AVIT
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY

VINAYAKA MISSION'S RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Accredited by NAAC

Approved by AICTE

SIGNAL PROCESSING LAB

II Year / IV Semester ECE - R_2017 - SCBCS

HOD/ ECE

TABLE OF CONTENTS

Generation of Elementary Signals – Unit Impulse Signals

Exp. No.: 1 a) **Date:**

Aim:

To generate a Unit Impulse Signals of desired frequency and amplitude using simulation software.

Software required:

MATLAB 9

Program:

```
clc;
close all;
clear all;
n=input('Enter the value of n');
x= -n:1:n;
y= [zeros(1,n),ones(1,1),zeros(1,n)];
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('Unit Impulse Signal');
```

Result:

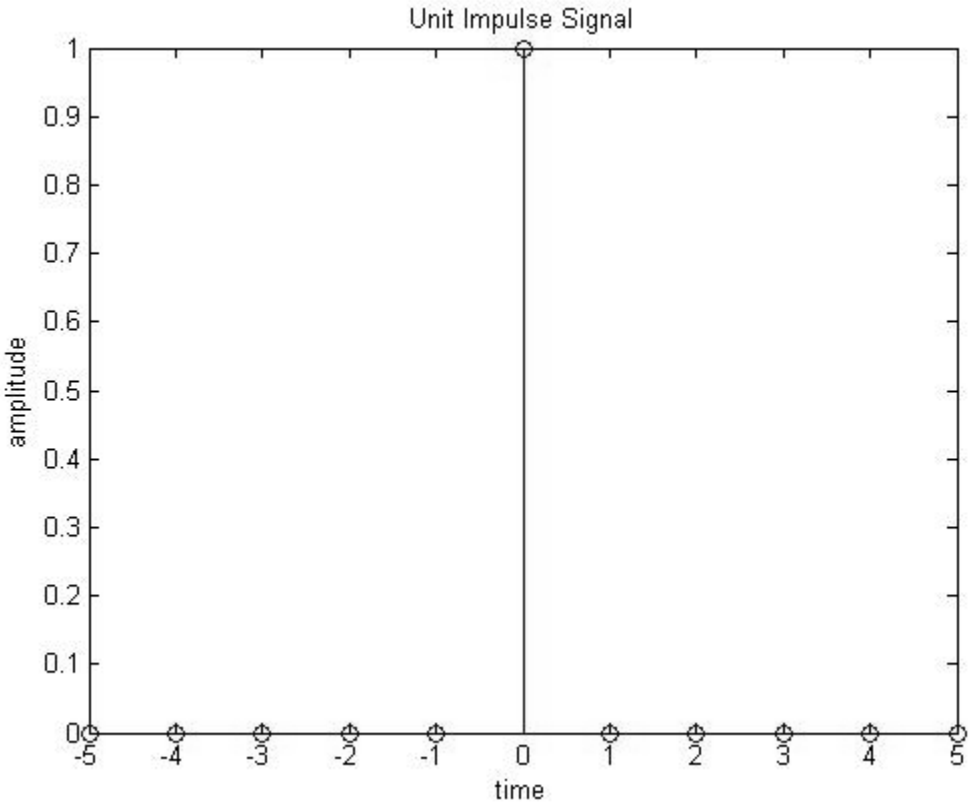
A Unit Impulse Signals was generated using MATLAB

OBSERVATION:

COMMAND WINDOW:

Enter the value of n - 5

OUTPUT WAVEFORM:



Generation of Elementary Signals – Unit Step Signals

Exp. No.: 1 b) **Date:**

Aim:

To generate a Unit Step Signals of desired frequency and amplitude using simulation software.

Software required:

MATLAB 9

Program:

```
clc;
close all;
clear all;
n=input('Enter the value of n');
x= -n:1:n;
y= [zeros(1,n),ones(1,n+1)];
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('UNIT Step Sequence');
```

Result:

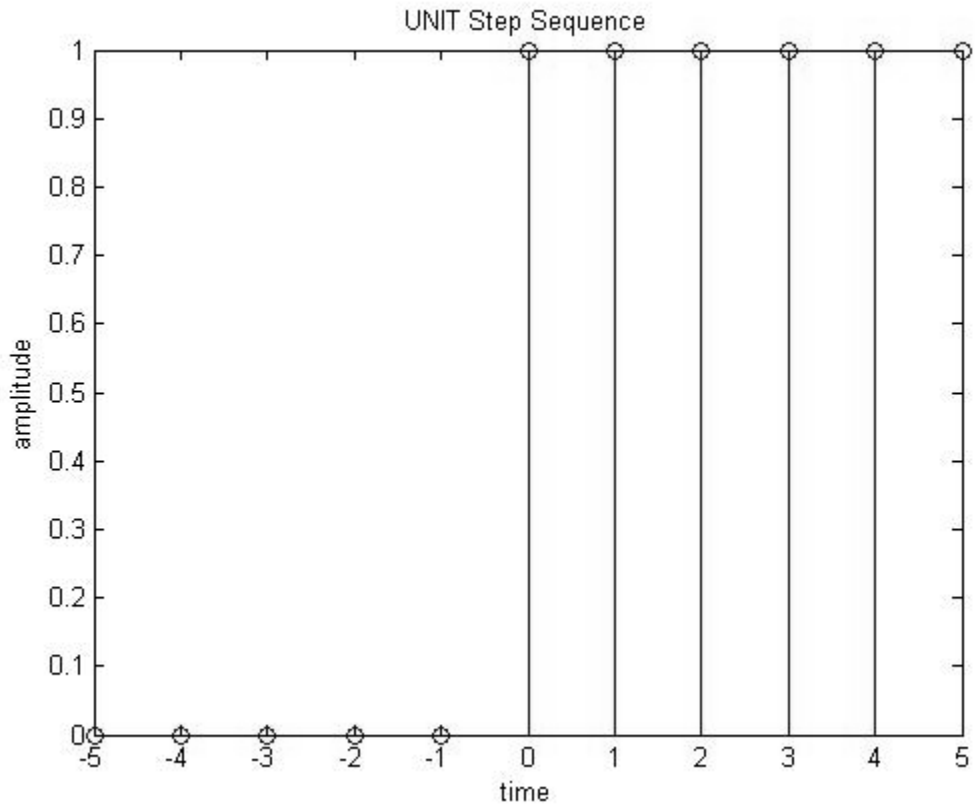
A Unit Step Signals was generated using MATLAB

OBSERVATION:

COMMAND WINDOW:

Enter the value of n - 5

OUTPUT WAVEFORM:



Generation of Elementary Signals – Unit Ramp Signals

Exp. No.: 1 c) **Date:**

Aim:

To generate a Unit Ramp Signals of desired frequency and amplitude using simulation software.

