Question 1 (a):-

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

Sol:-

According to sampling theorm

$F_1 = 100Hz$, $F_2 = 200Hz$

$F_s \geq 2F_{max}$ $\qquad f = \frac{\omega}{2\pi}$

So,

f_2 is max (greater than f_1)

$f_s > 2 \times 100$

$f_s = 200\ Hz$

ii) Sol:-

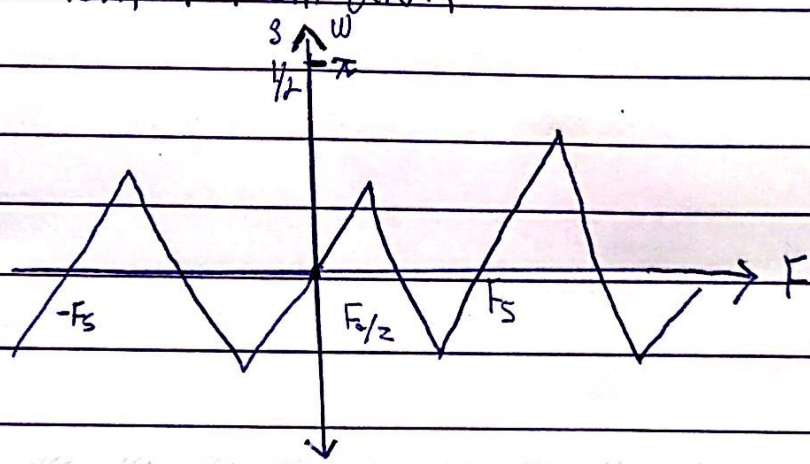
$f_s = 100Hz$

$f = \frac{100}{2} = 50\ Hz$

This is the max frequency that can be represented uniquely by the sampled signal

As $x_a[n] = 3\cos 2\pi (50/100) n + 4\sin 2\pi (100/100) n$

$= 3\cos\pi (5/10) n + 4\sin 2\pi n$



The effect of sampling rate on the newly generated discrete time signal is that. There will be no display phenomenan mean there will be not present unwanted compsent in Reconstruct of the signal.

iii) Sol:-

$$\text{folding frequency} = \frac{f_1}{2} = \frac{100}{2} = 50$$

$f_1 = 50\,Hz$, $f_2 = 100\,Hz$

frequency are either equal or greater the folding frequency
Hence for ideal interporation we can construct the orignal signal.

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

since only the frequency compounds at 100Hz are present on, the sampled signal. The analog signal we can remove or reconstruct is

$$y_a(t) = 3\cos 100\pi t \quad \underline{Ans}$$

Question 1(b):-

Consider a discrete time signal which is give

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

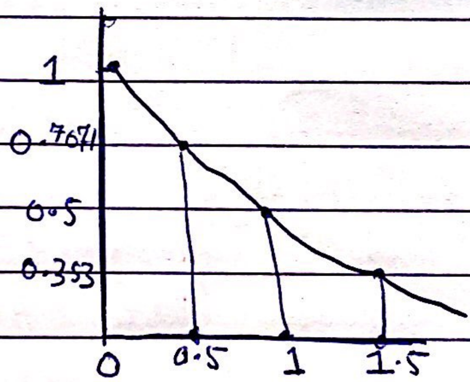
This signal is smapled at the rate $F_s = 2Hz$

i) Draw the sampled signal

$f_s = \frac{1}{T} \Rightarrow T = 1/f_s$

$= 1/2 = 0.5$ sec.

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



ii) The smaples of the signal .... signal achived.

