1)LINEAR CONVOLUTION

```
clc;
clear all;
close all;
x=input('enter the first sequence');
h=input('enter the second sequence');
y=xcorr(x,h);
figure ;
subplot(3,1,1);
stem(x);
ylabel('amplitude-->');
xlabel('(a)n-->');
subplot(3,1,2);
stem(h);
ylabel('amplitude-->');
xlabel('(b)n-->');
subplot(3,1,3);
stem(y);
ylabel('amplitude-->');
xlabel('(c)n-->');
disp('the resultant signal is');
display(y);
```

```
[1 1 1]
[1 2 3]
```

2)CIRCULAR CONVOLUTION

```
clc;
clear all;
close all;
x=[2 1 2 1]
h=[1 2 3 4]
N=max(length(x),length(h));
for n=0:N-1
    y(n+1)=0;
    for k=0:N-1
        i=mod((n-k),N);
        if(i<0)
          i=i+N;
        end
        y(n+1)=y(n+1)+h(k+1)*x(i+1);
    end
    end
    disp('circular convolution of x and h is y=');
    disp(y);
    n1=0:N-1;
    stem(n1,y);
    xlabel('time index n');
    ylabel('amplitude');
    title('circular convolution output y(n)');
```

3)CROSS CORRELATION

```
clc;
clear all;
close all;
x=input('enter the first sequence');
h=input('enter the second sequence');
y=xcorr(x,h);
figure ;
subplot(3,1,1);
stem(x);
ylabel('amplitude-->');
xlabel('(a)n-->');
subplot(3,1,2);
stem(h);
ylabel('amplitude-->');
xlabel('(b)n-->');
subplot(3,1,3);
stem(y);
ylabel('amplitude-->');
xlabel('(c)n-->');
disp('the resultant signal is');
display(y);
```

```
[1 2 3 4]
[4 3 2 1]
```

4)IMPULSE RESPONSE

```
clc;
y=input('the output sequence y(n) of the system=');
%plot y
n1=0:1:length(y)-1;
subplot (3,1,1);
stem(n1,y);
x=input('the input sequence x(n) of the system=');
%plot x
N2=0:1:length(x)-1;
subplot(3,1,2);
stem(N2,x);
% find the impulse response given x and y
h=deconv(y,x);
disp('the impulse response of the system is=');
disp(h);
%plot h
n=0:1:length(h)-1;
subplot(3,1,3);
stem(n,h);
xlabel('time index n');
ylabel('amplitude');
title('impulse response of system');
yv=conv(x,h);
disp('the verified output sequence is');
disp(yv);
```

```
[24 25 26 27]
[1 2 3 4]
```

5)STEP RESPONSE

```
clc;
N=input('length of response required=');
b=[1];
a=[1,-1,0.9];
x=[ones(1,N)];
n=0:1:N-1;
y=filter(b,a,x);
subplot(2,1,1);
stem(n,x);
title('step input');
xlabel('n');
ylabel('u(n)');
subplot(2,1,2);
stem(n,y);
title('step response');
xlabel('n');
ylabel('y(n)');
```

```
7
```

6)BUTTERWORTH HIGH PASS

```
clc;
clear all;
format long
rp=input('enter the passband ripple');
rs=input('enter the stopband ripple');
wp=input('enter the passband freq');
ws=input('enter the stopband freq');
fs=input('enter the sampling freq');
w1=2*wp/fs;
w2=2*ws/fs;
[n,wn]=buttord(w1,w2,rp,rs,'s');
[b,a]=butter(n,wn,'high','s');
w=0:0.01:pi;
[h,om]=freqs(b,a,w);
m=20*log10(abs(h));
an=angle(h);
subplot(2,1,1);
plot(om/pi,m);
ylabel('gain in db-->');
xlabel('(a)normalized freq-->');
subplot(2,1,2);
plot(om/pi,an);
xlabel('(b)normalized freq-->');
ylabel('phase in radians-->');
```

```
0.36
40
2000
3300
8000
```

7)BUTTERWORTH LOW PASS FILTER

```
clc;
clear all;
format long
rp=input('enter the passband ripple');
rs=input('enter the stopband ripple');
wp=input('enter the passband freq');
ws=input('enter the stopband freq');
fs=input('enter the sampling freq');
w1=2*wp/fs;
w2=2*ws/fs;
[n,wn]=buttord(w1,w2,rp,rs,'s');
[z,p,k]=butter(n,wn);
[b,a]=zp2tf(z,p,k);
[b,a]=butter(n,wn,'s');
w=0:0.01:pi;
[h,om]=freqs(b,a,w);
m=20*log10(abs(h));
an=angle(h);
subplot(2,1,1);
plot(om/pi,m);
ylabel('gain in db-->');
xlabel('(a)normalized freq-->');
subplot(2,1,2);
plot(om/pi,an);
xlabel('(b)normalized freq-->');
ylabel('phase in radians-->');
```

```
0.15
60
1500
3000
7000
```

8)BUTTERWORTH BAND PASS

```
clc;
clear all;
format long
rp=input('enter the passband ripple');
rs=input('enter the stopband ripple');
wp=input('enter the passband freq');
ws=input('enter the stopband freq');
fs=input('enter the sampling freq');
w1=2*wp/fs;
w2=2*ws/fs;
[n]=buttord(w1,w2,rp,rs,'s');
wn=[w1,w2];
[b,a]=butter(n,wn,'bandpass','s');
w=0:0.01:pi;
[h,om]=freqs(b,a,w);
m=20*log10(abs(h));
an=angle(h);
subplot(2,1,1);
plot(om/pi,m);
ylabel('gain in db-->');
xlabel('(a)normalized freq-->');
subplot(2,1,2);
plot(om/pi,an);
xlabel('(b)normalized freq-->');
ylabel('phase in radians-->');
```

```
0.36
36
1500
2000
6000
```

9)CHEBYSHEV

```
clc;
clear all;
format long
rp=input('enter the passband ripple');
rs=input('enter the stopband ripple');
wp=input('enter the passband freq');
ws=input('enter the stopband freq');
fs=input('enter the sampling freq');
w1=2*wp/fs;
w2=2*ws/fs;
[n,wn]=cheb1ord(w1,w2,rp,rs,'s');
[b,a]=cheby1(n,rp,wn,'s');
w=0:0.01:pi;
[h,om]=freqs(b,a,w);
m=20*log10(abs(h));
an=angle(h);
subplot(2,1,1);
plot(om/pi,m);
ylabel('gain in db-->');
xlabel('(a)normalized freq-->');
subplot(2,1,2);
plot(om/pi,an);
xlabel('(b)normalized freq-->');
ylabel('phase in radians-->');
```

```
0.23
2.3
1300
1550
7500
```

10)FIR FILTER

```
clc;
clear all;
format long
rp=input('enter the passband ripple');
rs=input('enter the stopband ripple');
fp=input('enter the passband freq');
fs=input('enter the stopband freq');
f=input('enter the sampling freq');
wp=2*fp/f;
ws=2*fs/f;
num=-20*log10(sqrt(rp*rs))-10;
den=14.6*(fs-fp)/f;
n=ceil(num/den);
n1=n+1;
if(rem(n,2)~=0)
 n1=n;
 n=n-1;
end
y=boxcar(n1);
b=fir1(n,wp,y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,1);
```

```
0.05
0.04
1500
2000
9000
```

```
plot(o/pi,m);
ylabel('gain in db-->');
xlabel('(a)normalized freq-->');
b=fir1(n,wp,'high',y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,2);
plot(o/pi,m);
ylabel('gain in db-->');
xlabel('(b)normalized freq-->');
wn=[wp,ws];
b=fir1(n,wn,y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,3);
plot(o/pi,m);
ylabel('gain in db-->');
xlabel('(c)normalized freq-->');
b=fir1(n,wn,'stop',y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,4);
plot(o/pi,m);
ylabel('gain in db-->');
xlabel('(d)normalized freq-->');
```

11)DFT USING FFT

```
clc;
close all;
N=4
Xn=[1,1,2,3];
disp('DFT of the sequence xn is,');
XK=fft(Xn,N)
disp('the magnitude sequence is');
magXK=abs(XK)
disp('the phase sequence is');
phaXK=angle(XK)
disp('inverse DFT of sequence XK is');
Xn=ifft(XK)
n=0:1:N-1;
WK=0:1:N-1;
subplot(2,2,1);
stem(n,Xn);
title('inputsequence')
xlabel('n');
ylabel('Xn');
subplot(2,2,2);
stem(n,Xn);
title('IDFT sequence')
xlabel('n');
ylabel('Xn');
subplot(2,2,3);
stem(WK,magXK);
title('magnitude spectrum')
xlabel('K');
ylabel('magXK');
```

```
[1 1 2 3]
```

```
subplot(2,2,4);
stem(WK,phaXK);
title('phase spectrum')
xlabel('K')
ylabel('phaXK')
```

12)DFT AND IDFT

```
clc;
close all;
clear all;
xn=input('enter the sequence x(n)');
ln=length(xn);
xk=zeros(1,ln);
ixk=zeros(1,ln);
for k=0:ln-1
    for n=0:ln-1
        xk(k+1)=xk(k+1)+(xn(n+1)*exp[((-i)*2*pi*k*n/ln));
    end
end
t=0:ln-1;
subplot(2,2,1);
stem(t,xn);
grid
ylabel('amplitude');
xlabel('time index');
title('input sequence');
magnitude=abs(xk);
t=0:ln-1;
subplot(2,2,2);
stem(t,magnitude);
grid
ylabel('amplitude');
xlabel('k');
title('magnitude response');
phase=angle(xk);
t=0:ln-1;
subplot(2,2,3);
stem(t,phase);
grid
ylabel('phase');
xlabel('k');
title('phase sequence');
for k=0:ln-1
    for n=0:ln-1
    ixk(k+1)=ixk(k+1)+xn(n+1)*exp((-i)*2*pi*k*n/ln);
end
end
ixk=ixk/ln;
t=0:ln-1;
subplot(2,2,4);
stem(t,xn);
grid
ylabel('amplitude');
xlabel('time index');
title('IDFT sequence');
```

```
[1 1 1 1 0 0 0 0]
```