Software required:

MATLAB 9

Program:

```
clc;
close all;
clear all;
n=input('Enter the value of n');
x= -n:1:n;
y= [zeros(1,n+1), 1:1:n];
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('UNIT RAMP SIGNAL');
```

Result:

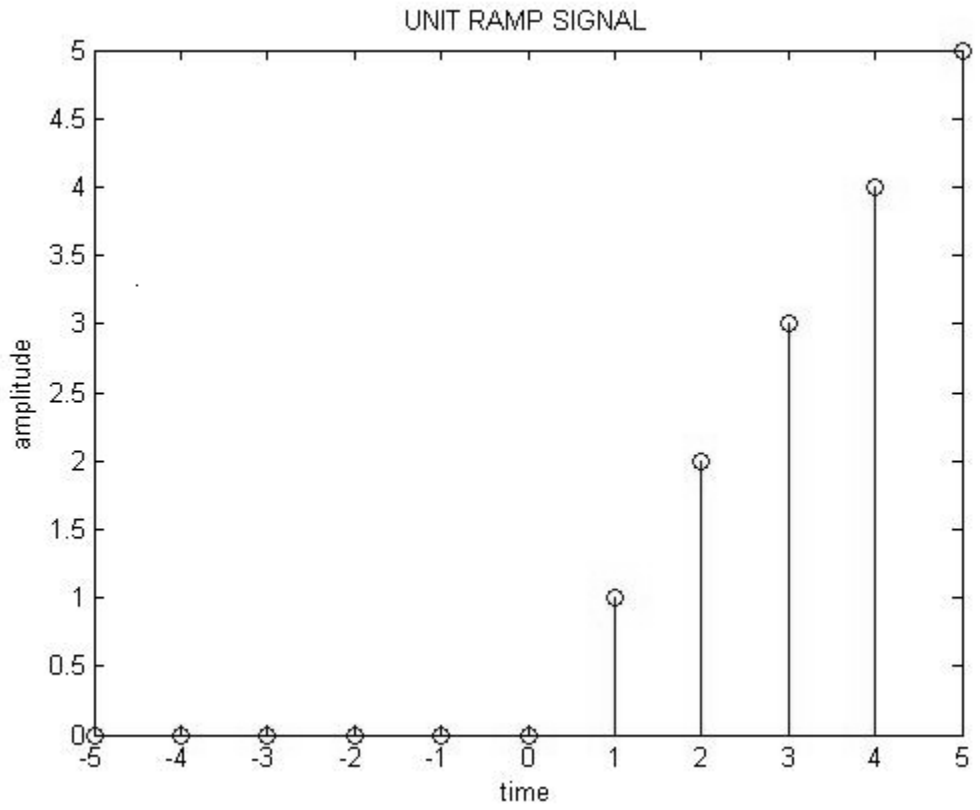
A Unit Ramp Signals was generated using MATLAB

OBSERVATION:

<u>COMMAND WINDOW:</u>

Enter the value of n - 5

OUTPUT WAVEFORM:



Generation of Signals – Exponential Signals

Exp. No.: 2 a) **Date:**

Aim:

To generate an Exponential signal of desired frequency and amplitude using simulation software.

Software required:

MATLAB 9

Program:

Rising Exponential signal

```
clc;
close all;
clear all;
n=input('Enter the value of n');
x= -n:1:n;
y= exp(x);
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('Rising exponential Signal');
```

Falling exponential Signal

```
clc;
close all;
clear all;
n=input('Enter the value of n');
x= -n:1:n;
y= exp(-x);
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('Falling exponential Signal');
```

Result:

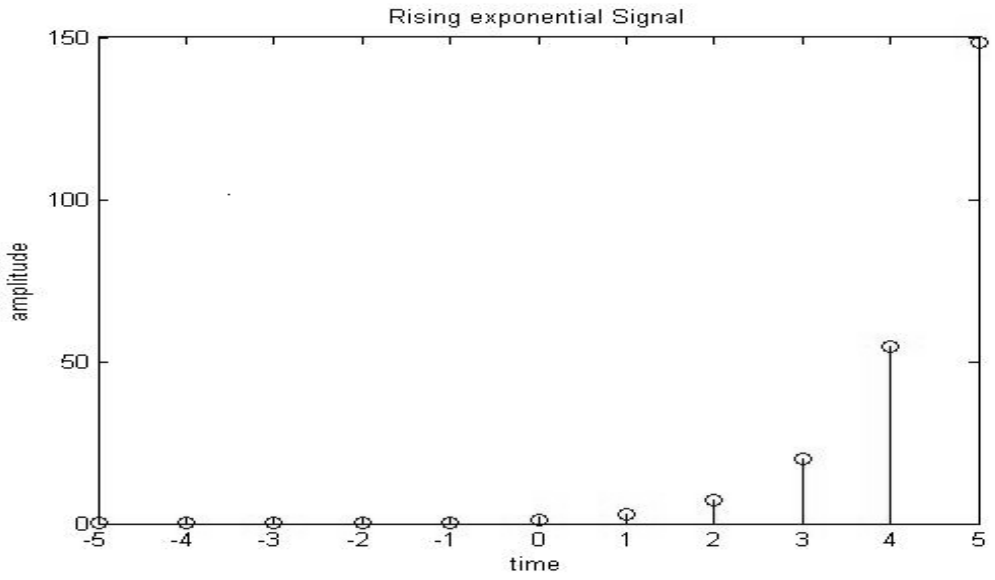
Exponential Signals was generated using MATLAB

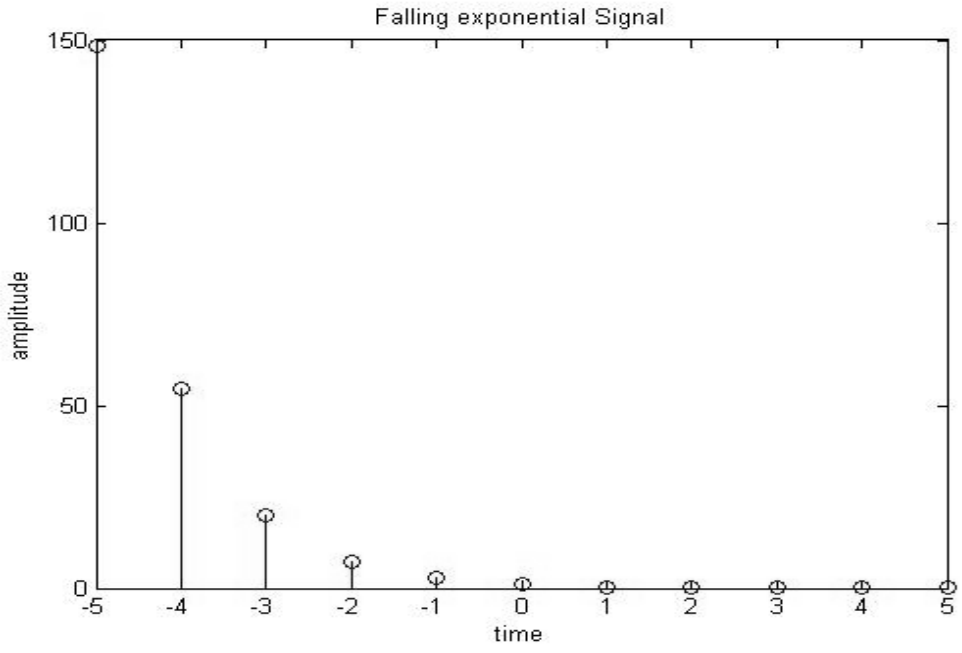
OBSERVATION:

COMMAND WINDOW:

Enter the value of n - 5

OUTPUT WAVEFORM:





Generation Signals – Power Signals

Exp. No.: 2 b) **Date:**

Aim:

To generate a power Signals of desired frequency and amplitude using simulation software.

