Experiment No 1

LIT System: To find the impulse and step response of a given system, Solution of difference equation, Verification of Sampling Theorem.

i)LIT System

```
%Without initializing values
%y(n)+0.8y(n-2)+0.6y(n-3)=x(n)+0.7x(n-1)+0.5x(n-2)

clear all;
close all;
b=input('Enter the coefficients of x ');
a=input('Enter the coefficients of y ');
N=input('Enter the length of the input sequence ');
n=0:1: N;
step=1.^n;
imp=[1,zeros(1,N)];

RES1=filter(b,a,step)
RES2=filter(b,a,imp)

subplot(2,2,1)
stem(n,step)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Input ')

subplot(2,2,2)
stem(n,imp)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Impulse Input')

subplot(2,2,3)
stem(n,RES1)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Response')

subplot(2,2,4)
stem(n,RES2)
grid on
xlabel('Input');
ylabel('Output Response');
title('Impulse Response')
```

Result

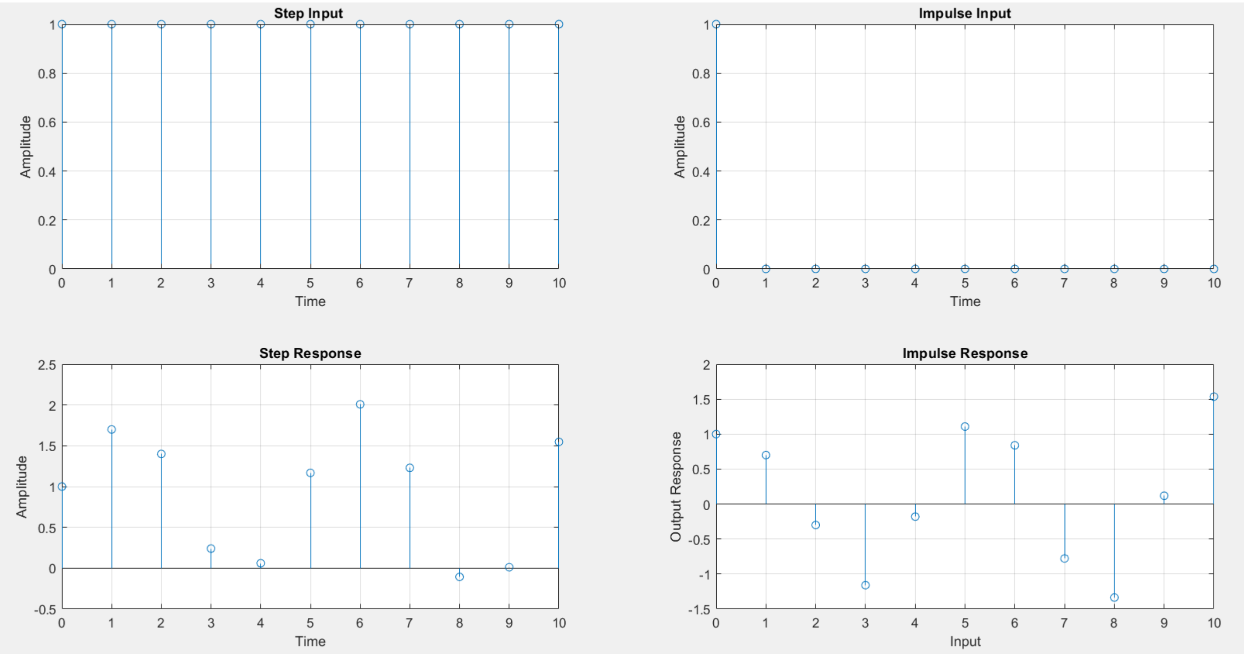
```
Enter the coefficients of x [1 0.7 0.5]
Enter the coefficients of y [1 0 0.8 0.6]
Enter the length of the input sequence 10

RES1 =

    1.0000    1.7000    1.4000    0.2400    0.0600    1.1680    2.0080    1.2296   -0.1072    0.0115
1.5480


RES2 =

    1.0000    0.7000   -0.3000   -1.1600   -0.1800    1.1080    0.8400   -0.7784   -1.3368
0.1187    1.5365
```



Program 2
%Initializing Y values
%y(n)=1//3x(n)+1/3x(n-1)+1/3x(n-2)+0.95y(n-1)-0.9025y(n-2)
%y(-1)=-2, y(-2)=-3

```
clear all;
close all;
b=input('Enter the coefficients of x ');
a=input('Enter the coefficients of y ');
N=input('Enter the length of the input sequence ');
n=0:1:N;
step=1.^n;
imp=[1,zeros(1,N)];

Y=[-2 -3];
```

```
XIC=filtic(b,a,Y);
RES1=filter(b,a,step,XIC)
RES2=filter(b,a,imp,XIC)

subplot(2,2,1)
stem(n,step)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Input ');

subplot(2,2,2)
stem(n,imp)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Impulse Input');

subplot(2,2,3)
stem(n,RES1)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Response');

subplot(2,2,4)
stem(n,RES2)
grid on
xlabel('Input');
ylabel('Output Response');
title('Impulse Response');
```