Ans:-

$L = 2^n$

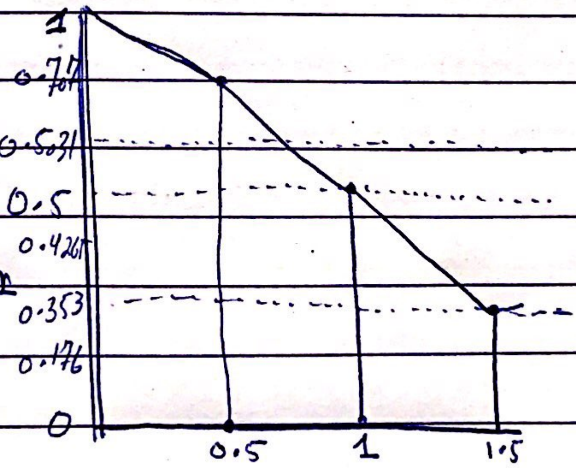
$n = bits = 3$

$L = 2^3 = 8$ levels

Resolution $= \frac{x_{max} - x_{min}}{L}$

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

$= 0.125$



iii)

	Distcrete Signal	inreution	Reading	error
0	1	1.6	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	0.0
6	0.353	0.3	0.4	-0.1
7	0.1765	0.2	0.1	-0.1

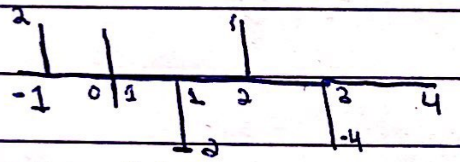
Question 2 :-

Determine the response of the system

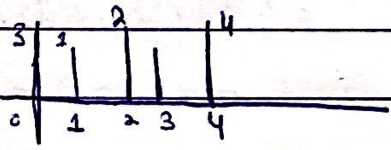
a) Input signal with given impulse response.

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

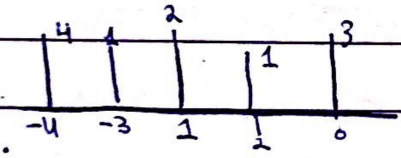
Sol:- $y[n] = \sum_{-\infty}^{\infty} x[K]\, h(n-K)$



h(K)



h(-K) folded signal

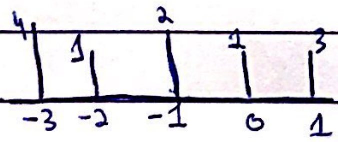


h(-K)

$$Y[0] = \sum_{K=1}^{0} x[-1]\, h[-1] + x(0)\, h(0)$$
$$= 2 \times 2 + (1)(3)$$
$$= 5$$

for $n = 1$

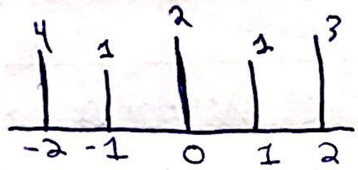
h(1-K)



$$Y[1] = \sum_{K=1}^{1} x(h]\, [h(1-k)]$$
$$= x(-2)h[-1] + x(0)h(0) + x(1)h(1)$$
$$= (2)(2) + (1)(1) + (3)(-2)$$
$$= 4 + 1 - 6$$
$$= -1$$

$n=2$

$h(2-K)$



$Y(2)= \sum_{K=?}^{2} n(n)\ h(2-k)$

$n(-1)\ h(-1) + 2(0) + h(0) + n(1)\ h(1)$

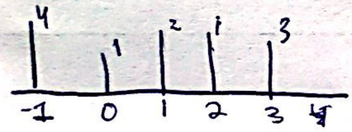
$n(1)\ h(-1) + n(0) + h(0) + n(1)(1)$

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

$= 2+2-2+9$

$= 11$

$n = 3$



$Y(3) = \sum_{K=0}^{3} n(n)\ h(3-K)$

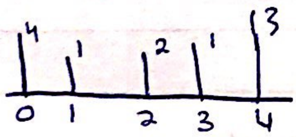
$\Rightarrow n(-1)\ h(-1) + n(0)\ h(0) + n(1)\ h(1) + n(n)\ h(2)$