Software required:

MATLAB 9

Program

```
clc;
close all;
clear all;
n=input('Enter the value of n');
a=input('Enter the value of a');
x= 0:1:n;
y=a.^x;
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('power Signal');
```

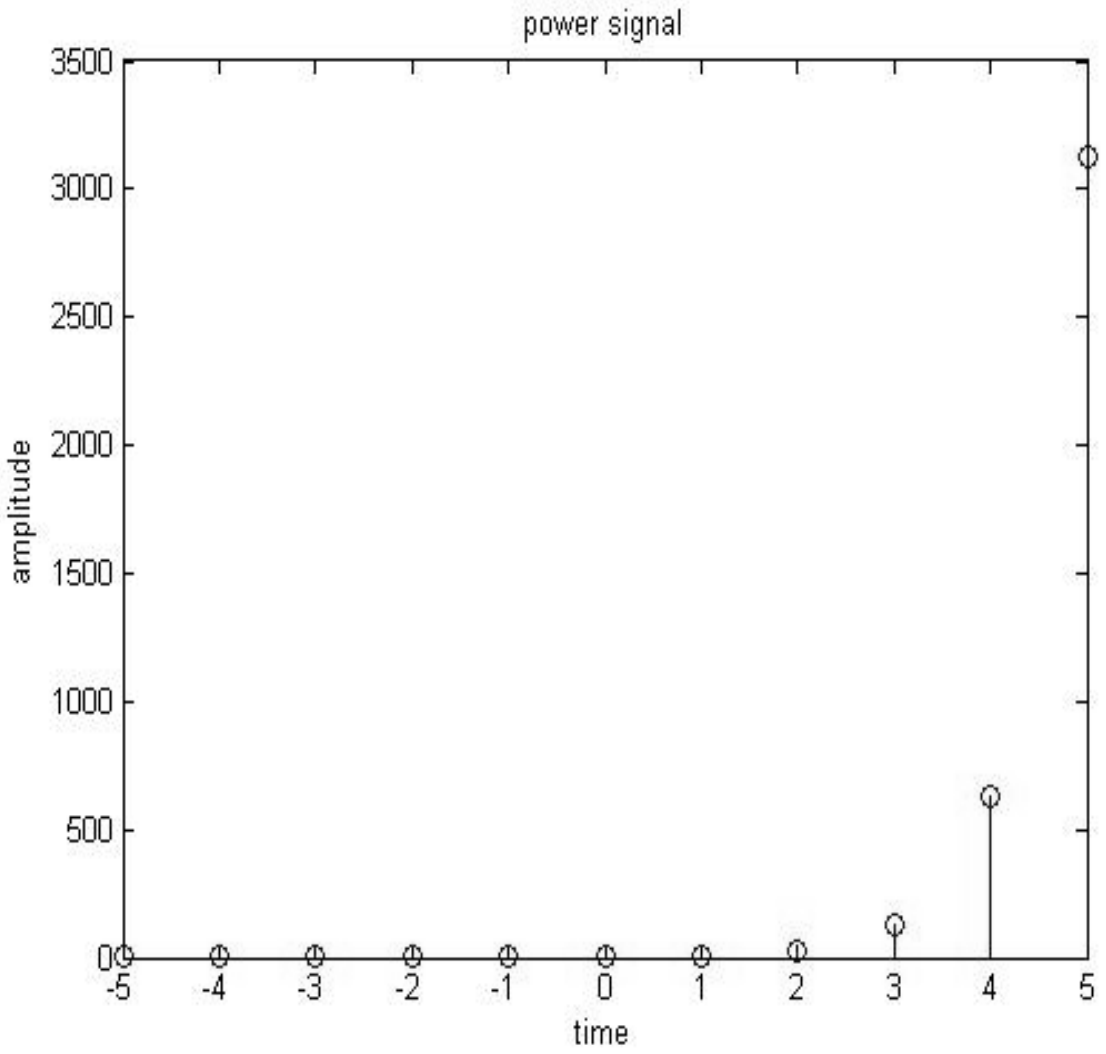
Result:

A power Signals was generated using MATLAB

OBSERVATION:

COMMAND WINDOW:

Enter the value of n - 5



Generation Signals – Cosine Wave

Exp. No.: 3 a) **Date:**

Aim:

To generate a cosine wave of desired frequency and amplitude using MATLAB.

Software required:

MATLAB 9

Program:

Discrete Cosine Wave

```
clc;
close all;
clear all;
x= 0:0.01:pi;
y= 5*cos(2*pi*x);
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('Discrete Cosine signal');
```

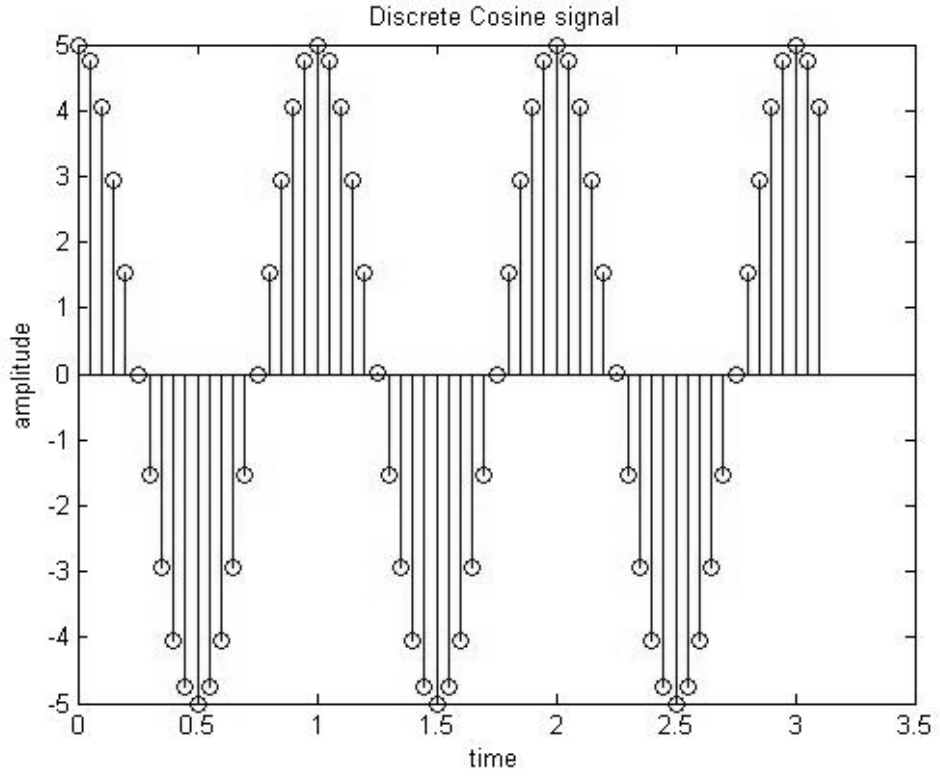
Continuous Cosine Wave

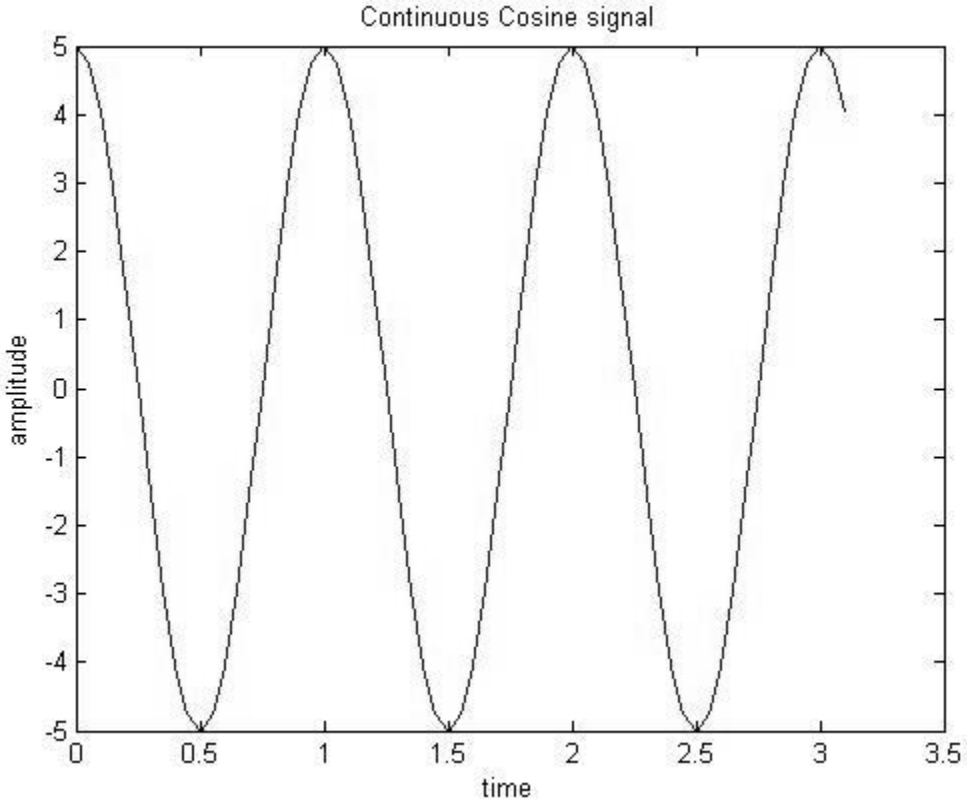
```
clc;
close all;
clear all;
x= 0:0.05:pi;
y= 5*cos(2*pi*x);
plot(x,y);
xlabel('time');
ylabel('amplitude');
title('Continuous Cosine signal');
```

