



AVIT
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY



VINAYAKA MISSION'S
RESEARCH FOUNDATION
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BIOMEDICAL SIGNAL AND IMAGE PROCESSING LAB

LAB MANUAL

HOD-BME- ECE

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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:

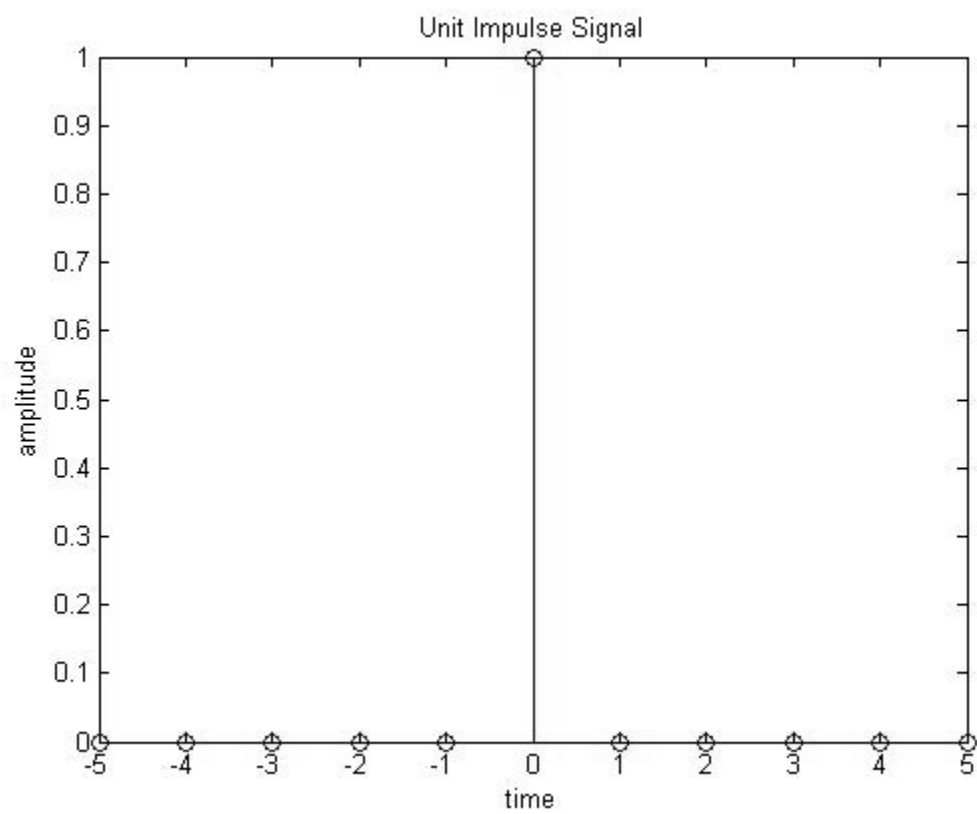
A Unit Impulse Signals was generated using MATLAB

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:

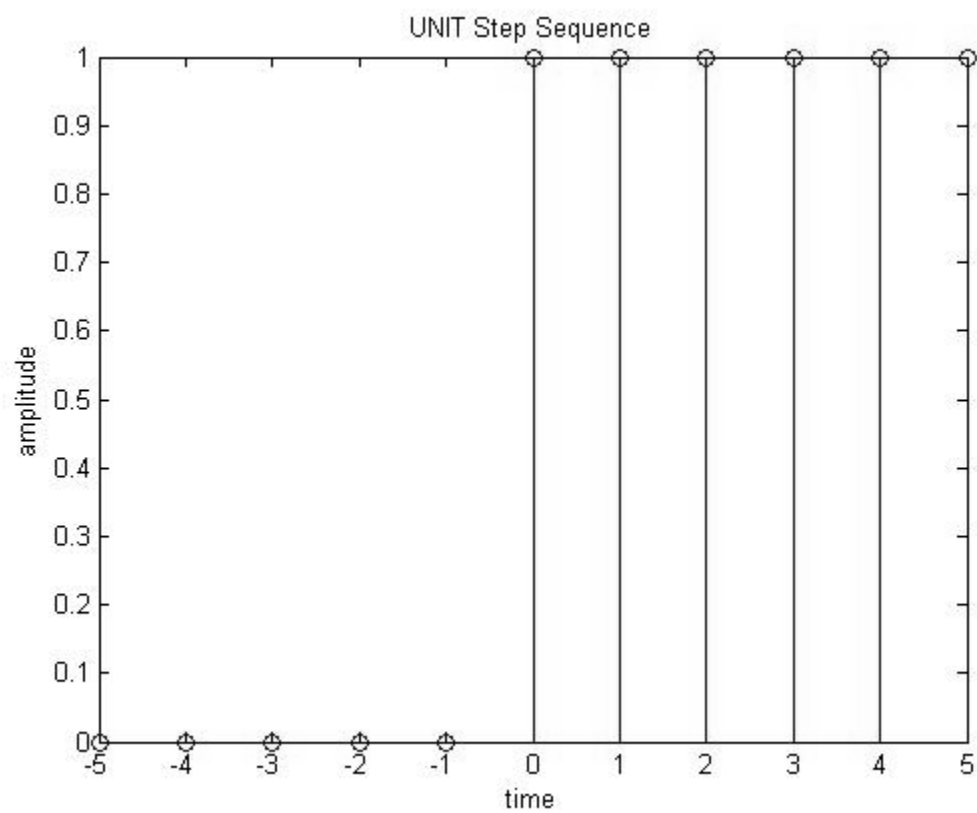
A Unit Step Signals was generated using MATLAB

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:

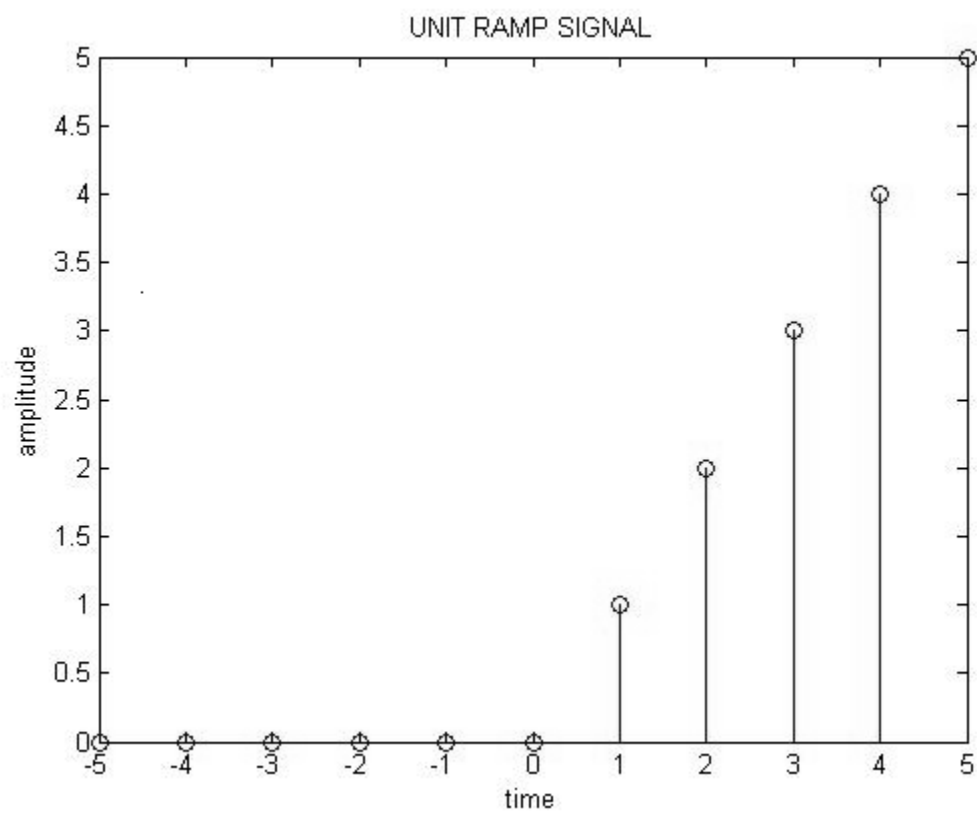
A Unit Ramp Signals was generated using MATLAB

OBSERVATION:

COMMAND WINDOW:

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:

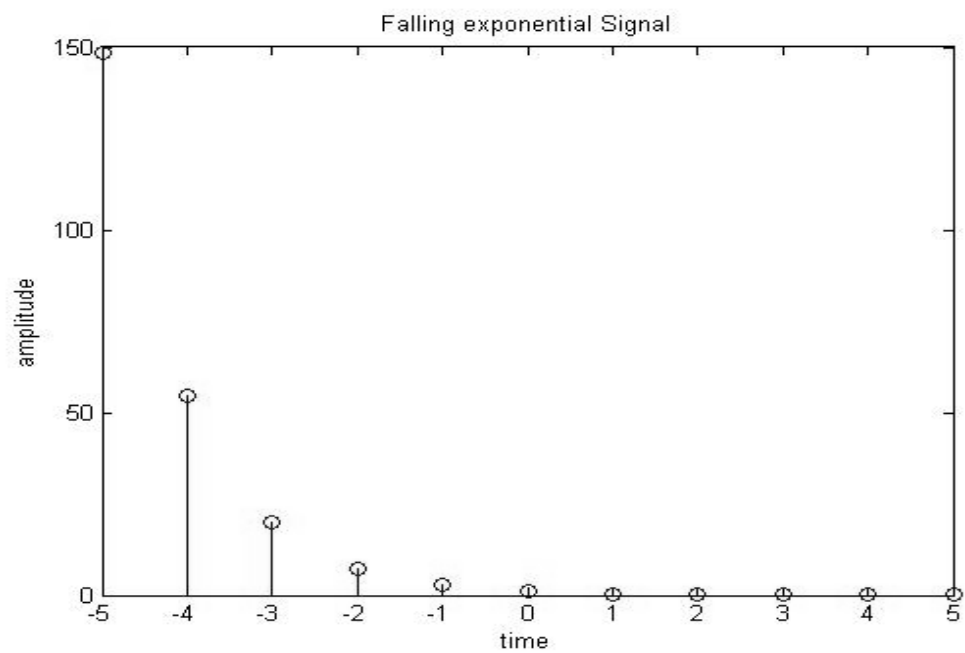
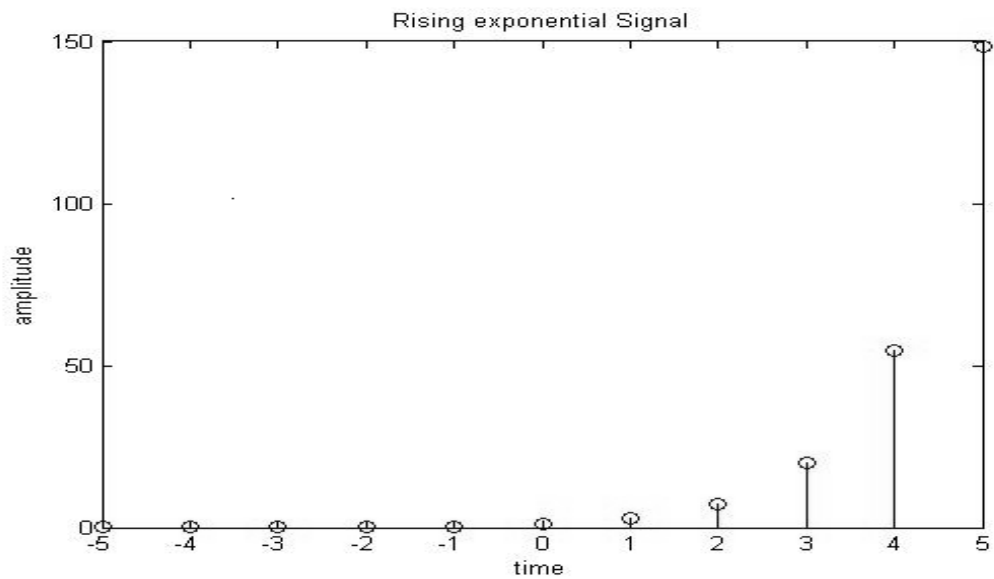
Exponential Signals was generated using MATLAB