Result

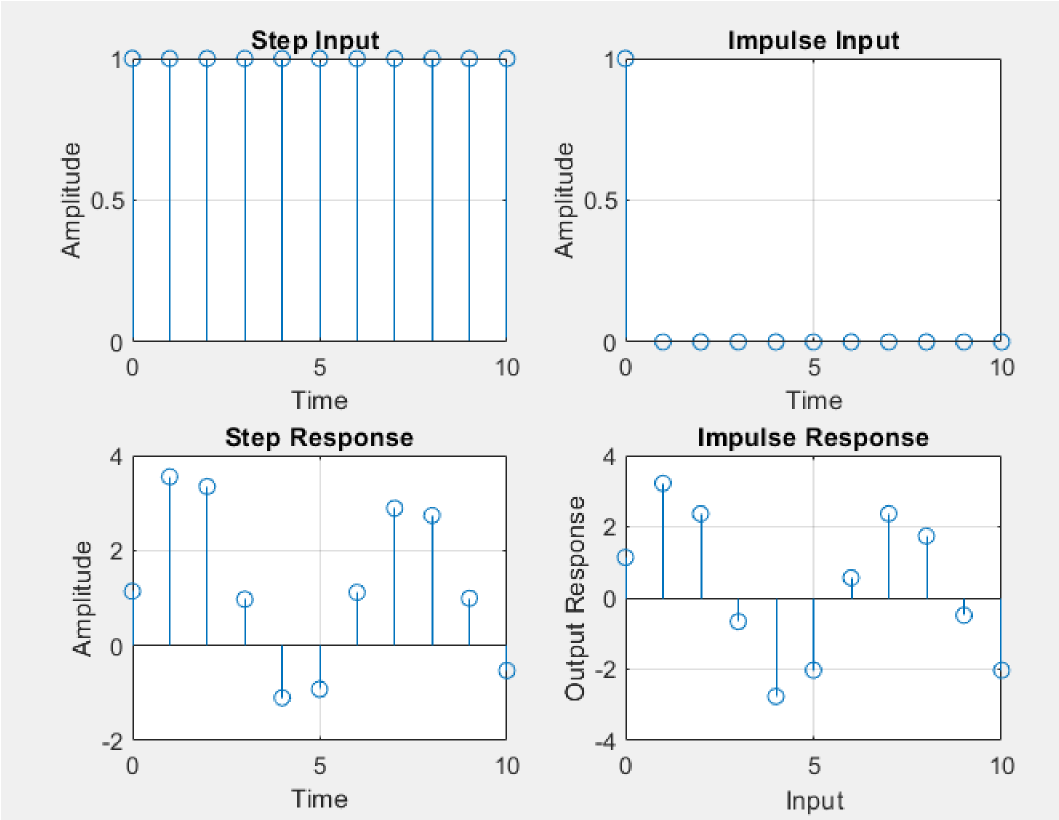
```
Enter the coefficients of x [1/3 1/3 1/3]
Enter the coefficients of y  [1 -0.95 0.9025]
Enter the length of the input sequence 10

RES1 =

    1.1408    3.5555    3.3481    0.9719   -1.0984   -0.9206    1.1167    2.8917    2.7393
0.9925
 -0.5293


RES2 =

    1.1408    3.2221    2.3647   -0.6615   -2.7626   -2.0275    0.5671    2.3686    1.7383   -
0.4862
 -2.0307
```



%For the given interval
%y(n)-y(n-1)+0.9y(n-2)=x(n) for all n
%n=-5:5

```
%For the given interval
%y(n)-y(n-1)+0.9y(n-2)=x(n) for all n
%n=-5:5

clear all;
close all;
b=input('Enter the coefficients of x ');
a=input('Enter the coefficients of y ');
n=-5:5;
step=[zeros(1,5) ones(1,5)];
imp=[zeros(1,5) 1 zeros(1,5)];

RES1=filter(b,a,step)
RES2=filter(b,a,imp)

subplot(2,2,1)
stem(step)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Input ');
```

```
subplot(2,2,2)
stem(imp)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Impulse Input');

subplot(2,2,3)
stem(RES1)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Step Response');

subplot(2,2,4)
stem(RES2)
grid on
xlabel('Time');
ylabel('Amplitude');
title('Impulse Response');
```