Result:

A Cosine wave of frequency, f and amplitude, A was generated using MATLAB

OUTPUT WAVEFORM:





Generation Signals – Sine Wave

Exp. No.: 3 b) **Date:**

Aim:

To generate a sine wave of desired frequency and amplitude using MATLAB .

Software required:

MATLAB 9

Program:

DiscreteSine Wave

```
clc;
close all;
clear all;
x= 0:0.01:pi;
y= 5*sin(2*pi*x);
stem(x,y);
xlabel('time');
ylabel('amplitude');
title('Discrete sine signal');
```

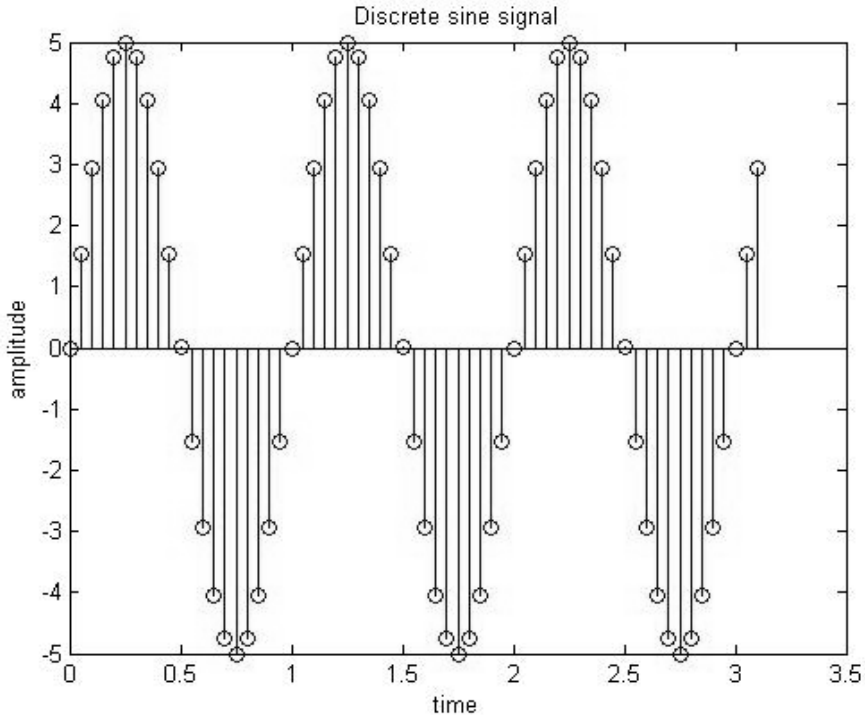
Continuous Sine Wave

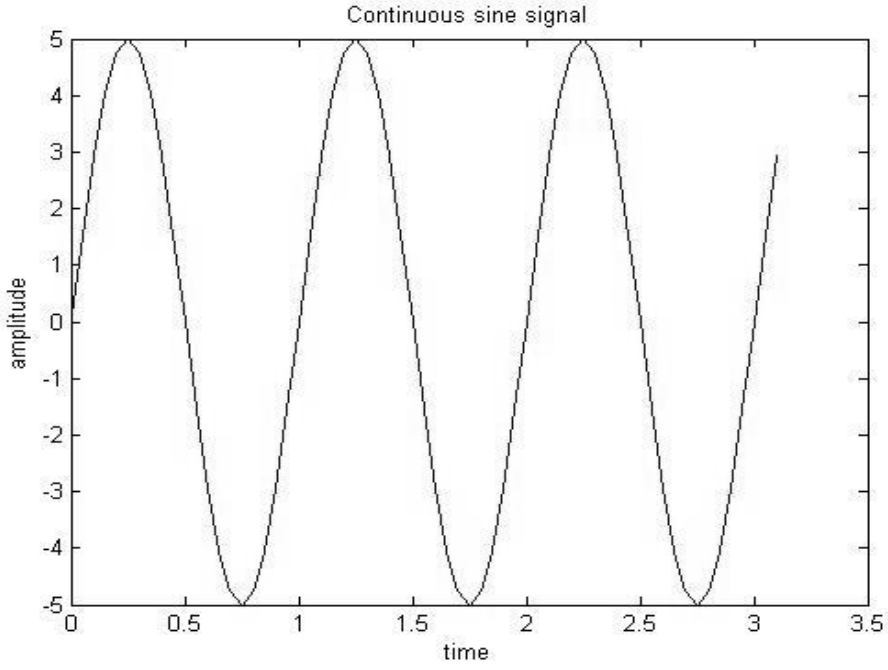
```
clc;
close all;
clear all;
x= 0:0.05:pi;
y= 5*sin(2*pi*x);
plot(x,y);
xlabel('time');
ylabel('amplitude');
title('Continuous sine signal');
```

Result:

A sine wave of frequency, *f* and amplitude, *A* was generated using MATLAB

OUTPUT WAVEFORM:





LINEAR CONVOLUTION

Exp. No.: 4 a) **Date:**

Aim:

To compute Linear convolution between two sequence using MATLAB .

Software required:

MATLAB 9

Program:

```
clc; clear all; close all;
x=input('Enter the First Sequence');
h=input('Enter the Second Sequence');
y=conv(x,h);
disp('linear Convolution of the sequence is');
disp(y);
subplot(3,1,1);
stem(x);
title('linear Convolution x(n) input seq');
xlabel('time period');
ylabel('amplitude');
subplot(3,1,2);
stem(h);
title('h(n) input seq');
xlabel('time period');
ylabel('amplitude');
subplot(3,1,3);
stem(y);
title('output seq');
xlabel('time period');
ylabel('amplitude');
```

Result:

Linear convolution between two sequence using MATLAB is computed .