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');
```

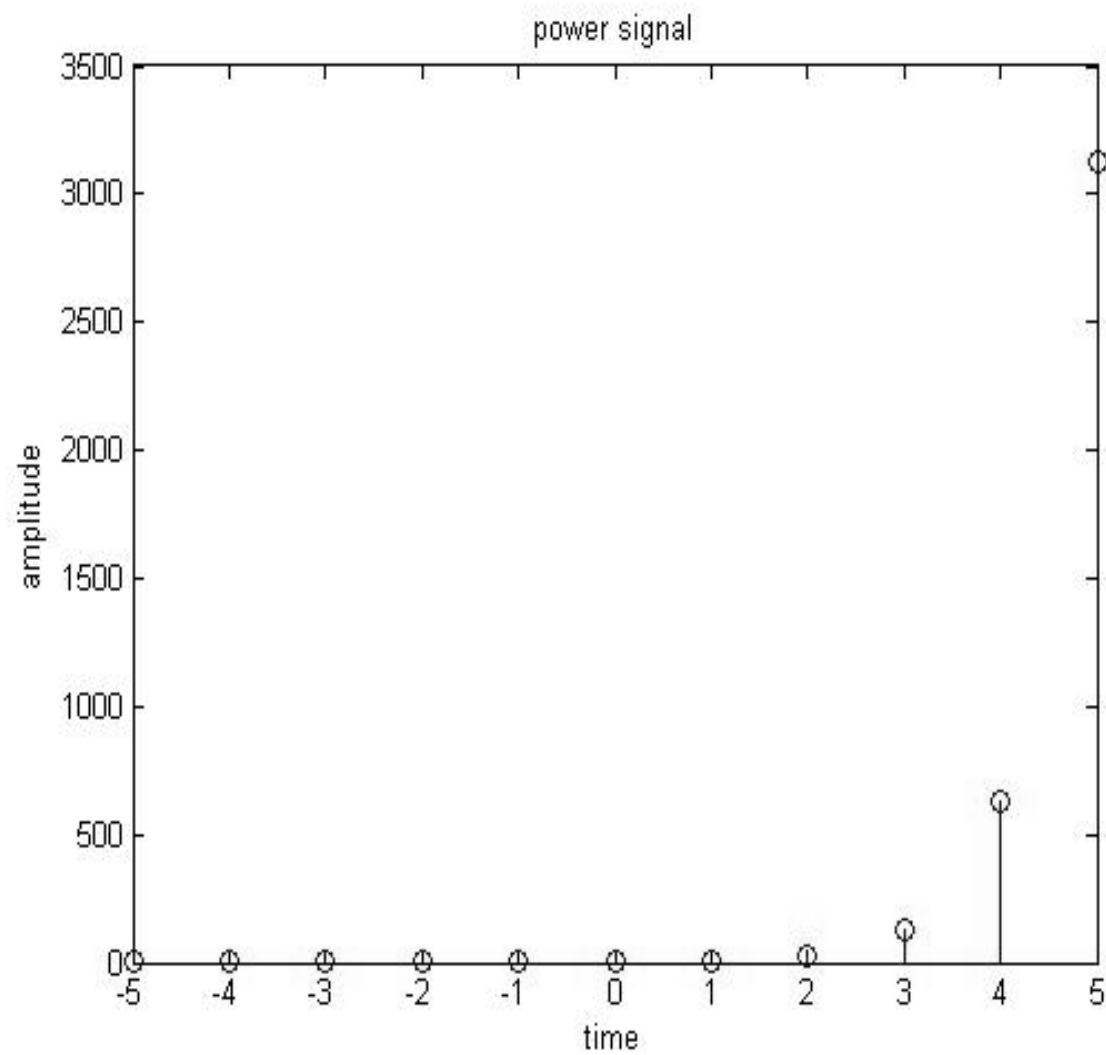
Result:

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');
```

