Lab Report on

Signal processing Laboratory

(EE 314)

Submitted By:

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ASSIGNMENT

1. Design an FIR filter using windowing technique with the following specifications:

$$|H(e^{j\omega})| = \begin{cases} 1, -2 \le \omega \le 2 \\ 0, otherwise \end{cases}$$

Use rectangular window with length L=5

$$W(n) = \begin{cases} 1, -2 \le \omega \le 2 \\ 0, otherwise \end{cases}$$

Also find the frequency response of the filter.

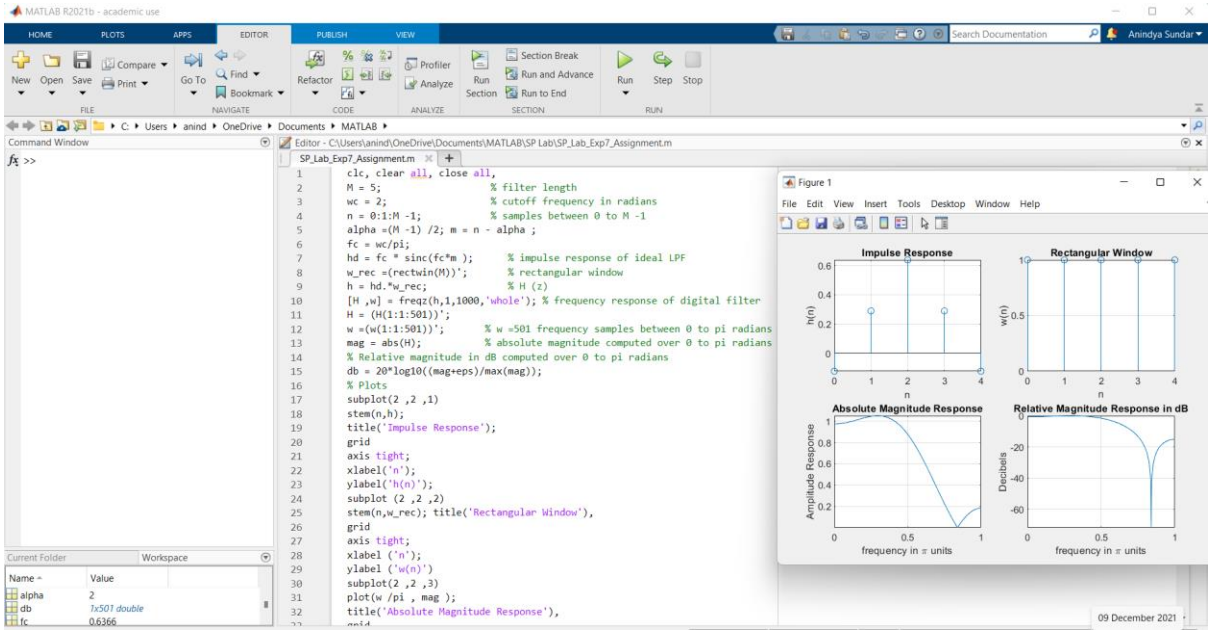

Figure: MATLAB Window

MATLAB Code:

```
clc,
clear all,
close all,
M = 5;                % filter length
wc = 2;               % cutoff frequency in radians
n = 0:1:M -1;         % samples between 0 to M -1
alpha =(M -1) /2; m = n - alpha ;
fc = wc/pi;
hd = fc * sinc(fc*m );     % impulse response of ideal LPF
w_rec =(rectwin(M))';      % rectangular window
h = hd.*w_rec;             % H (z)
[H ,w] = freqz(h,1,1000,'whole'); % frequency response of digital filter
```

```
H = (H(1:1:501))';
w =(w(1:1:501))';              % w =501 frequency samples between 0 to pi radians
mag = abs(H);          % absolute magnitude computed over 0 to pi radians
% Relative magnitude in dB computed over 0 to pi radians
db = 20*log10((mag+eps)/max(mag));
% Plots
subplot(2 ,2 ,1)
stem(n,h);
title('Impulse Response');
grid
axis tight;
xlabel('n');
ylabel('h(n)');
subplot (2 ,2 ,2)
stem(n,w_rec); title('Rectangular Window'),
grid
axis tight;
xlabel ('n');
ylabel ('w(n)')
subplot(2 ,2 ,3)
plot(w /pi , mag );
title('Absolute Magnitude Response'),
grid
axis tight;
xlabel('frequency in \pi units');
ylabel('Amplitude Response')
subplot(2 ,2 ,4)
plot(w/pi,db);
title('Relative Magnitude Response in dB'),
grid
axis tight;
xlabel('frequency in \pi units');
ylabel ('Decibels');
```