OBSERVATION:

COMMAND WINDOW:

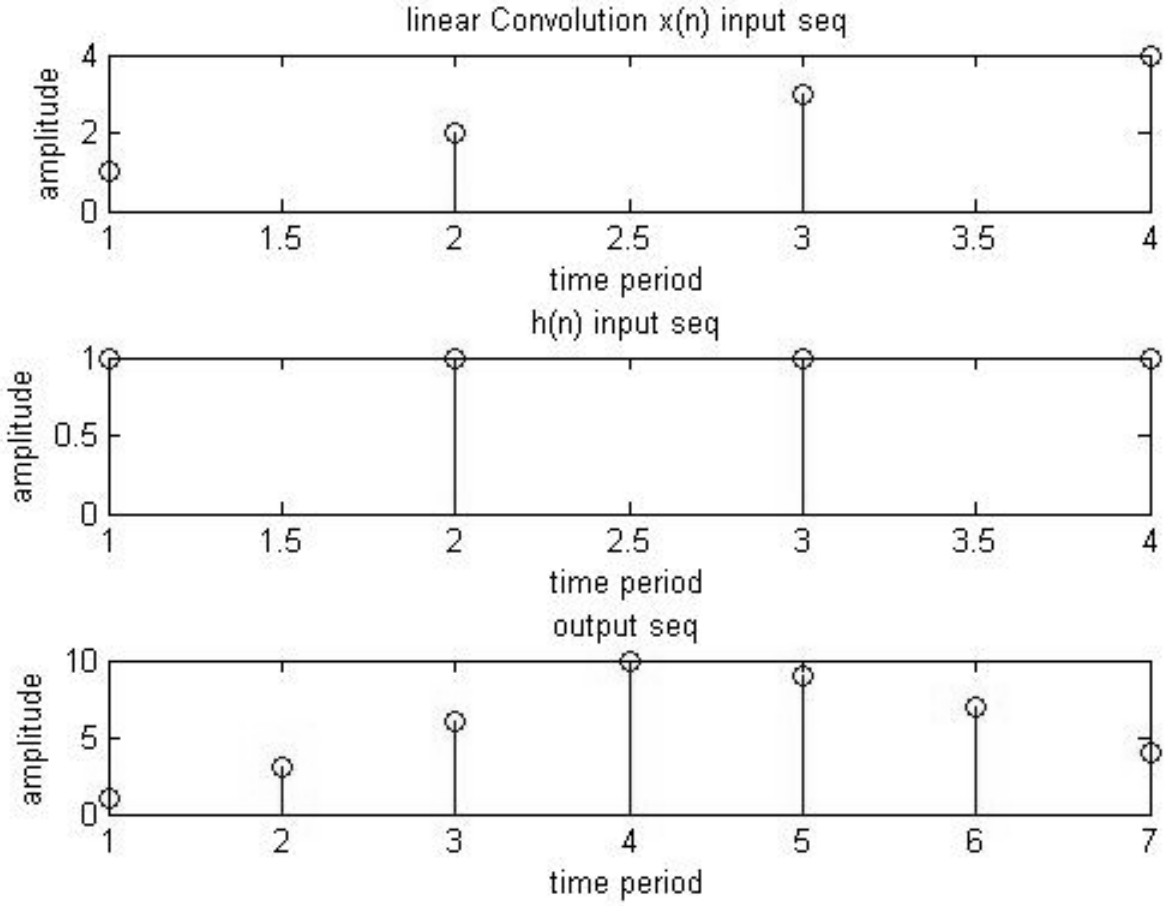
Enter the First Sequence [1 2 3 4]

Enter the Second Sequence [1 1 1 1]

linear Convolution of the sequence is

1 3 6 10 9 7 4

OUTPUT WAVEFORM



CIRCULAR CONVOLUTION

Exp. No.: 4 b) **Date:**

Aim:

To compute circular convolution between two sequence using MATLAB .

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
x=input('Enter the First Sequence');
h=input('Enter the Second Sequence');
a=length(x);
b=length(h);
c=max(a,b);
y=cconv(x,h,c);
disp('Circular convolution of the sequences is');
disp(y);
subplot(3,1,1);
stem(x);
title('Circular Convolution : x(n) input seq');
xlabel('time period');
ylabel('amplitude');
subplot(3,1,2);
stem(h);
title('h(n) input seq');
xlabel('time period');
ylabel('amplitude');
subplot(3,1,3);
stem(y);
title('output seq');
xlabel('time period');
ylabel('amplitude');
```

Result:

Circular convolution between two sequence using MATLAB is computed .

OBSERVATION:

COMMAND WINDOW:

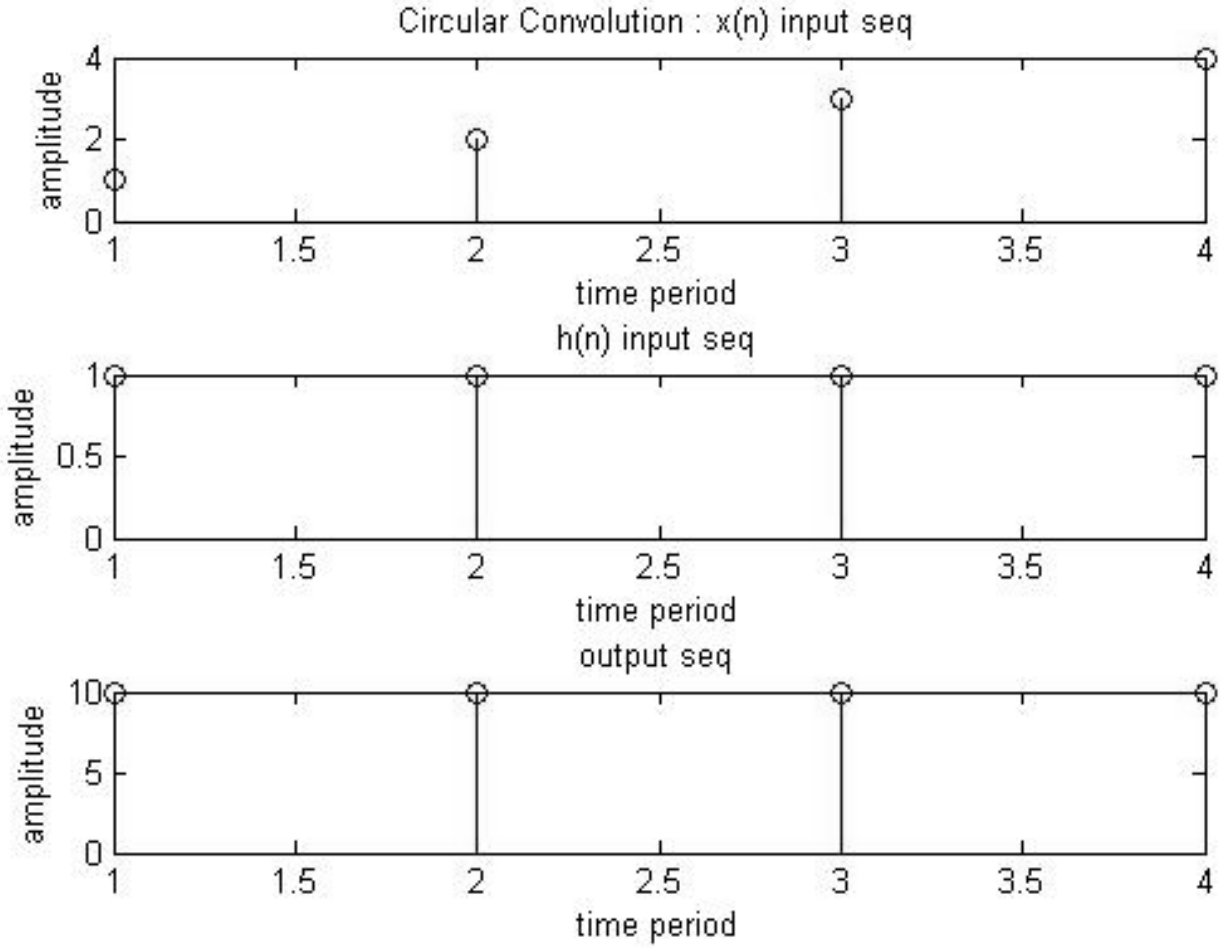
Enter the First Sequence [1 2 3 4]

Enter the Second Sequence [1 1 1 1]

Circular Convolution of the sequences is

10 10 10 10

OUTPUT WAVEFORM



IMPULSE RESPONSE OF A DIFFERENCE EQUATION

Exp. No.: 5 **Date:**

Aim:

To compute the impulse response of a system defined by a Difference equation using MATLAB.

Y[n]+0.7y[n-1]-0.45y[n-2]-0.6y[n-3]=0.8x[n]-0.44x[n-1]+0.36x[n-2]+0.2x[n-3]

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
N=input('Enter the required length of impulse response N=');
n=0:N-1;
b=input('Enter the co-efficients of x(n),b=');
a=input('Enter the co=efficients of y(n),a=');
x=[1,zeros(1,N-1)];
y=filter(b,a,x);
stem(n,y);
xlabel('time');
ylabel('amplitude');
title('IMPULSE RESPONSE');
grid on;
```

