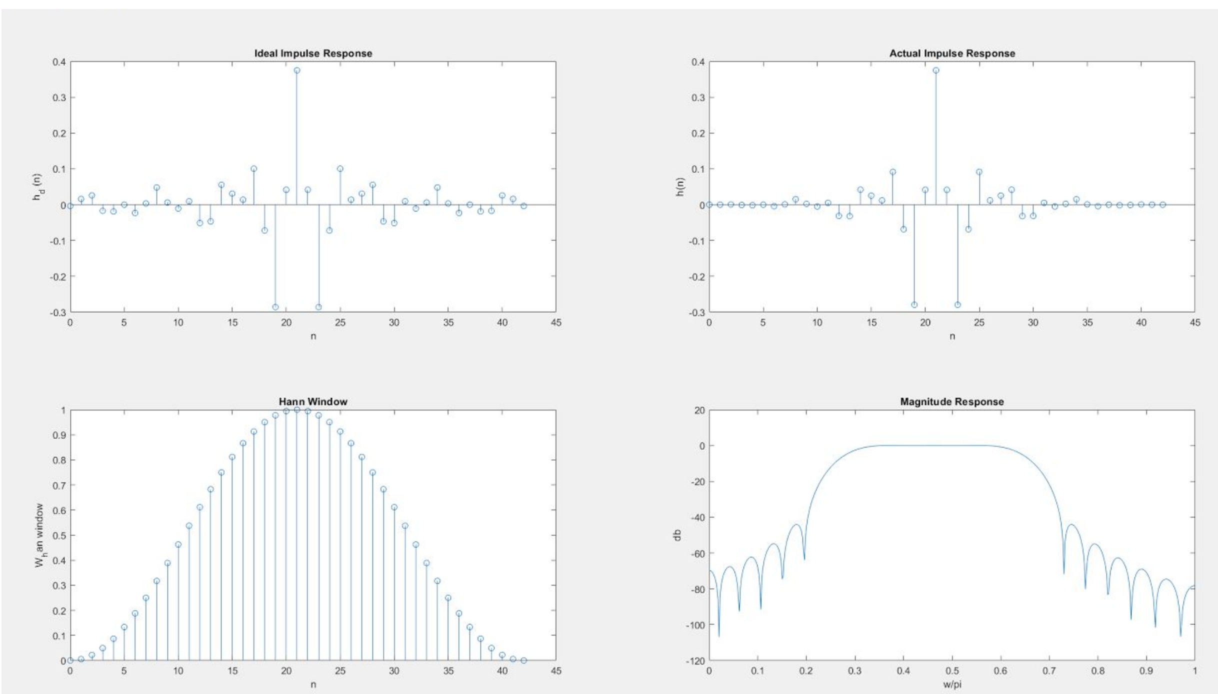
Name: Jeremy Liem

1. Code :

```
function[Rp,As] = delta2db(delta1, delta2)
%convert absolute specs delta1 and delta2 into dB specs Rp and As
%[Rp,As] = delta2db(delta1, delta2)
Rp = -20*log10((1-delta1)/(1+delta1));
As = -20*log10((delta2)/(1+delta1));


function[delta1 , delta2] = db2delta(Rp,As)
%converts dB specs Rp and As into absolute specs delta1 and delta2
%[delta1, delta2] = db2delta(Rp,As)
A = 10^(Rp/20);
delta1 = (A-1) / (A+1);
delta2 = (1+delta1)*(10^(-As/20));
```