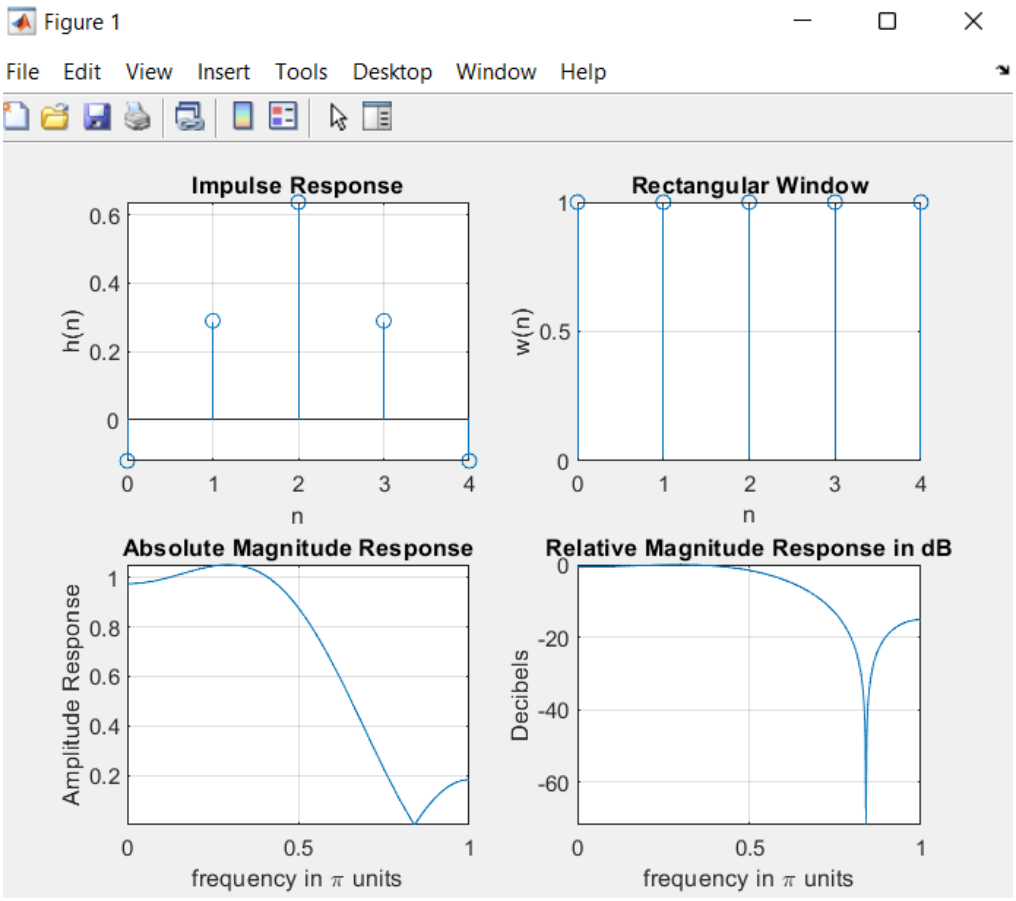
Figure 1
File Edit View Insert Tools Desktop Window Help
Impulse Response
h(n)
n
Rectangular Window
w(n)
n
Absolute Magnitude Response
Amplitude Response
frequency in π units
Relative Magnitude Response in dB
Decibels
frequency in π units