Result:

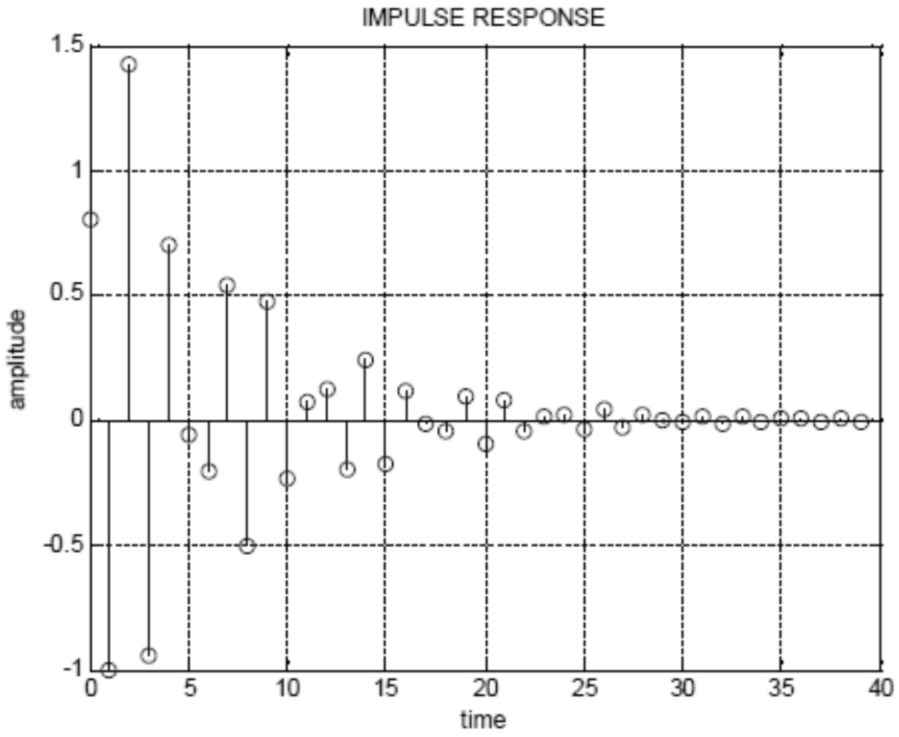
The impulse response of a system defined by a Difference equation using MATLAB is computed

OBSERVATION:

Y[n]+0.7y[n-1]-0.45y[n-2]-0.6y[n-3]=0.8x[n]-0.44x[n-1]+0.36x[n-2]+0.2x[n-3]

Enter the required length of impulse response	N	=	40
Enter the co-efficients of x(n),	b	=	[0.8 -0.44 0.36 0.02]
Enter the co=efficients of y(n),	a	=	[1 0.7 -0.45 -0.6]

OUTPUT:



DFT COMPUTATION

Exp. No.: 6 a) **Date:**

Aim:

To compute DFT of a sequence using MATLAB .

Software required:

MATLAB 9

Program:

```
clc;

close all;

clear all;

x = input(' Enter the sequence');

n = length (x);

a = dftmtx(n);

y = x*a;

disp('DFT of the sequence is');

disp(y);
```

Result:

The MATLAB program for computing the DFT of the given sequence has been written and verified.

OBSERVATION:

COMMAND WINDOW:

Enter the sequence - [1 , 2 , 3 , 4]

DFT of the sequence is

10.0000 -2.0000 + 2.0000i -2.0000 -2.0000 - 2.0000i

FFT COMPUTATION

Exp. No.: 6 b) **Date:**

Aim:

To compute FFT of a sequence using MATLAB .

Software required:

MATLAB 9

Program:

```
clc;

close all;

clear all;

x = input(' Enter the sequence');

y = fft(x);

disp('FFT of the sequence is');

disp(y);
```

Result:

The MATLAB program for computing the DFT of the given sequence has been written and verified.

OBSERVATION:

COMMAND WINDOW:

Enter the sequence - [1 , 2 , 3 , 4]

DFT of the sequence is

10.0000 -2.0000 + 2.0000i -2.0000 -2.0000 - 2.0000i

IIR FILTER DESIGN

DIGITAL BUTTERWORTH LOW PASS FILTER

Exp. No.: 7 a) **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital Butterworth Low pass filter.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
rp=input('enter the passband attenuation:');
rs=input('enter the stop band attenuation:');
wp=input('enter the pass band frequency:');
ws=input('enter the stop band frequency:');
[N,wn]=buttord(wp/pi,ws/pi,rp,rs);
[b,a]=butter(N,wn);
freqz(b,a);
title('butterworth low pass filter');
```

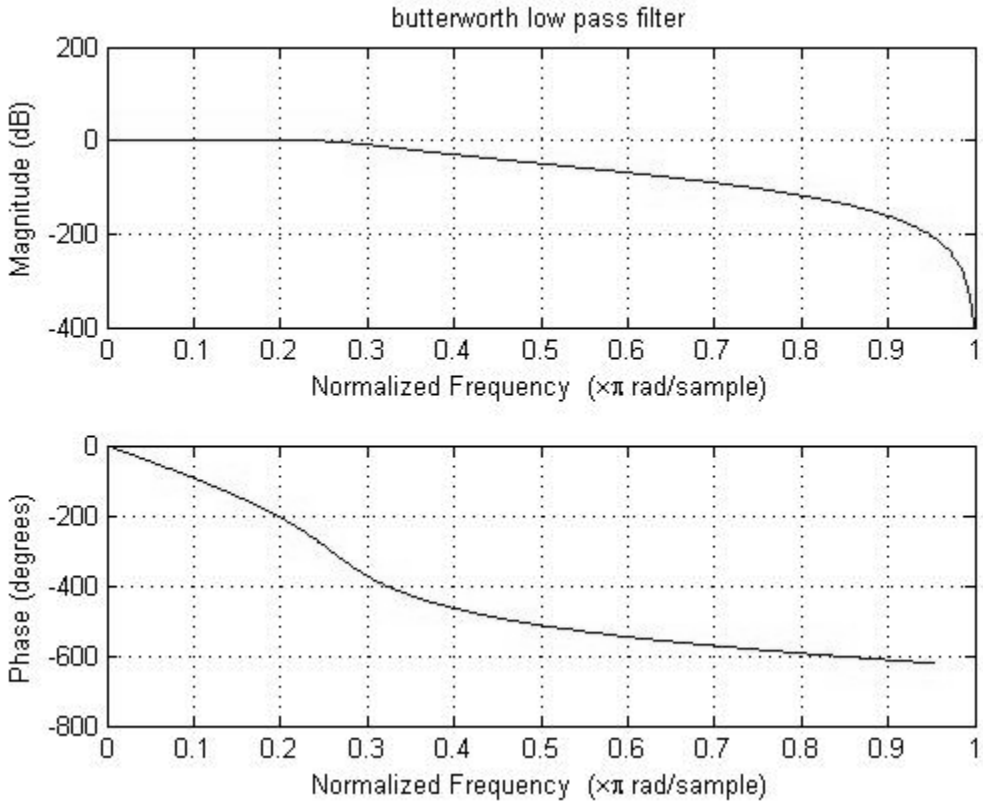
RESULTS:

Thus the magnitude response and phase response of Digital Butter worth Low pass filter was verified.

OBSERVATION:

enter the passband attenuation : 0.4
enter the stop band attenuation : 30
enter the pass band frequency : 0.2 * pi
enter the stop band frequency : 0.4 * pi

OUTPUT:



IIR FILTER DESIGN

DIGITAL BUTTERWORTH HIGH PASS FILTER

Exp. No.: 7 b) **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital Butterworth High pass filter.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
rp=input('enter the passband attenuation:');
rs=input('enter the stop band attenuation:');
wp=input('enter the pass band frequency:');
ws=input('enter the stop band frequency:');
[N,wn]=buttord(wp/pi,ws/pi,rp,rs);
[b,a]=butter(N,wn,'high');
freqz(b,a);
title('butterworth high pass filter');
```

