%FIR Filter using Window Technique High pass Filter

clc;

clear all;

close all;

wc = input('Enter the cutoff frequency (in radians): ');

N = input('Enter the order/length of filter: ');

alpha = floor((N-1)/2);

hd = zeros(1, N);

for n = 1:N

if (n-1) == alpha

hd(n) = 1 - (wc/pi);

else

hd(n) = (1 / (pi \* (n - 1 - alpha))) \* ...

(sin(pi \* (n - 1 - alpha)) - sin(wc \* (n - 1 - alpha)));

end

end

wn = hamming(N)';

hn = hd .\* wn;

w = 0:0.01:pi;

h = freqz(hn, 1, w);

subplot(3, 1, 1);

plot(w/pi, abs(h), 'LineWidth', 1.5);

xlabel('Normalized Frequency (\times\pi rad/sample)');

ylabel('Magnitude');

title('Frequency Response of High-Pass FIR Filter');

grid on;

fs = 570;

t = 0:(1/fs):1;

x = 2\*sin(2\*pi\*50\*t) + 4\*sin(2\*pi\*120\*t) + 8\*sin(2\*pi\*240\*t);

y = fft(x);

f = (0:length(x)-1) \* fs / length(x);

subplot(3, 1, 2);

stem(f, abs(y), 'filled');

xlabel('Frequency (Hz)');

ylabel('Magnitude |X(f)|');

title('Frequency Spectrum of Input Signal');

grid on;

H = freqz(hn, 1, 2\*pi\*f/fs);

yout = y .\* H';

subplot(3, 1, 3);

stem(f, abs(yout), 'filled');

xlabel('Frequency (Hz)');

ylabel('Magnitude |Y(f)|');

title('Frequency Spectrum of Output Signal');

grid on;