$= 2\times 4 + (1)(1) + (-2)(2) + (3)(1) + (-4)(3)$

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

$= -8$

$n=4$



$h(4-K)$

$f(4) = \sum_{K=0}^{4} n(n)\ h(4-K)$

$= n(0)\ h(0) + n(1)\ h(4) + n(2)\ h(2) + n(3)\ h(3)$

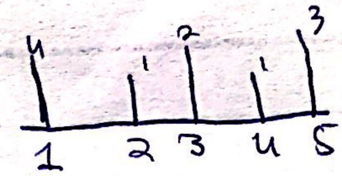
$= 4-2+6-4$

$= 4$

Scanned with CamScanner

③ Qu.2(a)

$n = 5$



$y(5=) \sum_{k1}^{5} n(h)\, h(5-k)$

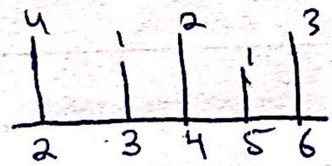
$= n(1)h(1) + n(2)h(2) + n(3)\, h(3)$

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

$= -8 + 3 - 8$

$= 13$

$n = 6$



$y(6) = \sum_{k=3}^{h=3} n(2)\, h(2) + n(3)\, h(3)$

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

$= 8$

Q2 (B)

Sol

We have

$x(n) = x(k) = \{ \alpha^{-2}, \alpha^{-1}, 1\, \alpha\, \alpha^2\, \alpha^4\, \alpha^5\, \alpha$

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

To find $y(n)$

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

for $n=0$ first to find $h(n-k) =$
$h = (0-k$

so by inverting $h(k)$ we get $h(-k$

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

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

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

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

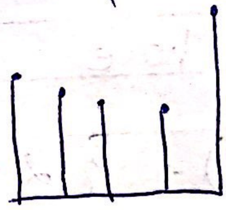
$= \alpha - 2 + 4\alpha 2 + 4\alpha^{-2}$

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

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

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

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

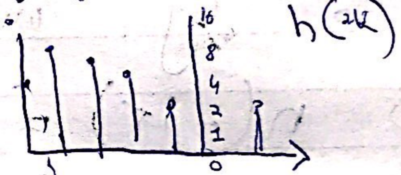


Now for $n=2$

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

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

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

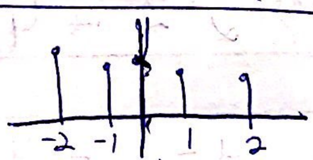


Now $n=3$

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

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

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



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

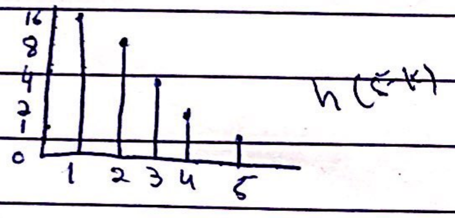
$$y(4) = (\alpha\times 16) + (\alpha^{2}\times 8) + (\alpha^{3}+4) + (\alpha^{4}\ldots + (\alpha^{5}+1)$$

$$16\alpha + 8\alpha^{2} + 4\alpha^{3} + 2\alpha^{4} + \alpha^{5}$$

$h(5-K) = \{0, 16, 8, 4, 2, 1\}$

$y(5) = (\alpha^1 \times 0) + (\alpha^2 \times 16) + (\alpha^3 \times 8) + (\alpha^4 \times 4) + (\alpha^5 \times 2)$

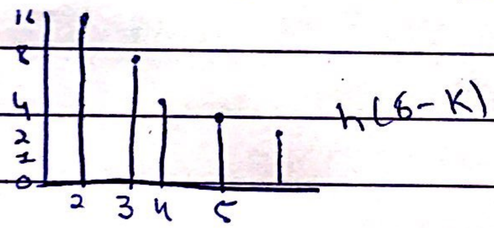
$= 16\alpha^2 + 8\alpha^3 + 4\alpha^4 + 2\alpha^5 + \alpha^6$



