EXPERIMENT NO.6

AIM: To calculate N point DFT of a sequence and study its properties.

APPARATUS: MATLAB software

THEORY:

The DFT is one of the most powerful tools in digital signal processing which enables us to find the spectrum of a finite-duration signal. Discrete Fourier DFT is purely discrete: discrete-time data sets are converted into a discrete-frequency representation. This is in contrast to the DTFT that uses discrete time, but converts to continuous frequency. Since the resulting frequency information is discrete in nature, it is very common for computers to use DFT calculations when frequency information is needed.

There is an algorithm for computing the DFT that is very fast on modern computers. This algorithm is known as the Fast Fourier Transform (FFT), and produces the same results as the normal DFT, in a fraction of the computational time as ordinary DFT calculations.

The DFT is defined as such:

X(k) = exp(-j*2*pi*n*k/N)

Properties of DFT are as follows:

1. Periodicity
2. Linearity
3. Circular Symmetries of a sequence
4. Symmetry Property of a sequence
5. Circular Convolution
6. Multiplication
7. Time reversal of a sequence
8. Circular Time shift
9. Circular frequency shift
10. Complex conjugate property

PROGRAM:

```
N=input("enter the value of N");
x=input("enter the sequence")
n=[0:1:N-1];
k=[0:1:N-1];
W=exp(-1j*2*pi/N);
nk=n'*k;
Wnk=W.^nk;
Xk=x*Wnk
```

OUTPUT:

enter the value of N 4

enter the sequence [1 2 3 4]

x = 1 2 3 4

Xk = 10.0000 + 0.0000i -2.0000 + 2.0000i -2.0000 - 0.0000i -2.0000 - 2.0000i

LINEARITY PROPERTY:

```
x1 = [ 1 2 3];
x2 = [5 6 7];
a1 = 2;
a2 = 3;
x = a1*x1 + a2*x2;
y =fft(x)
X1 = fft(x1);
X2 = fft(x2);
X = a1*X1 + a2*X2
```

OUTPUT:

y = 66.0000 + 0.0000i -7.5000 + 4.3301i -7.5000 - 4.3301i

X = 66.0000 + 0.0000i -7.5000 + 4.3301i -7.5000 - 4.3301i

POST LAB QUESTION:

Q1. Describe the different properties of DFT in detail.