**LAB#05**

**Object:** Computation of Discrete Fourier Transformer.

**TASK #01:**

Data sequence is given as follows:

X(n)={1 0 0 1}

Compute by hand the DFT function X(k).

**SOLUTION:**

**TASK #02:**

Use FFT command to compute the DFT function for the given data sequence in Task1.

**CODING:**

x=[1 0 0 1]

n=0:3

y=fft(x)

**RESULT:**

y = 2.0000 1.0000 + 1.0000i 0 1.0000 - 1.0000i

**TASK #03:**

Plot the magnitude and phase graphs of DFT function of Task 2.

**CODING:**

x=[1 0 0 1]

n=0:3

y=fft(x)

y1=abs(y)

y2=angle(y)

subplot(2,1,1)

plot(n,y1)

subplot(2,1,2)

plot(n,y1)

**FIGURE:**



**TASK #04:**

Plot a^n sequence , where a=0.8 & n= 0 t0 35 .Find its DFT, Plot its magnitude & phase graphs also.

**CODING:**

a=0.8

n=0:35

x=a.^n

y=fft(x)

y1=abs(y)

y2=angle(y)

subplot(2,1,1)

plot(n,y1)

subplot(2,1,2)

plot(n,y2)

**FIGURE:**



**TASK #05:**

Take IDFT of the results of Task 2 & verify the output.

**CODING:**

x=[ 2.0000 1.0000 + 1.0000i 0 1.0000 - 1.0000i]

n=0:3

y=ifft(x)

**RESULT:**

y = 1 0 0 1

**TASK #06:**

Given three sinusoids :

X1(t)=5cos(1000πt)

X2(t)= 5cos(2400πt+0.25π)

X3(t)=5cos(3200πt+0.5π)

1. Create a Matlab program to sample each sinusoid & generates a sum of three signal i-e x(n)=x1(n)+x2(n) .Using fs=8000hz . Plot the sum x(n).
2. Compute DFT of x(n) & plot the result.

**CODING:**

f1=500

f2=1200

f3=1600

fs=8000

n=0:50

x1=5\*cos(2\*pi\*f1\*n/fs)

x2=5\*cos((2\*pi\*f2\*n)/fs+0.25\*pi)

x3=5\*cos((2\*pi\*f3\*n)/fs+0.5\*pi)

x=x1+x2+x3

stem(n,x)

**FIGURE:**

**TASK #07:**

For a sequence x(n)=[5 0 -3 4] . Prove Passeval theorem

∑|x(n)|^2 ↔1/N ∑|x(K)|^2

**CODING:**

x=[5 0 -3 4]

n=0:3

y=abs(x)

z=y.^2

s1=sum(z)

N=4

y1=fft(x)

y2=abs(y1)

y3=y2.^2

s2=(1/N)\*sum(y3)

**RESULT:**

**∑|x(n)|^2**

y = 5 0 3 4

z = 25 0 9 16

**s1= 50**

**1/N ∑|x(K)|^2**

N =4

y1 = 6.0000 8.0000 + 4.0000i -2.0000 8.0000 - 4.0000i

y2 = 6.0000 8.9443 2.0000 8.9443

y3 = 36.0000 80.0000 4.0000 80.0000

**s2 =50.0000**

**TASK #08:**

Prove linearity by taking a1=0.8 and a2=0.1.

When

x1(n)=(1/4)^n -1<n<16

x2(n)=cos(0.375πn) -1<n<16

**CODING:**

a1=0.8

a2=0.1

n=0:15

x1=(1/4).^n

x2=cos(0.375\*pi\*n)

y1=fft(a1\*x1+a2\*x2)

y2=fft(x1)

y3=fft(x2)

y=a1\*y2+a2\*y3

subplot(2,1,1)

stem(n,y1)

title('fft(a1x1(n)+a2x2(n))')

subplot(2,1,2)

stem(n,y)

title('a1x1(k)+a2x2(k)')

**FIGURE:**