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

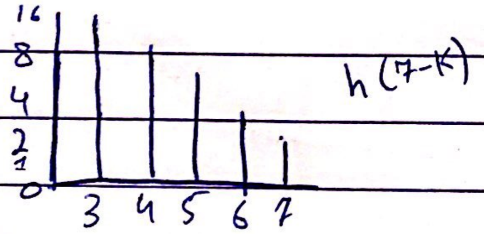
$y(6) = 0 + 0 + 16\alpha^3 + 8\alpha^4 + 4\alpha^5 + 2\alpha^6$

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



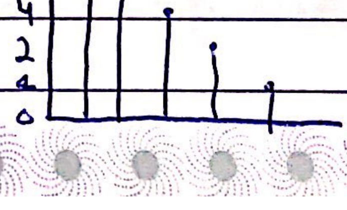
$y(7) = 0 + 0 + 0 + 16\alpha^4 + 8\alpha^5 + 4\alpha^4$

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



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

$\rightarrow 16\alpha^5 + 8\alpha^6$



Q No 3

(i)

Sol As we know that

Z - transform

$$X(Z) = \sum_{n=0}^{\infty} (1/4)^n_z + \sum_{n=0}^{0} (1/3)^n_{zn} - 1$$

Using Geometric Series

$$\Rightarrow \frac{1}{1 - 1/4 z^{-1}} + \sum_{n=0}^{\infty} (1/3)^n z^n - 1$$

$$\Rightarrow \frac{1}{1 - \frac{1}{4} z^{-1}} + \frac{1}{1 - 1/3} - 1$$

$$\Rightarrow 1 - \frac{1/1}{4} Z^{-1} + \frac{1}{1 - 2/3} - 1$$

$$\Rightarrow (1 - 1/4) z^{-1} \left(1 - 1/3\, z^{-3}\right)^{-1}$$

$$\frac{1 - 1/3\, z + 1 - 1/4\, z^{2} \left(1 - 1/4\, z^{-2}\right)\left(1 - 1/3 \right.}{\left(1 - 1/4 z^{3}\right)\left(1 - 1/3\, z\right)}$$

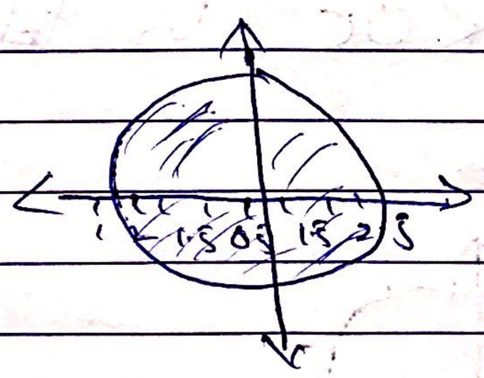
$$\frac{1 - 1/3\, z + 1 - 1/4\, z^{1} - 1 + 1/3 + 1/4\, z + 1/12}{(1 - 1/4\, z^{1})(1 - 1/3\, z)}$$

$$\frac{1 - 1/12}{1 - 1/4\, z^{2}(1 - 1/3\, z)}$$

$$\frac{13/12}{(1 - 1/4\, z^{-2})(1 - 1/3\, \cancel{z})}$$

Hence the ROC is $1/4 < |z| < 3$

The Sketch is under



Q3 (ii)

Sol

Using the z transform Pair eq

i.e $x(n) = \alpha^n u(n) \longleftrightarrow X(z) = \frac{1}{1-\alpha z^{-1}}$ — (1)

By putting values

$$X(z) = \sum_{n=0}^{\infty} (1/2) z^{n} \, {}_{-n} - \sum_{n=0}^{\infty} 2^n z^{-n}$$

$$\frac{1}{1-1/2 z^{-3}} - 1/1-2z^{2}$$

$$\frac{-\frac{5}{2} z^{-1}}{(1-1/2 z^{1})(1-2z^{-1})}$$

As seen The ROC is $|z| > 2$

The sketch are