

EXPERIMENT 6

By,

Raja Aadhithan

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Write a MATLAB Script to design the FIR filter (low pass, high pass, band pass, band stop) using Window Method.

1. Rectangular
2. Hamming
3. Hann
4. Kaiser

Code:

```
clc;%clear console
clear;%clear variables
close all;%close all figures

n = 20;%order of filter
fp = 200;%pass band frequency
fs = 600;%stop band frequency
f = 2000;%sampling frequency
wp = 2*(fp/f);%pass band frequency in rads
ws = 2*(fs/f);%stop band frequency in rads

window_1 = boxcar(n+1);%rectangular window
window_2 = hamming(n+1);%hamming window
window_3 = hann(n+1);%hann window
window_4 = kaiser(n+1); %kaiser window

%attaching all the doubles to use in loop conveniently
y = [window_1 ,window_2 ,window_3 ,window_4];

%to be used in titles
name = ["rectangular","hamming","hann","kaiser"];

%plotting loops
for i = 1:4
    window = y(1:n+1,i);%takes one window at a time
    t = ["high","low","bandpass","stop"];%four different types of filter

    for x = 1:length(t)
        if x < 3
            wn = wp;%single frequency for high and low pass filters
        else
            wn = [wp,ws];%two frequencies for band filters
        end

        b = fir1(n,wn,t(x),window);%filter function
        [H,w] = freqz(b,1);%transfer function
```

```
figure (i)%individual figures for each window
```

```
subplot(4,2,2*x-1)
plot(w/pi,20*log(abs(H)));%magnitude
xlabel('normalized frequency');
ylabel('mag in db');
title ('mag response for ' + name(i) + ' as ' + t(x) + ' pass filter ');

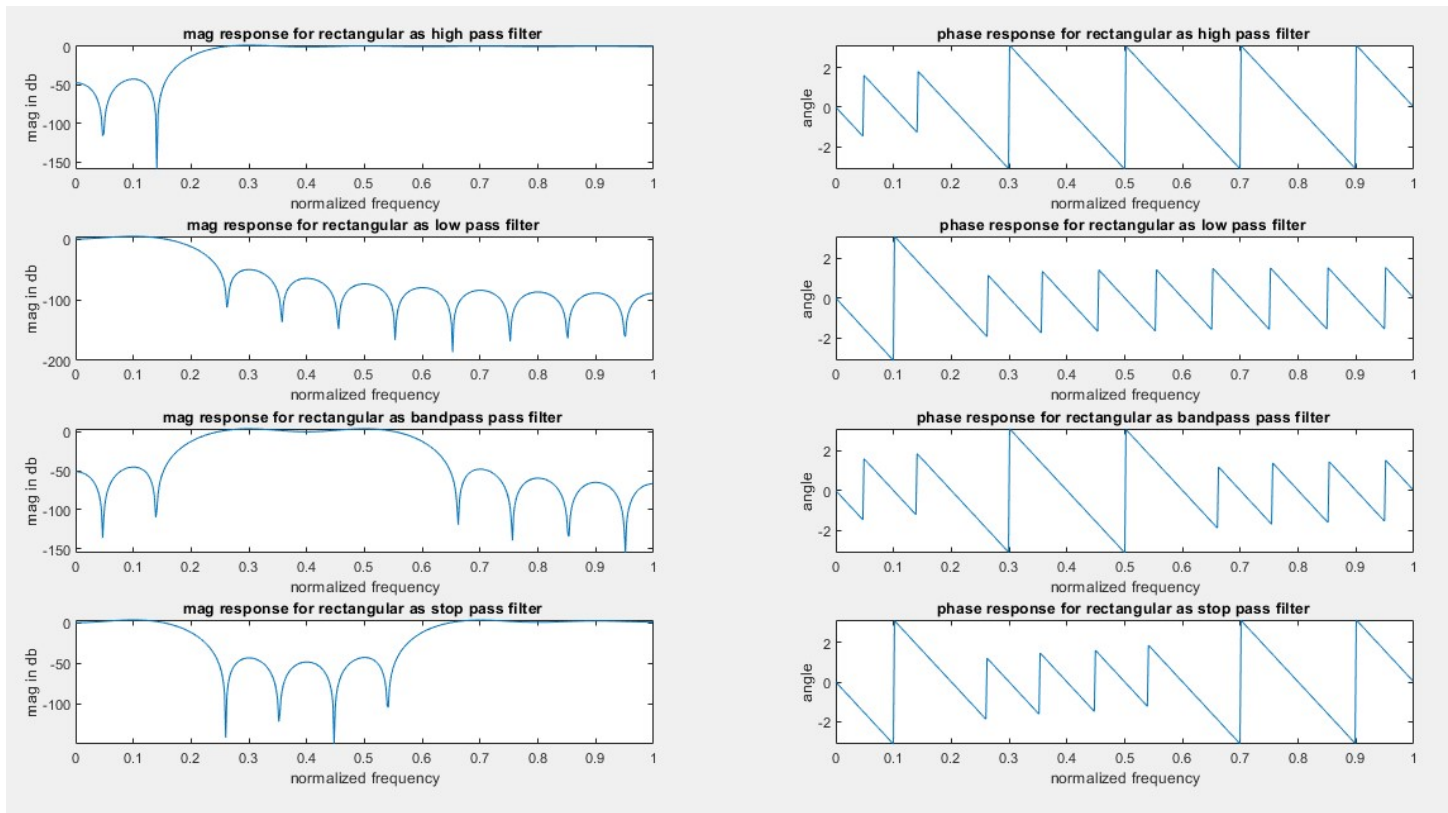
subplot(4,2,2*x)
plot(w/pi,angle(H));%phase
xlabel('normalized frequency');
ylabel('angle');
title ('phase response for ' + name(i) + ' as ' + t(x) + ' pass filter ');
```

```
end
```