Result

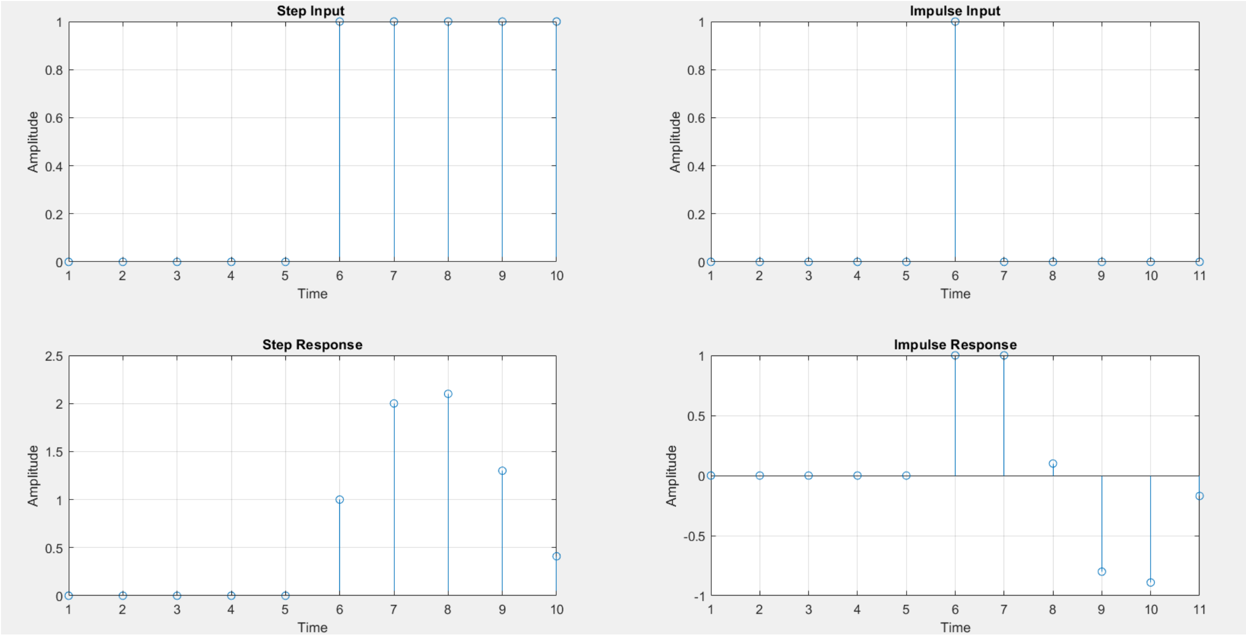
Enter the coefficients of x 1
Enter the coefficients of y [1 -1 0.9]

```
RES1 =

     0     0     0     0     0    1.0000    2.0000    2.1000    1.3000    0.4100


RES2 =

     0     0     0     0     0    1.0000    1.0000    0.1000   -0.8000   -0.8900   -0.1700
```



ii) Sampling Theorem

```
close all;
clear all;
t=0:0.001:0.1;
f1=input('Enter the Input Frequency1 = ');
f2=input('Enter the Input Frequency2 = ');

%Input Signal
y=cos(2*pi*f1*t) + cos(2*pi*f2*t);
fm=max(f1,f2);

subplot(4,1,1)
plot(t,y);
grid on;
title('Input Sinusoidal Signal');
xlabel('Time(s)');
ylabel('Amplitude(V)');

%Under Sampling
fs1=fm;
ts1=1/fs1;
tx1=0:ts1:0.1;
y1=cos(2*pi*f1*tx1) + cos(2*pi*f2*tx1)

subplot(4,2,3)
stem(tx1,y1);
grid on;
title('Sinusoidal Signal sampled at fs=fm Hz');
xlabel('Time(s)');
```

```
ylabel('Amplitude(V)');

subplot(4,2,4)
plot(tx1,y1);
grid on;
title('Recovered Signal sampled at fs=fm Hz');
xlabel('Time(s)');
ylabel('Amplitude(V)');

%Right Sampling
fs2=2*fm;
ts2=1/fs2;
tx2=0:ts2:0.1
y2=cos(2*pi*f1*tx2) + cos(2*pi*f2*tx2)

subplot(4,2,5)
stem(tx2,y2);
grid on;
title('Sinusoidal Signal sampled at fs=2*fm Hz');
xlabel('Time(s)');
ylabel('Amplitude(V)');

subplot(4,2,6)
plot(tx2,y2);
grid on;
title('Recovered Signal sampled at fs=2*fm Hz');
xlabel('Time(s)');
ylabel('Amplitude(V)');

%Over Sampling
fs3=3*fm;
ts3=1/fs3;
tx3=0:ts3:0.1;
y3=cos(2*pi*f1*tx3) + cos(2*pi*f2*tx3)

subplot(4,2,7)
stem(tx3,y3);
grid on;
title('Sinusoidal Signal sampled at fs=3*fm Hz');
xlabel('Time(s)');
ylabel('Amplitude(V)');

subplot(4,2,8)
plot(tx3,y3);
grid on;
title('Recovered Signal sampled at fs=3*fm Hz');
xlabel('Time(s)');
```

```
ylabel('Amplitude(V)');
```

Result

Enter the Input Frequency1 = 100
Enter the Input Frequency2 = 200