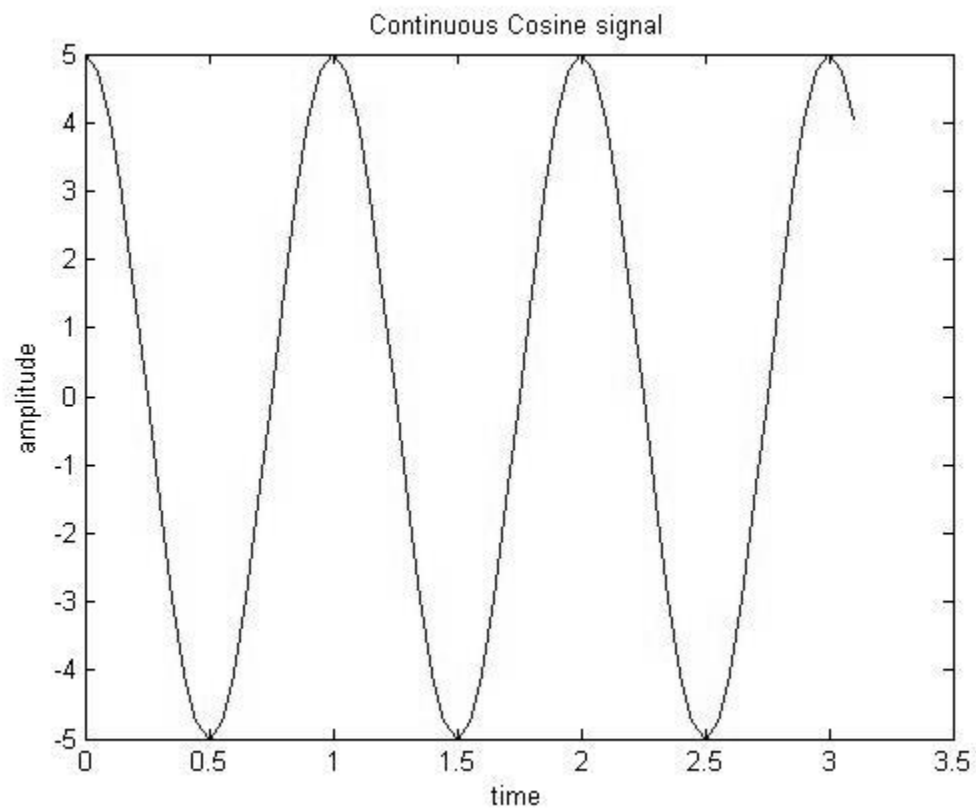
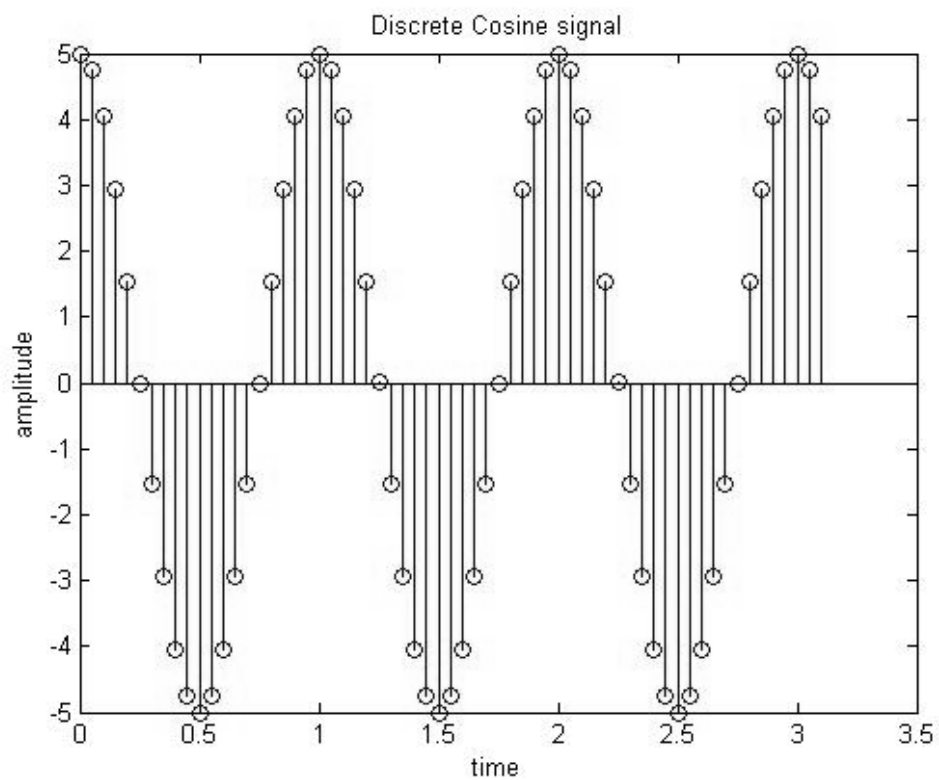
Continuous Cosine Wave

```
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');
```