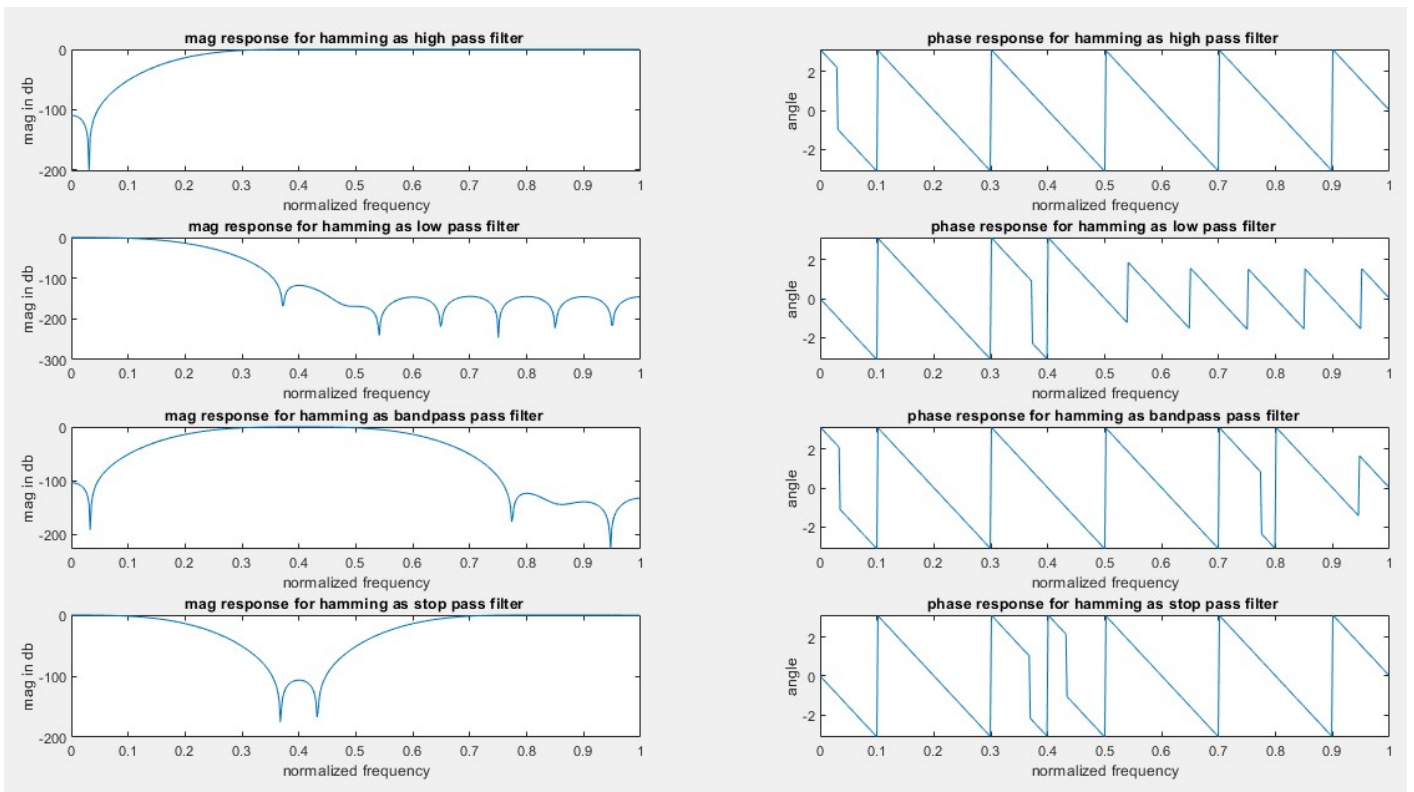
```
end
```

Output:

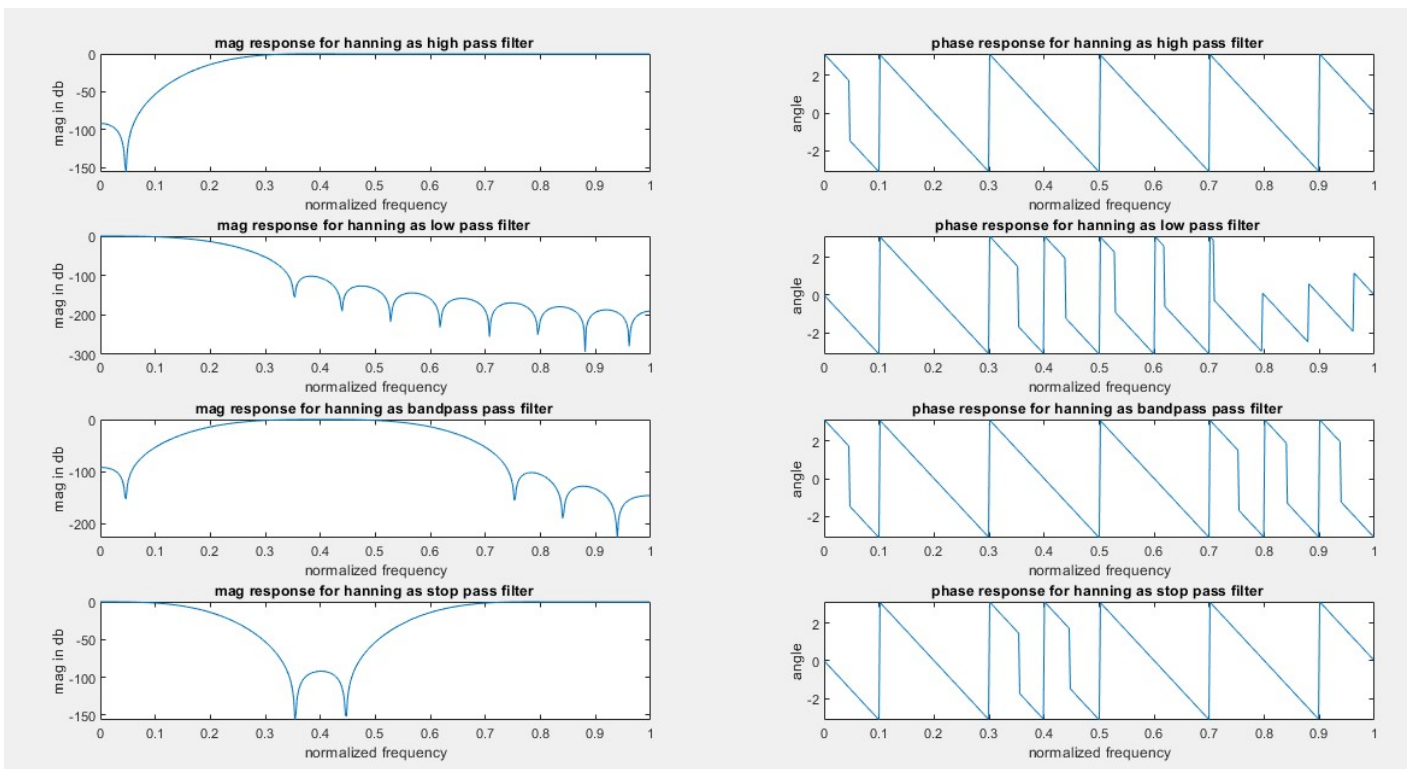
Rectangular:



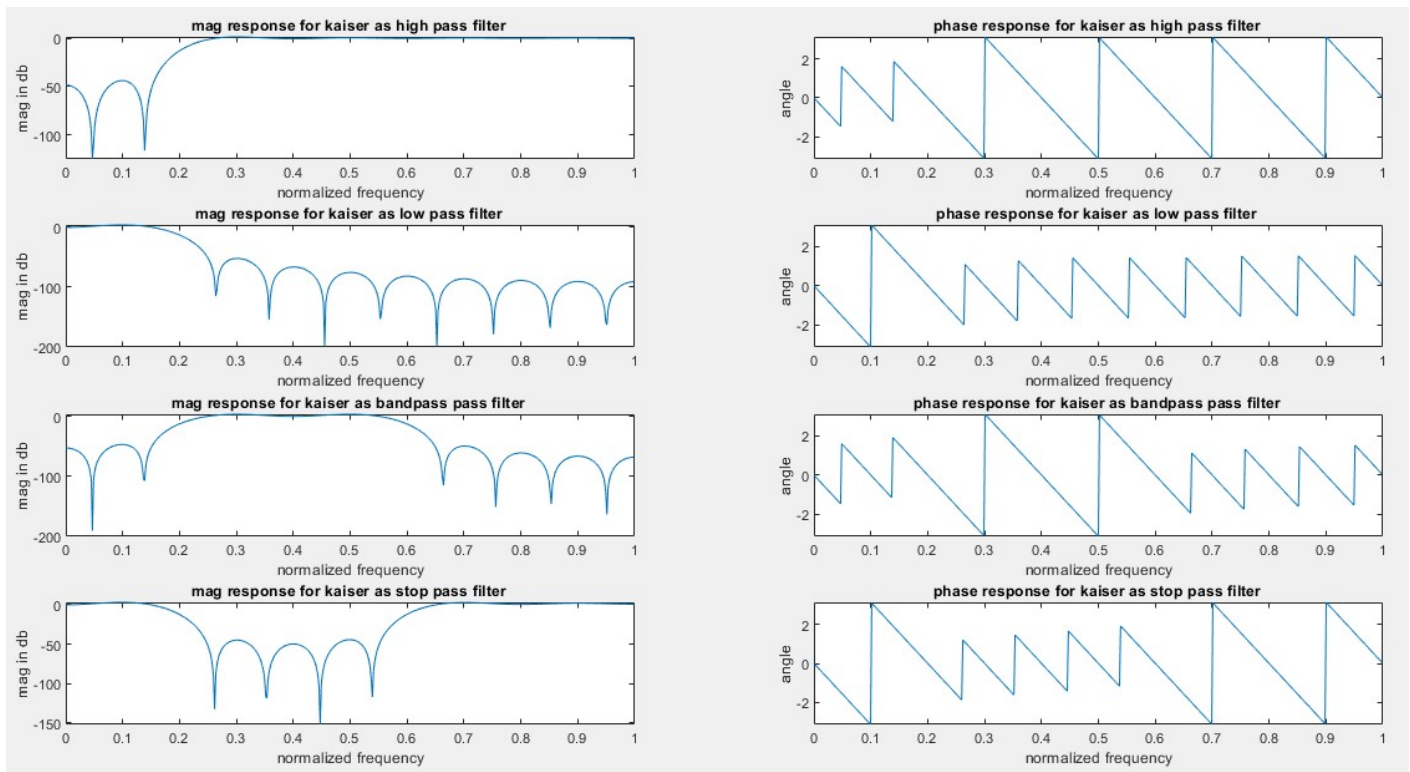
Hamming:



Hanning:



Kaiser:



List of variables:

```
>> whos
```

Name	Size	Bytes	Class	Attributes
H	512x1	8192	double	complex
b	1x21	168	double	
f	1x1	8	double	
fp	1x1	8	double	
fs	1x1	8	double	
i	1x1	8	double	
n	1x1	8	double	
name	1x4	328	string	
t	1x4	328	string	
w	512x1	4096	double	
window	21x1	168	double	
window_1	21x1	168	double	
window_2	21x1	168	double	
window_3	21x1	168	double	
window_4	21x1	168	double	
wn	1x2	16	double	
wp	1x1	8	double	
ws	1x1	8	double	
x	1x1	8	double	
y	21x4	672	double	