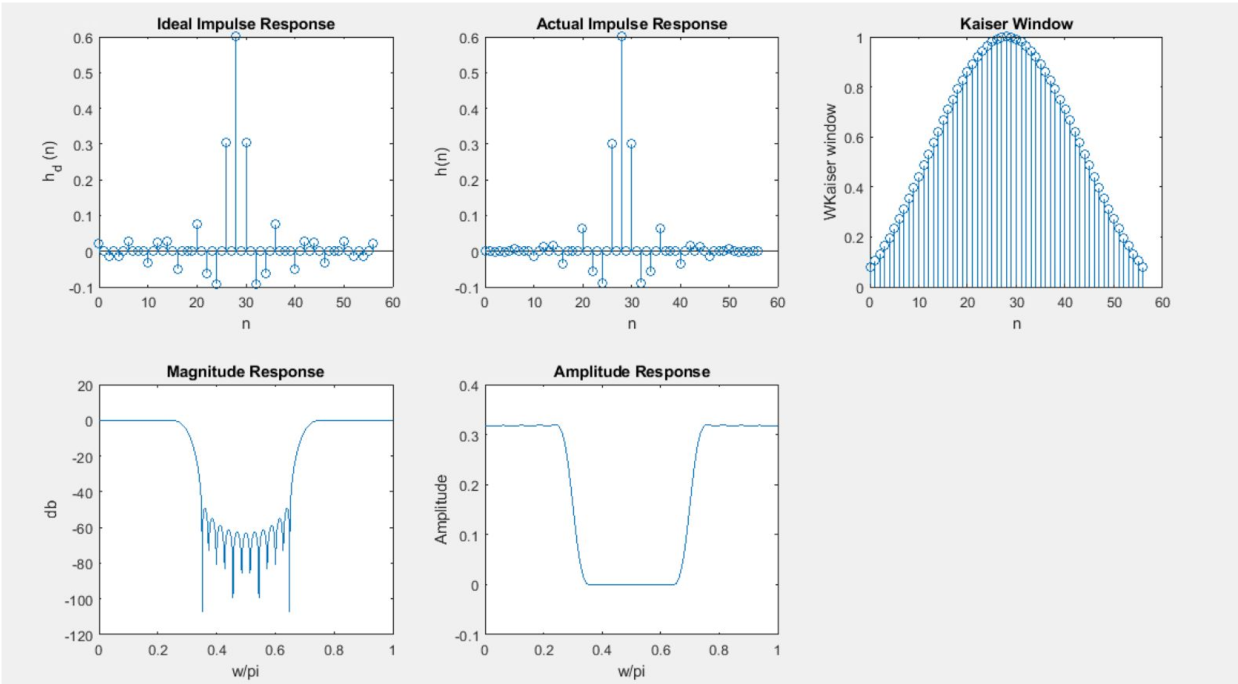
2.




```
%Ingle & proakis 7.9

wp1 = 0.35*pi;
wp2 = 0.55*pi;
ws1 = 0.2*pi;
```

```
ws2 = 0.75*pi;


trWidth = min((wp1 - ws1),(ws2-wp2));
M = ceil(6.2*pi/ trWidth) + 1;
wc1 = (wp1+ws1)/2;
wc2 = (wp2+ws2)/2;
n = 0:M-1;
hd = ideal_lp(wc2,M) - ideal_lp(wc1,M);
w_hann = (hann(M))';
h = hd .* w_hann;
[db,mag,pha,grd,w] = freqz_m(h,1);
deltaW = pi/500;

%Check properties
Rp = -min(db(wp1/deltaW + 1:wp2/deltaW));
As = -round(max(db(ws2/deltaW+1:1:501)));
figure;
subplot(2,2,1);
stem(n,hd);
xlabel('n');
ylabel('h_d (n)');
title('Ideal Impulse Response');
subplot(2,2,2);
stem(n,h);
xlabel('n');
ylabel('h(n)');
title('Actual Impulse Response');
subplot(2,2,3);
stem(n,w_hann);
xlabel('n');
ylabel('W_han window');
title('Hann Window');
subplot(2,2,4);
plot(w/pi,db);
xlabel('w/pi');
ylabel('db');
title('Magnitude Response');
```

3.



Code:

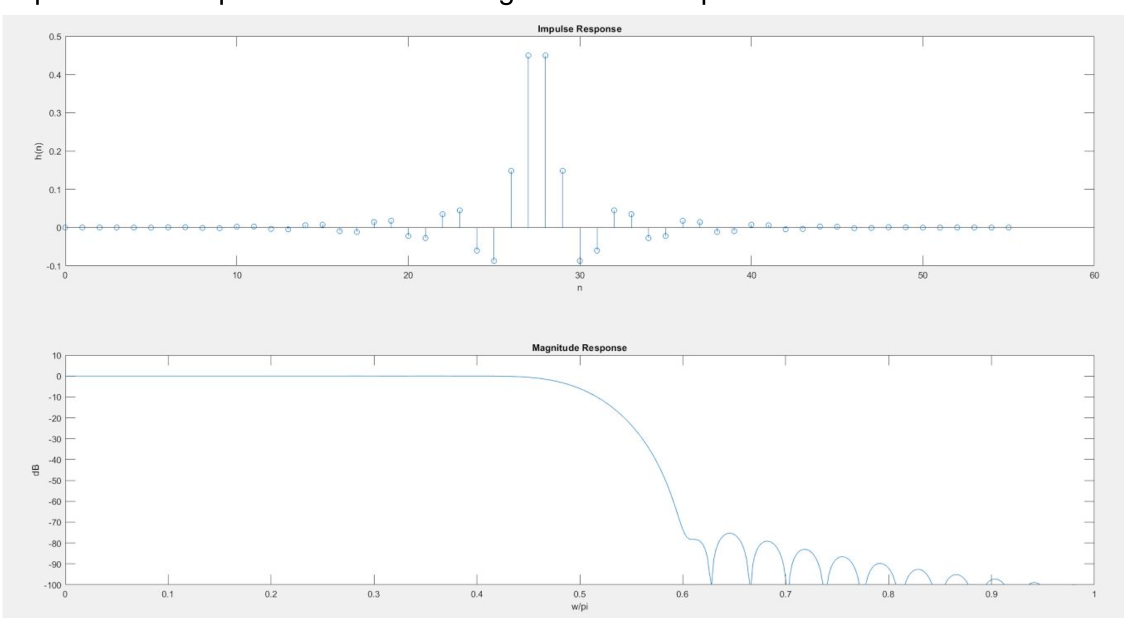
```
%Ingle & Proakis 7.13

wp1 = 0.25*pi;
wp2 = 0.75*pi;
ws1 = 0.35*pi;
ws2 = 0.65*pi;

delta1 = 0.025;
delta2 = 0.005;
trWidth = abs(min((wp1-ws1),(ws2-wp2)))/(2*pi);
wc1 = (wp1+ws1)/2; wc2 = (wp2+ws2)/2;
[Rp, As] = delta2db(delta1,delta2);
M = ceil((As-7.95)/(14.36*trWidth)+1)+1;
M = 2*floor(M/2) +1;
n = 0:1:M-1;
beta = 0.1102*(As - 8.7);
wKaiser = (kaiser(M, beta))';
hd = ideal_lp(pi,M) + ideal_lp(wc1,M) - ideal_lp(wc2, M);
h = hd.* wKaiser;
[db, mag, pha, grd ,w] = freqz_m(h, 1);
deltaW = pi/500;
[Hr,w,c,L] = Ampl_res(h);
figure;
subplot(2,3,1);
stem(n,hd);
xlabel('n');
```

```
ylabel('h_d (n)');
title('Ideal Impulse Response');
subplot(2,3,2);
stem(n,h);
xlabel('n');
ylabel('h(n)');
title('Actual Impulse Response');
subplot(2,3,3);
stem(n,wKaiser);
xlabel('n');
ylabel('WKaiser window');
title('Kaiser Window');
subplot(2,3,4);
plot(w/pi,db);
xlabel('w/pi');
ylabel('db');
title('Magnitude Response');
subplot(2,3,5);
plot(w/pi,Hr/pi);
xlabel('w/pi');
ylabel('Amplitude');
title('Amplitude Response');
```

4.

a) We cannot use a Hamming Window to design filter because its stopband attenuation requirement is equal to 66dB. Hamming's Window Stopband attenuation is 53 dB.

b)



c) M =56 , therefore it is type II

d) Rp = 0.0033

As = 73

```
% Ingle and Proakis

wp = 0.4*pi;
ws = 0.6*pi;
trWidth = ws-wp;
M = ceil(11*pi/trWidth) + 1;
n = 0:1:M-1;
wc = (ws+wp)/2;
hd = ideal_lp(wc,M);
w_window = blackman(length(hd))';
h = hd .*w_window;
h = h/sum(h);
[db,mag,pha,grd,w] = freqz_m(h,1);
deltaW = pi/500;


% Plot
subplot(2,1,1);
stem(n,h);
xlabel('n');
ylabel('h(n)');
title('Impulse Response');
subplot(2,1,2);
plot(w/pi, db);
xlabel('w/pi');
ylabel('dB');
title('Magnitude Response');
axis([0 1 -100 10])

%No4
Rp = -min(db(1:1:wp/deltaW+1));
As = -round(max(db(ws/deltaW+1:1:501)));
```