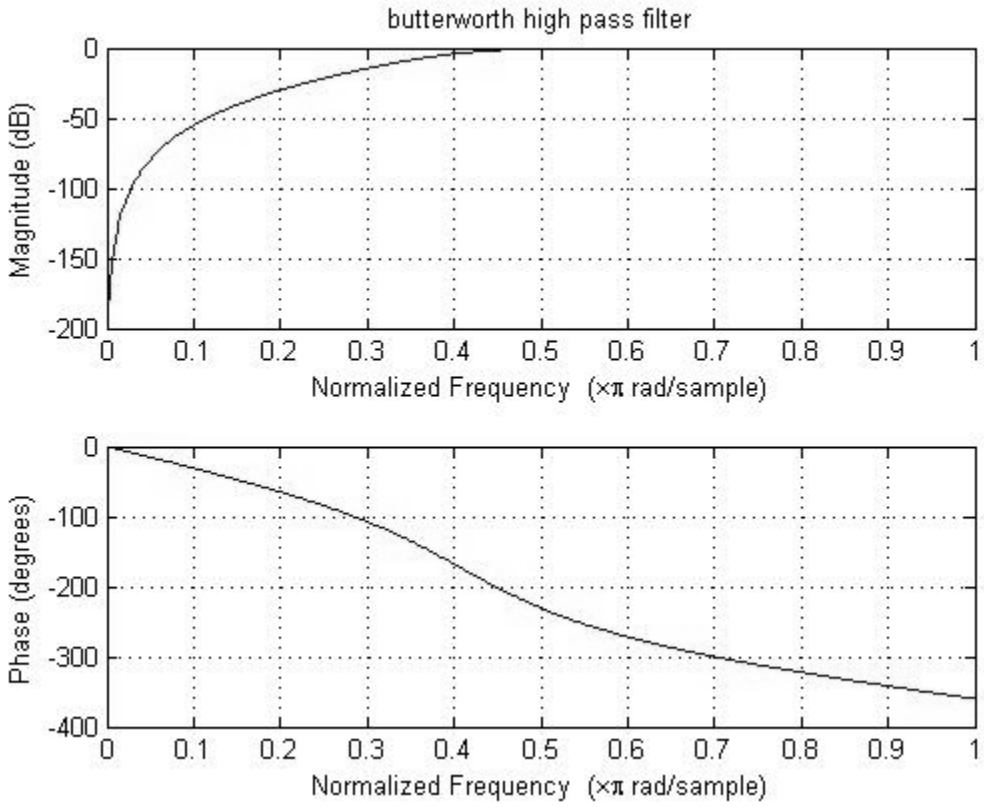
RESULTS:

Thus the magnitude response and phase response of Digital Butter worth High pass filter was verified.

OBSERVATION:

Enter the pass band attenuation : 0.4
Enter the stop band attenuation : 30
Enter the pass band frequency : 0.6*pi
Enter the stop band frequency : 0.2*pi

OUTPUT:



IIR FILTER DESIGN

DIGITAL BUTTERWORTH BANDPASS FILTER

Exp. No.: 7 c) **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital Butterworth Band pass filter.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
rp=input('enter the passband attenuation:');
rs=input('enter the stop band attenuation:');
wp=input('enter the pass band frequency:');
ws=input('enter the stop band frequency:');
[N,wn]=buttord(wp/pi,ws/pi,rp,rs);
[b,a]=butter(N,wn,'bandpass');
freqz(b,a);
title('Butterworth Band Pass filter');
```

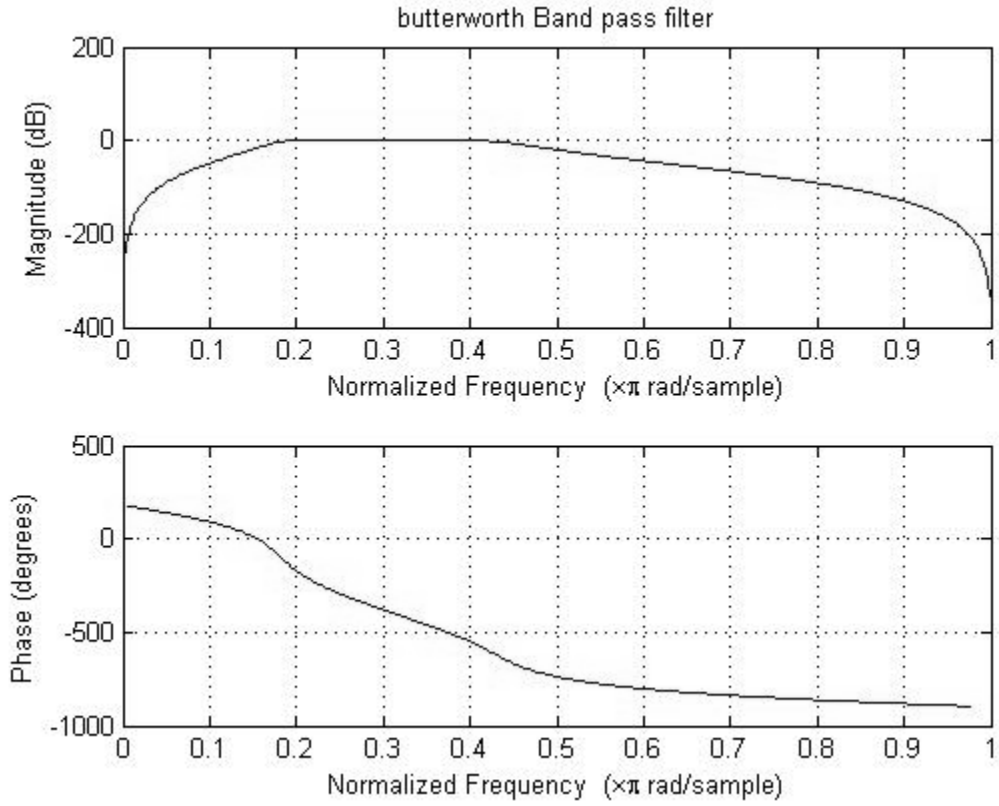
RESULTS:

Thus the magnitude response and phase response of Digital Butter worth Band Pass filter was verified.

OBSERVATION :

enter the passband attenuation : 0.2
enter the stop band attenuation : 20
enter the pass band frequency : [0.2*pi,0.4*pi]
enter the stop band frequency : [0.1*pi,0.5*pi]

OUTPUT:



IIR FILTER DESIGN

DIGITAL BUTTERWORTH BAND STOP FILTER

Exp. No.: 7 d) **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital Butterworth Band Stop filter.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
rp=input('enter the passband attenuation:');
rs=input('enter the stop band attenuation:');
wp=input('enter the pass band frequency:');
ws=input('enter the stop band frequency:');
[N,wn]=buttord(wp/pi,ws/pi,rp,rs);
[b,a]=butter(N,wn,'stop');
freqz(b,a);
title('Butterworth Band Stop filter');
```