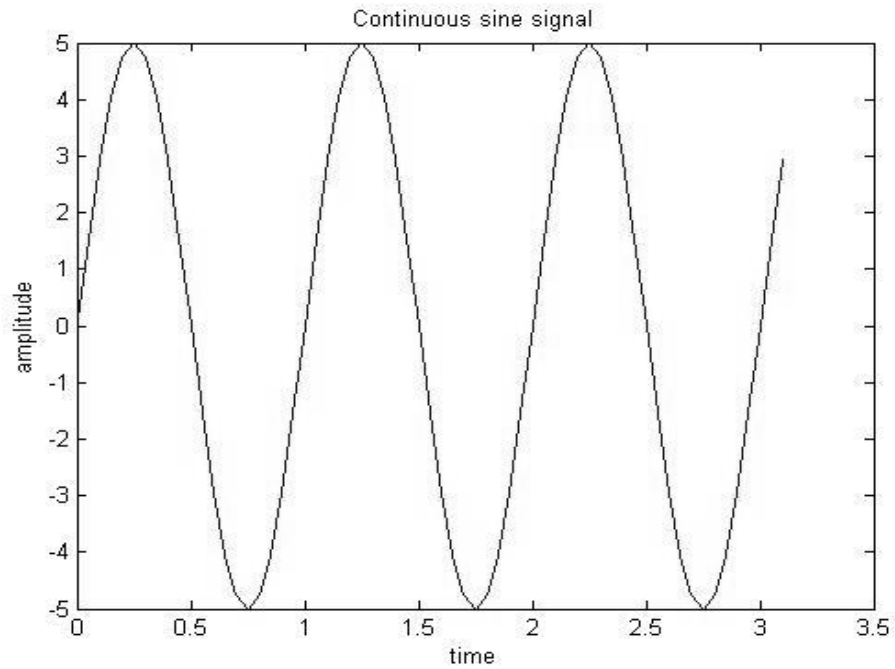
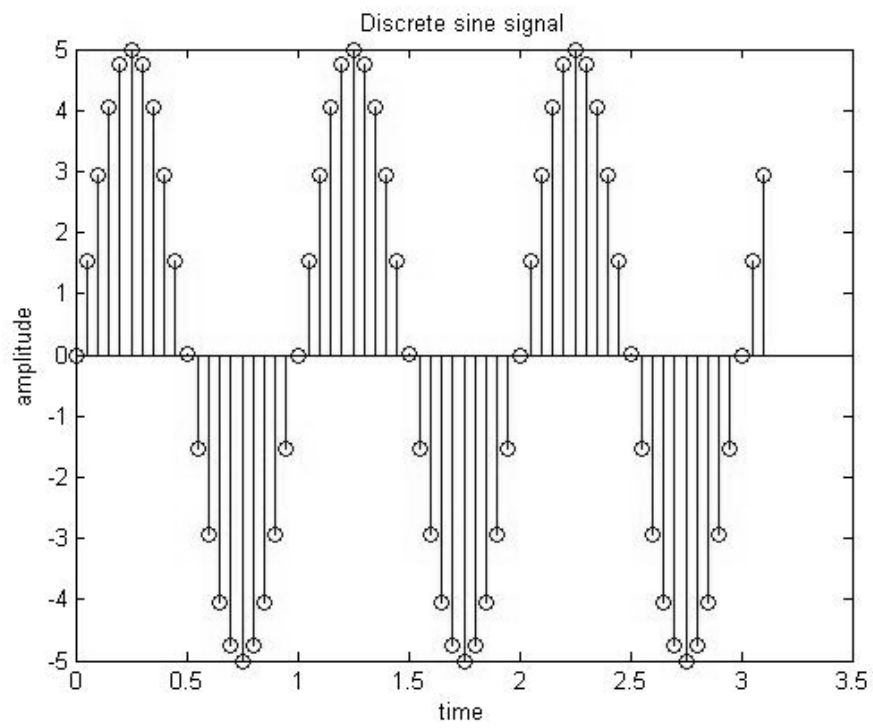
Continuous Sine Wave

```
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:

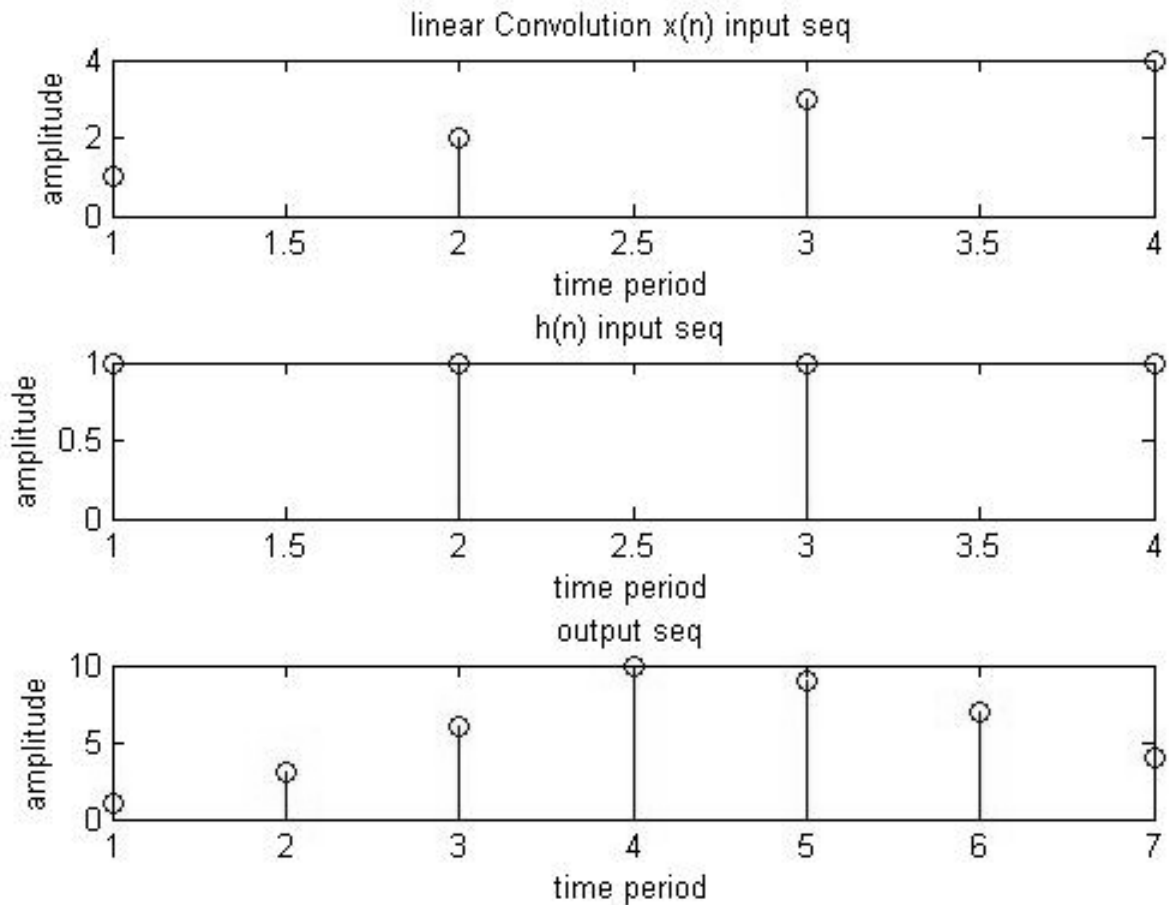
Enter the First Sequence [1 2 3 4]

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:

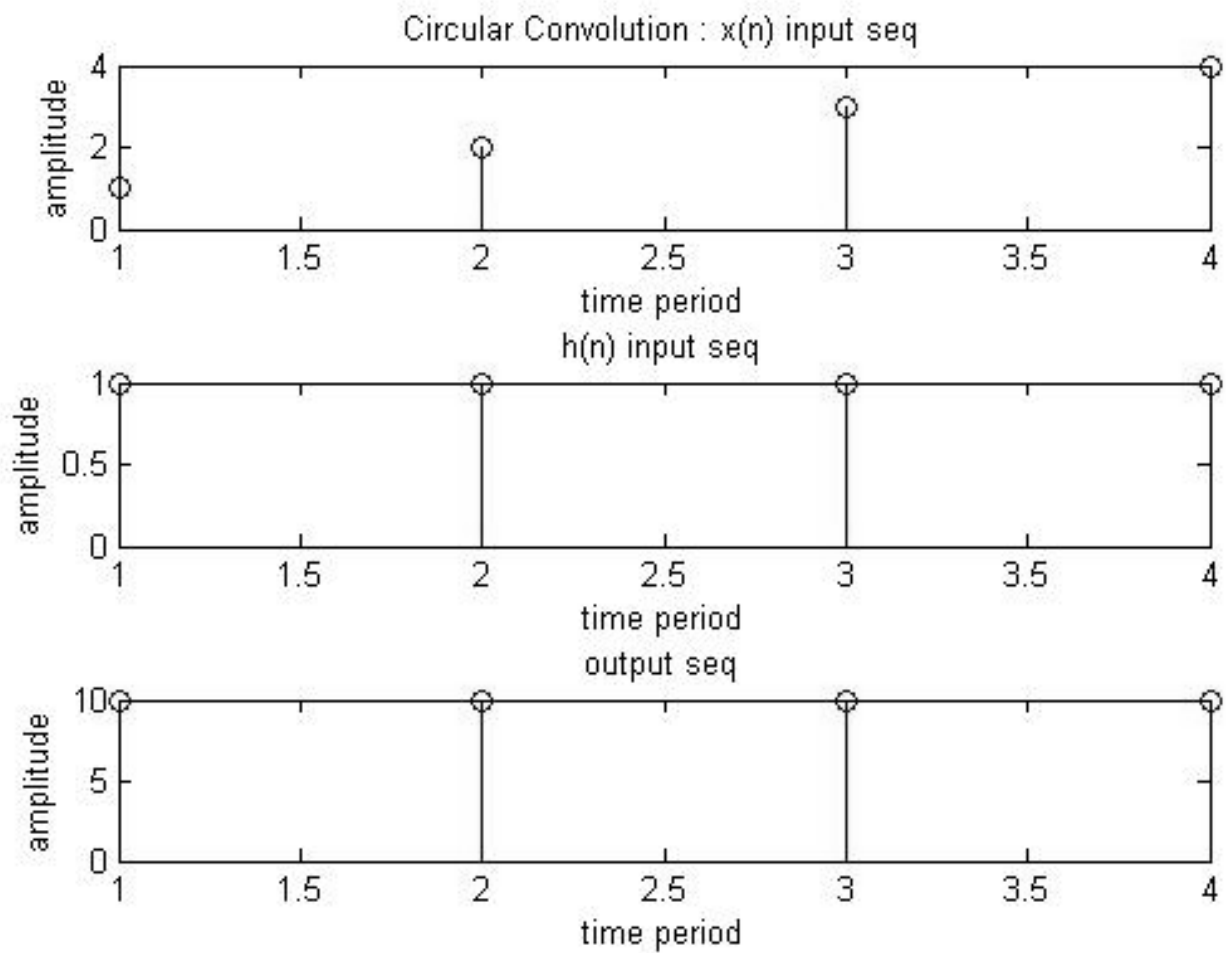
Enter the First Sequence [1 2 3 4]

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:

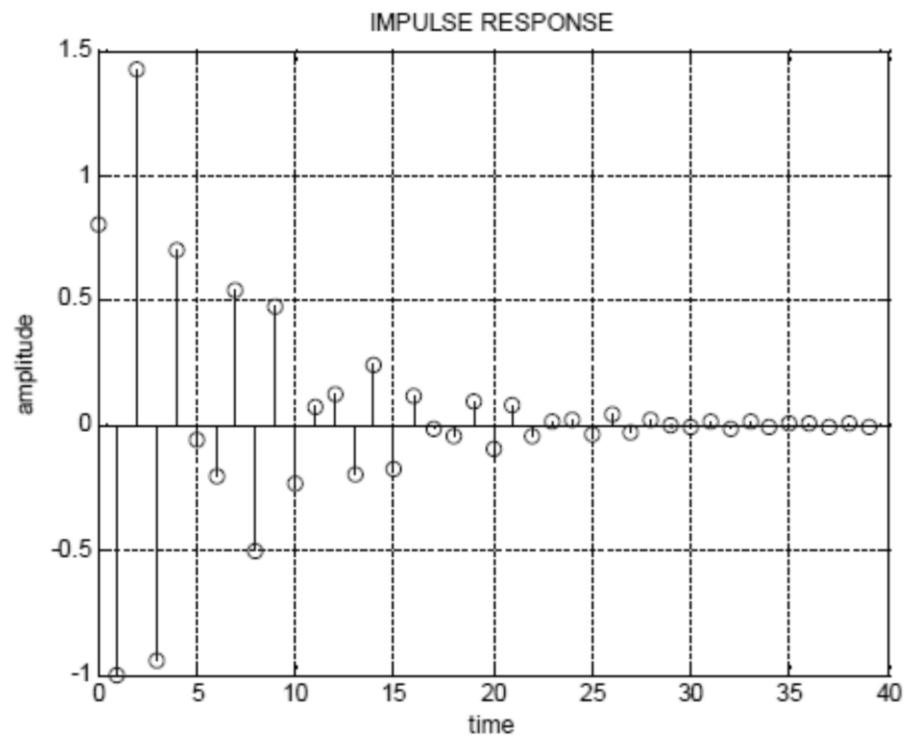
$$Y[n] + 0.7y[n-1] - 0.45y[n-2] - 0.6y[n-3] = 0.8x[n] - 0.44x[n-1] + 0.36x[n-2] + 0.2x[n-3]$$

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
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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
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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');
```

