EXPERIMENT NO.5

AIM: To solve the difference equation and calculate the system response.

APPARATUS: MATLAB software

THEORY:

In order to solve the difference equation, first it is converted into the algebraic equation by taking its Z-transform. Then, the solution of the equation is calculated in z-domain and finally, the time-domain solution of the equation is obtained by taking its inverse Z-transform.

The various responses of a system are −

- **Forced Response** - When the initial conditions are neglected, then the response of the system due to input alone is called *the forced response of the system.*
- **Natural Response** - the input is neglected, the response of the system due to initial conditions alone is called *the natural response of the system.*
- **Total Response** - The response of the system due to initial conditions and input considered simultaneously is called *the total response of the system.*
- **Impulse Response** - When the input to the system is a unit impulse signal, then the response of the system is called *the impulse response of the system.*
- **Step Response** - When the input to the system is a unit step signal, then the response of the system is called *the step response of the system.*

PROGRAM:

STEP RESPONSE

```
N= input('Enter the length of response = ');
num = [-1 2];
den = [1 -1/4 -3/8];
x = [ones(1,N)];
n = 0:1:N-1;
h = filter(num,den,x);
disp('Response of filter =');
disp(h);
subplot(2,1,1);
stem(n,x);
title('Step input');
xlabel('n');
ylabel('x(n)');
subplot(2,1,2);
stem(n,h);
```

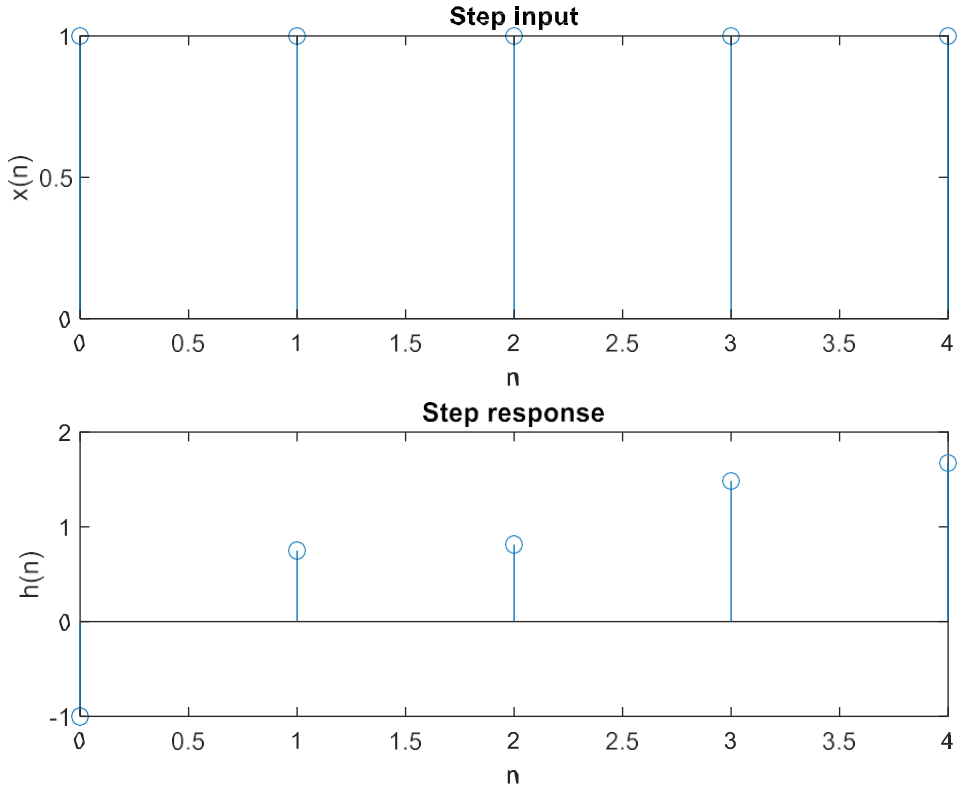
```
title('Step response');
xlabel('n');
ylabel('h(n)');
```

OUTPUT:

Enter the length of response = 5

Response of filter =

-1.0000 0.7500 0.8125 1.4844 1.6758



IMPULSE RESPONSE

```
N= input('Enter the length of response = ');
b = [-2 5/4];
a = [1 1/4 -1/8];
x = [1,zeros(1,N-1)];
n = 0:N-1;
h = filter(b,a,x);
disp('Response of filter =');
disp(h);
subplot(2,1,1);
stem(n,x);
```

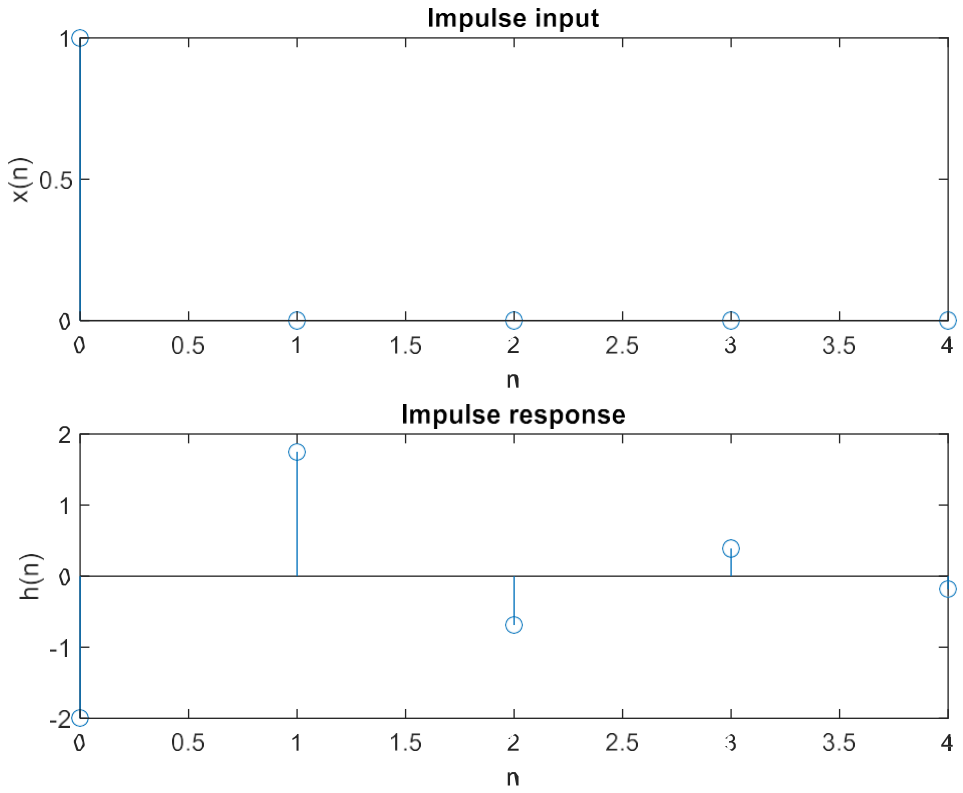
```
title('Impulse input');
xlabel('n');
ylabel('x(n)');
subplot(2,1,2);
stem(n,h);
title('Impulse response');
xlabel('n');
ylabel('h(n)');
```

OUTPUT

Enter the length of response = 5

Response of filter =

-2.0000 1.7500 -0.6875 0.3906 -0.1836



POST LAB QUESTION:

Q1. Describe the properties of Z Transform in detail.