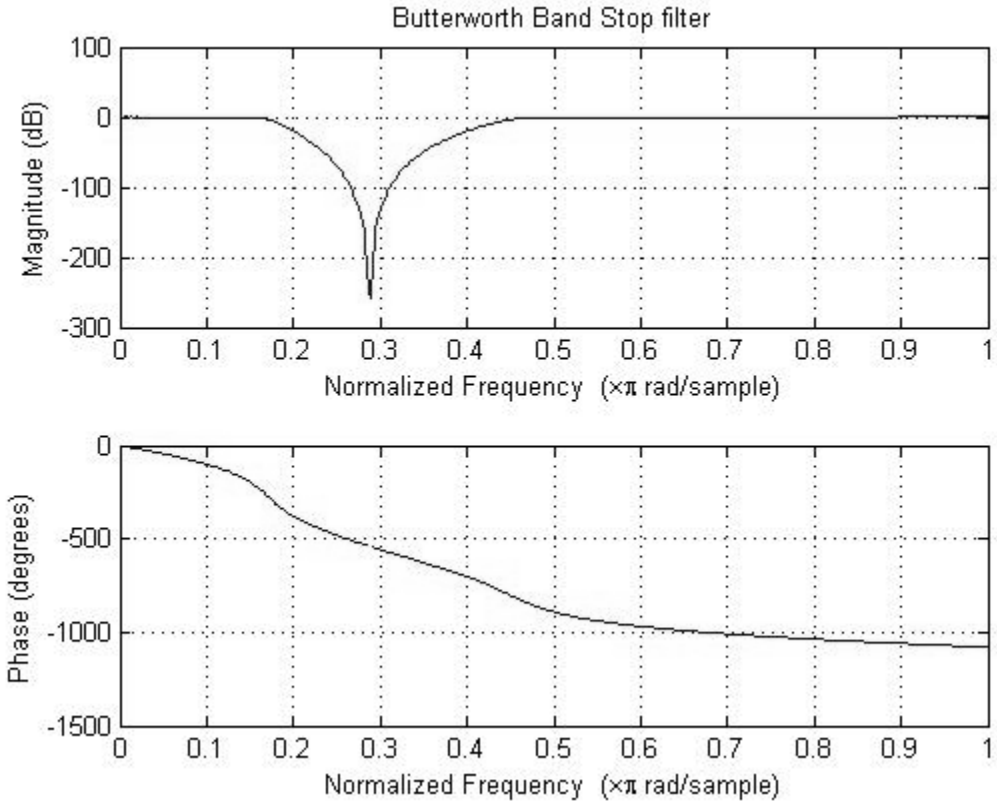
RESULTS:

Thus the magnitude response and phase response of Digital Butter worth Band Stop filter was verified.

OBSERVATION :

enter the passband attenuation : 0.2
enter the stop band attenuation : 20
enter the pass band frequency : [0.1*pi,0.5*pi]
enter the stop band frequency : [0.2*pi,0.4*pi]

OUTPUT :



IIR FILTER DESIGN

DIGITAL CHEBYSHEV (TYPE-1) LOW PASS FILTER

Exp. No.: 7 e) **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital Chebyshev type-1 Low pass filter.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
rp=input ('Enter the pass band attenuation:');
rs=input ('Enter the stop band attenuation:');
wp=input ('Enter the pass band frequency:');
ws=input ('Enter the stop band frequency:');
[N,wn]=cheb1ord(wp/pi,ws/pi,rp,rs);
[b,a]=cheby1(N,rp,wn);
freqz(b,a);
```

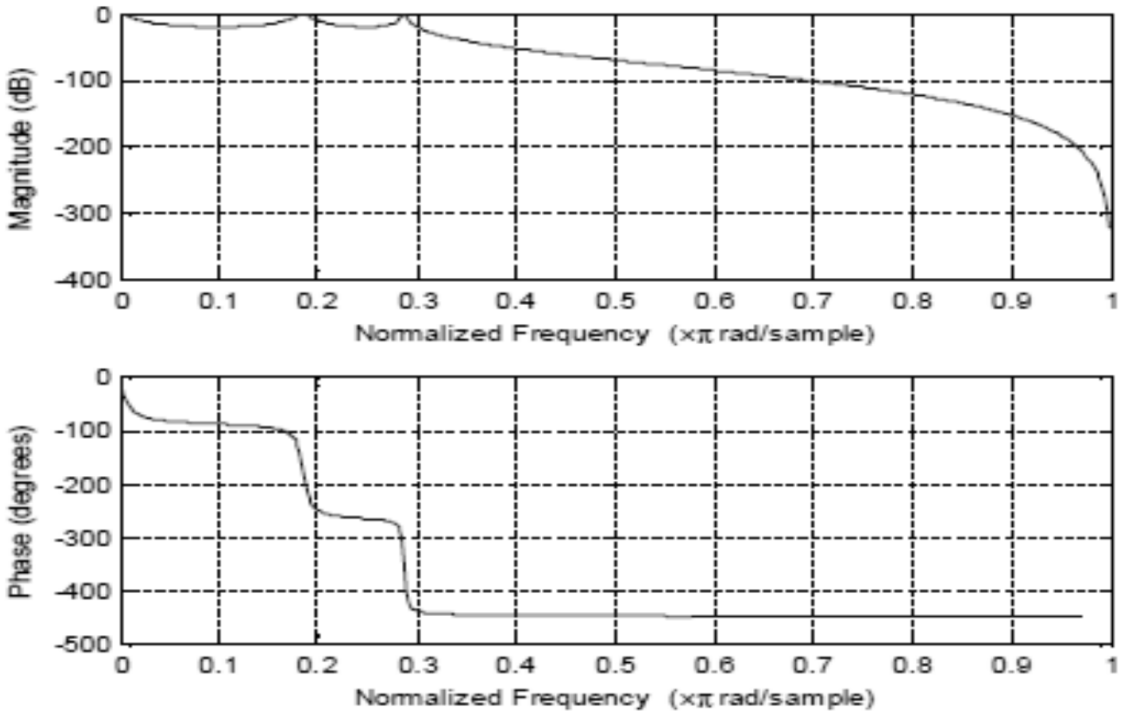
RESULTS:

Thus the magnitude response and phase response of digital Chebyshev type-1 Low pass filter was verified.

OBSERVATION :

enter the passband attenuation : 0.2
enter the stop band attenuation : 20
enter the pass band frequency : [0.1*pi,0.5*pi]
enter the stop band frequency : [0.2*pi,0.4*pi]

OUTPUT:



FIR FILTER DESIGN

DIGITAL FIR LP FILTER USING HANNING WINDOW

Exp. No.: 8 **Date:**

Aim:

To write a MATLAB program to plot magnitude response and phase response of digital FIR LP filter using Hanning window.

Software required:

MATLAB 9

Program:

```
clc;
clear all;
close all;
N=input('Enter the value of N:');
wc=input('Enter cutoff frequency:');
h=fir1(N,wc/pi,hanning(N+1));
freqz(h);
```

RESULTS:

Thus the magnitude response and phase response of digital FIR LP filter using Hanning window was verified.

OBSERVATION:

Enter the value of N : 28

Enter cutoff frequency : 0.5*pi

OUTPUT: