11$

$n = 3$



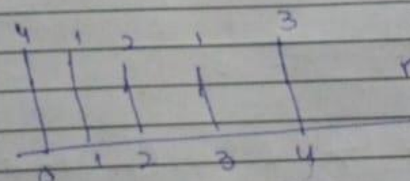
$n(3-k)$

$$y(3) = \sum_{k=-2}^{3} x(n)h(3-k)$$

$= 4+1-4+3-12$

$= 8$

$n=4$



$n(4-k)$

$$f(4) = \sum_{k=}^{4} x(n)h(4-k)$$

$x(0)h(0)+x(1)h(1)+x(2)(2)+x(3)$
$n(3)$

$= 4-2+6-4$

$= 4$

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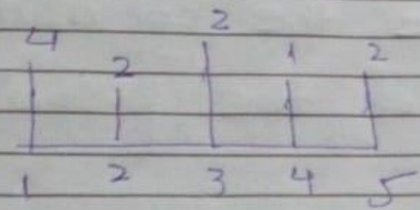
$n = 5$

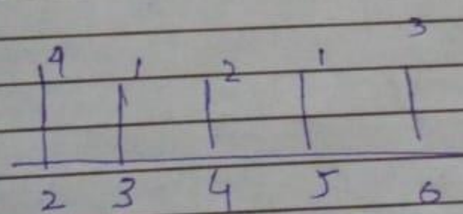


$$y(5) = \sum_{k=1} x(n)\, h(5-k)$$

$= -8 + 3 - 8$

$= 13$

$n = 6$



$= (3)(4) + (1) - (4)$

$= 8$

Q#3 Compute the convolution $y[n]$ of the following signal.

$$x(n) = \begin{cases} \alpha^{n+1}, & -3 \le n \le 5 \\ 0, & \text{else where} \end{cases}$$

$$h(n) = \begin{cases} 2^{n}, & 0 \le n \le 4 \\ 0, & \text{elsewhere.} \end{cases}$$

Solution:→

$$x(n) = x(K)\{\alpha^{-2}, \alpha^{-1}, 1, \alpha, \alpha^{2}, \alpha^{3}, \alpha^{4}, \alpha^{4}, \alpha^{5}, \uparrow\alpha^{6}, 0, 0\}$$

$$(n) = h(K) = \{0 \dots 0, 1, 2, 4, 8, 16, 0, \dots\}$$

To find $y(n)$

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

For $n=0$ first to find $h(n-K)$

$= h(0-K)$

So by inverting $h(K) \times h(-K)$

$\Rightarrow h(-k) = \{16, 8, 4, 2, 1\}$ — (2)

So $y(0) = \sum_{k=-\infty}^{\infty} x(k$

So $y(0) = \sum_{k=-\infty}^{\infty} x(k) \times h(-k)$

$y(0) = (\alpha^{-2} \times 8) + (\alpha^{-1} \times 4) + (1 \times 2) + (\alpha \times 1)$

$y(0) = 8\alpha^{-2} + 4\alpha^{-1} + \alpha + 2$

for $n=1$, $h(1-k) = \{16, 8, 4, 2, 1\}$

So, $y(1) = (\alpha^{-2} \times 16) + (\alpha^{-1} \times 8) + (1 \times 4)$
$+ (\alpha \times 2) + (\alpha^2 \times 1)$

$y(1) = 16\alpha^{-2} + 8\alpha^{-1} + 4 + 2\alpha + \alpha^2$

Now for $n=2$

$h(2-k) = \{16, 8, 4, 2, 1\}$

$y(2) = (\alpha^{-1} \times 16) + (1 \times 8) + (\alpha \times 4)$
$+ (\alpha^2 \times 2) + (\alpha^3 \times 1)$

$= 16\alpha^{-1} + 8 + 4\alpha + 2\alpha^3 + \alpha^3$

Similarly For $n=3$

$n(3-k) = \{16, 8, 4, 2, 1\}$

$y(3) = (1 \times 16) + (\alpha \times 8) + (\alpha^2 + 4) +$
$(\alpha^3 \times 2) + (\alpha^4 \times 1)$

$= 16, 8\alpha + 4\alpha^2 + 2\alpha^3 + \alpha^4$

Now

$n(4-k) = \{16, 8, 4, 2, 1\}$

$y(4) = (\alpha \times 16) + (\alpha^2 \times 8) + (\alpha^3 + 4)$
$+ (\alpha^4 + 2) + (\alpha^5 + 1)$

$= 16\alpha^2 + 8\alpha^3 + 4\alpha^4 + 2\alpha^5 + \alpha^6$

Similarly if we calculate for rest of the values of n uptill there are any common values we get.

$y(6) = 0 + 0 + 16\alpha^3 + 8\alpha^4 + 4\alpha^5 + 2\alpha^6$

$y(7) = 0 + 0 + 0 + 16\alpha^4 + 8\alpha^5 + 4\alpha^6$

$y(8) = 0 + 0 + 0 + 0 + 16\alpha^5 + 8\alpha^6$

$y(9) = 0 + 0 + 0 + 0 + 0 + 16\alpha^6$