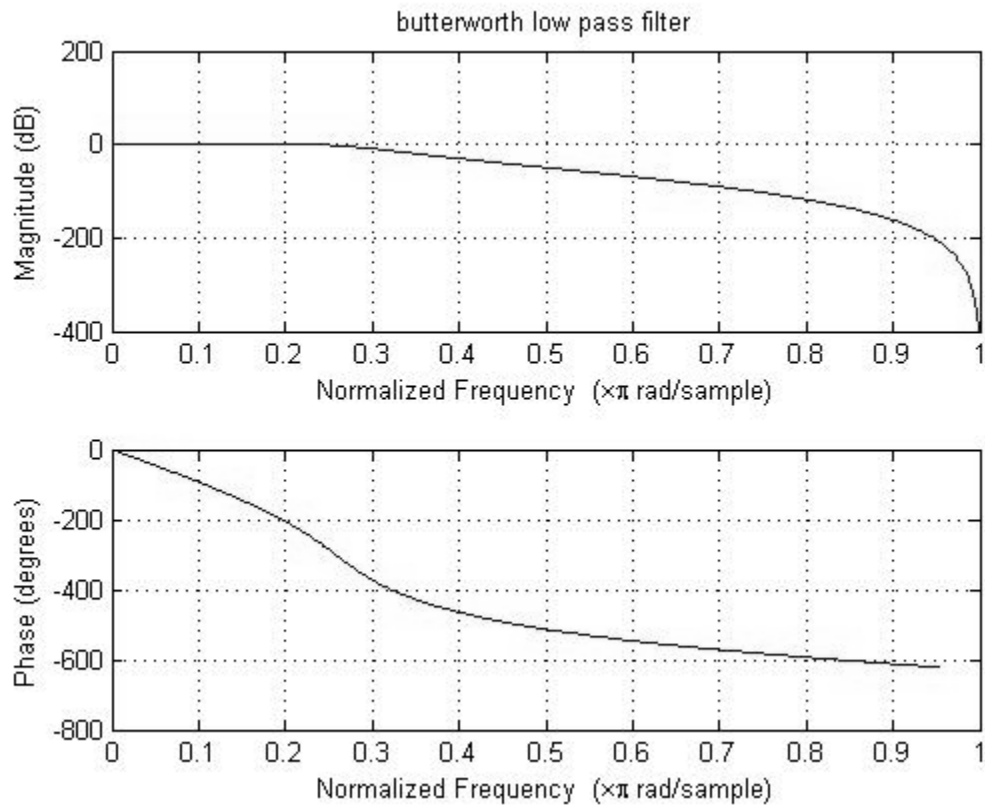
RESULTS:

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 : 0.2π
enter the stop band frequency : 0.4π

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');
```

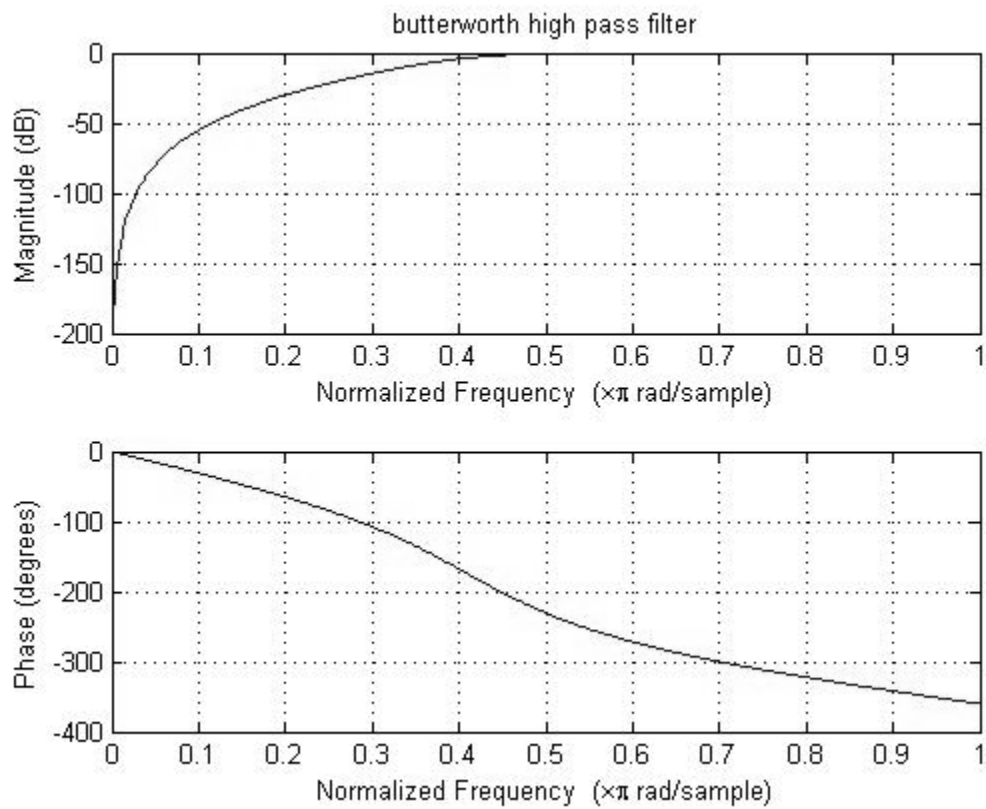
RESULTS:

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 : 0.6π
Enter the stop band frequency : 0.2π

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');
```

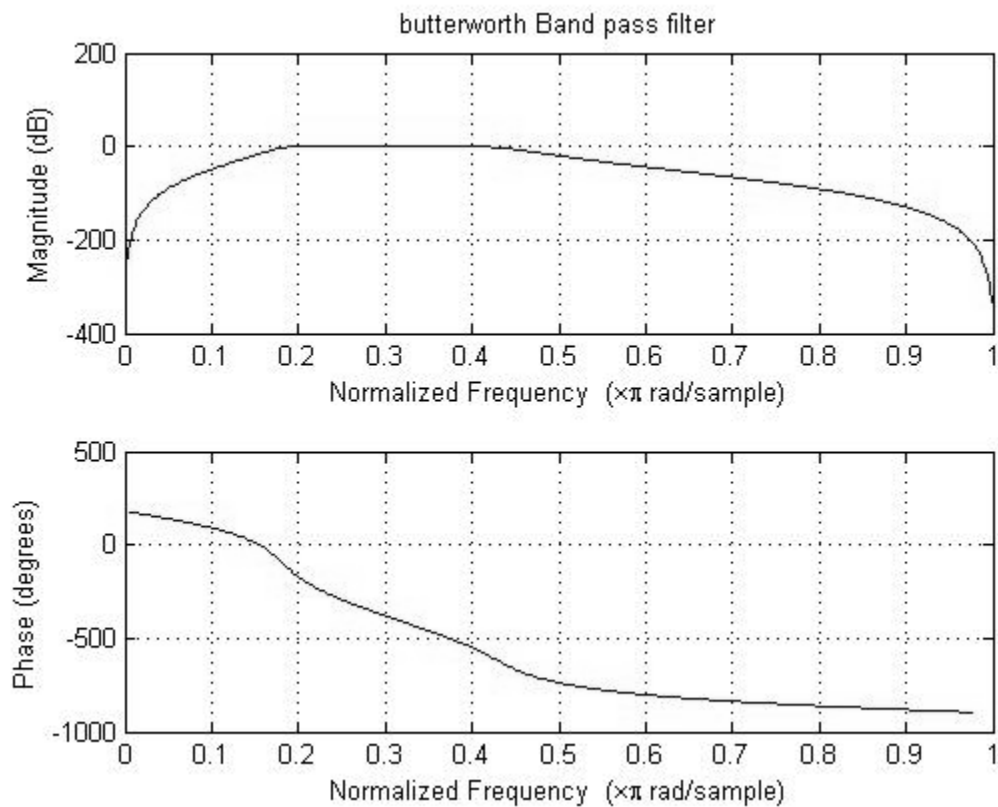
RESULTS:

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');
```

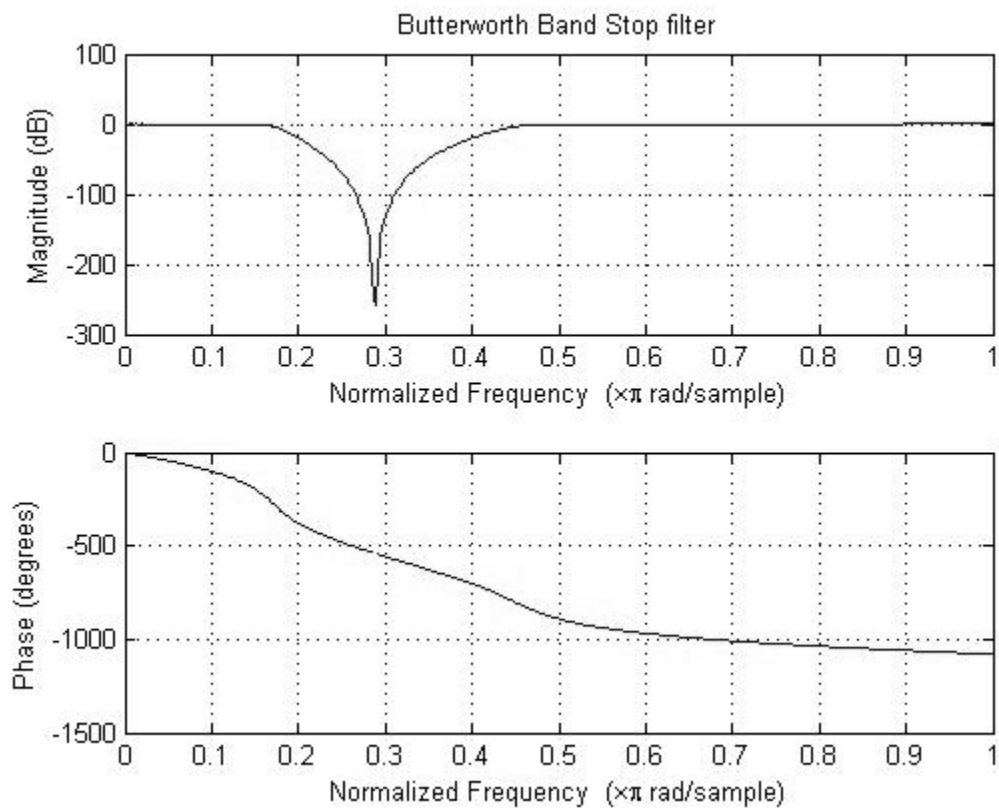
RESULTS:

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);
```

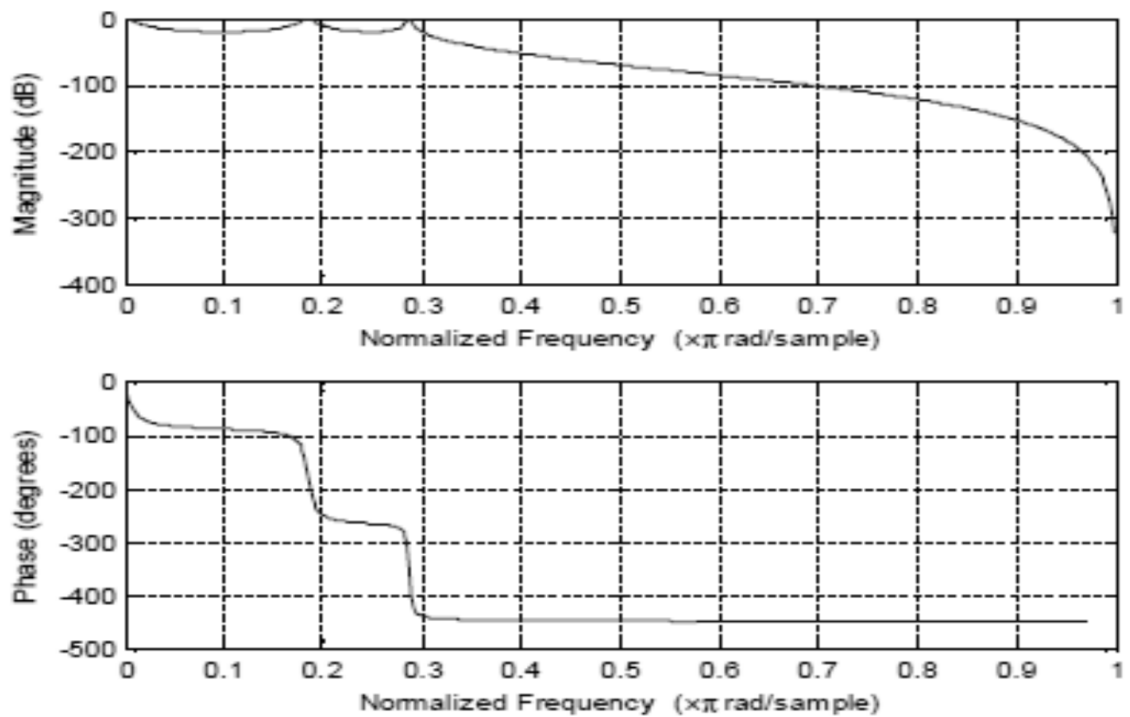
RESULTS:

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 : 0.5π

OUTPUT:

