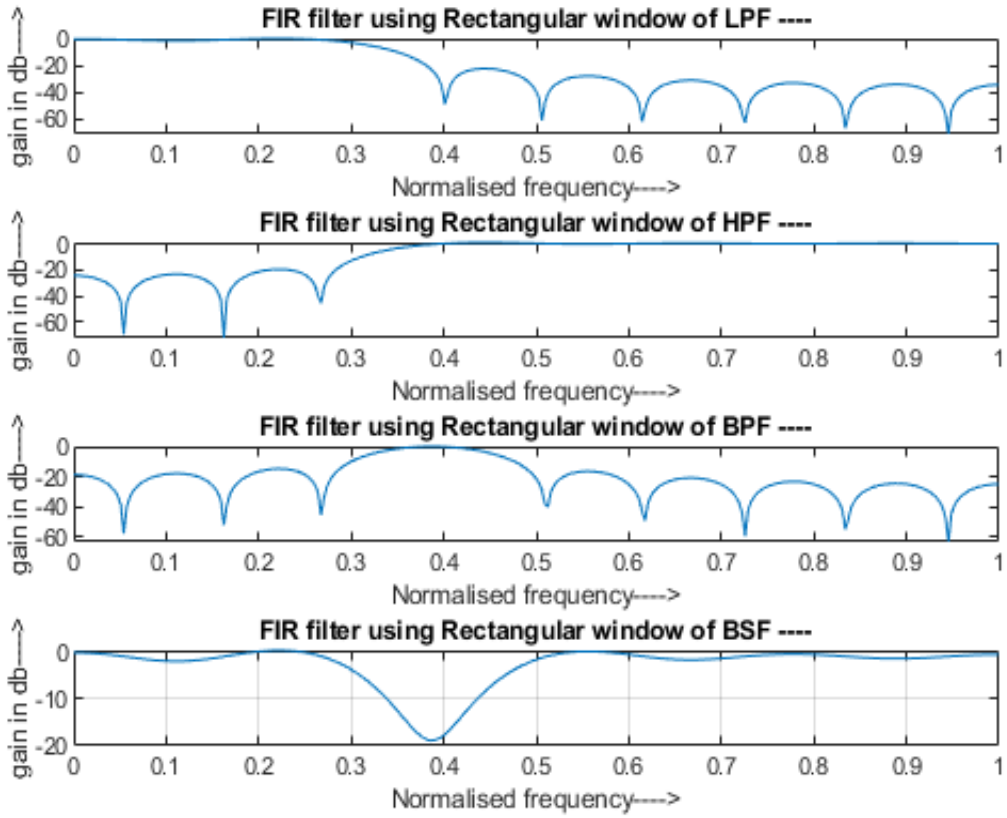
```
%Rectengular window based filter design

clc;
close all;
clear all;
format long;
rp=input('enter the passband ripple:(default:0.04)');
rs=input('enter the stopband ripple:(default: 0.05)');
fp=input('enter the passband frequency:(default:1500)');
fs=input('enter the stopband frequency:(default:2000)');
f=input('enter the sampling frequency:(default:9000)');
wp=2*(fp/f);
ws=2*(fs/f);
num=-20*log10(sqrt(rp*rs))-13;
dem=14.6*(fs-fp)/f;
n=ceil(num/dem);
n1=n+1;
if(rem(n,2)~=0)
n1=n;
n=n-1;
end;
y=boxcar(n1);
%Lowpass filter
b=fir1(n,wp,y);
w= 0:0.01:pi; %w is a normalized frequency
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,1);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Rectangular window of LPF ----');
%Highpass filter
b=fir1(n,wp,'high',y);
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,2);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Rectangular window of HPF ----');
%Bandpass filter
b=fir1(n,[wp ws],'bandpass',y);
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,3);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Rectangular window of BPF ----');
%Bandstop filter
b=fir1(n,[wp ws],'stop',y);
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,4);
plot(w/pi,m);
ylabel('gain in db---->');
```

```
xlabel('Normalised frequency---->');
title('FIR filter using Rectangular window of BSF ----');
grid on;
```



```
%Hanning window based filter design
clc;
close all;
clear all;
format long;
rp=input('enter the passband ripple:(default:0.04)');
rs=input('enter the stopband ripple:(default: 0.05)');
fp=input('enter the passband frequency:(default:1500)');
fs=input('enter the stopband frequency:(default:2000)');
f=input('enter the sampling frequency:(default:9000)');
wp=2*fp/f;
ws=2*fs/f;
num=-20*log10(sqrt(rp*rs))-13;
dem=14.6*(fs-fp)/f;
n=ceil(num/dem);
n1=n+1;
if(rem(n,2)==0)
    m=n+1;
else
    m=n;
    n=n-1;
end

w=hann(m);
%Lowpass filter
b=fir1(n,wp);
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,1);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Hanning window of LPF ----');
%Highpass filter
b=fir1(n,wp,'high');
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,2);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Hanning window of HPF ----');
%Bandpass filter
b = fir1(n, [wp ws], 'bandpass', hanning(n+1));
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,3);
plot(w/pi,m);
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Hanning window of BPF ----');
%Bandstop filter
b=fir1(n,[wp ws],'stop');
h=freqz(b,1,w);
m=20*log10(abs(h));
subplot(4,1,4);
plot(w/pi,m);
```

```
ylabel('gain in db---->');
xlabel('Normalised frequency---->');
title('FIR filter using Hanning window of BSF ----');
grid on;
```