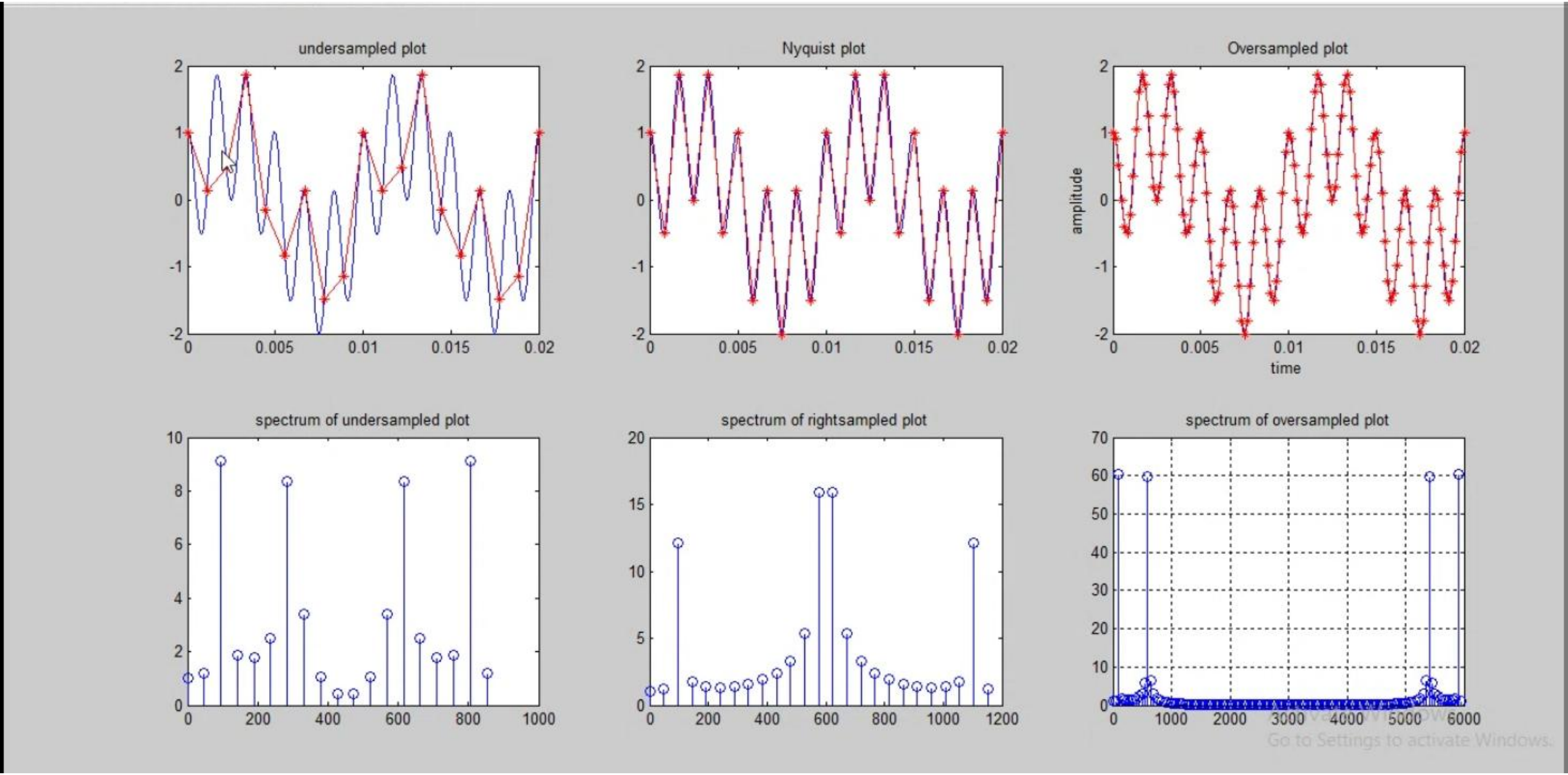

undersampled plot
Nyquist plot
Oversampled plot
amplitude
time
spectrum of undersampled plot
spectrum of rightsampled plot
spectrum of oversampled plot
Go to Settings to activate Windows.

Theory:

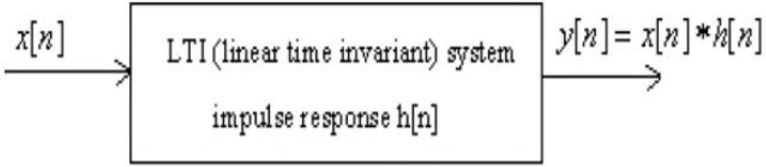


Fig.2.1 A LTI system

A complete **characterization of any LTI system** can be represented in terms of its **response to an unit impulse**, which is referred to as **Impulse response** of the system. Alternatively, the impulse response is the output of a LTI system due to an impulse input applied at t=0, or n=0.

- A discrete time LTI system (also called digital filters) as shown in Fig.2.1 is represented by
  - A linear constant coefficient difference equation, for example, $y[n] + a_1 y[n-1] - a_2 y[n-2] = b_0 x[n] + b_1 x[n-1] + b_2 x[n-2]$;
  - A system function H(z) (obtained by applying Z transform to the difference equation).

    $H(z) = \frac{Y(z)}{X(\ldots} \quad b_0 + b_1 z^{-1} + b_2 z^{-2}$

- Given the difference equation or H(z), the impulse response of the LTI system is found using

PROBLEM:

Obtain the Impulse response of a system described by the difference equation-

$$y(n)-3/4\,y(n-1)+1/8\,y(n-2) = x(n)-1/3\,x(n-1)$$

Solution:

$$Y(z) - 3/4\,Y(z)z^{-1} + 1/8\,Y(z)z^{-2} = X(z) - 1/3\,X(z)\,z^{-1}$$

$$H(z) = Y(z) / X(z) = (1-1/3\,z^{-1}) / (1-3/4\,z^{-1}+1/8\,z^{-2})$$

Applying partial fractions,

$$H(z) = (1-1/3\,z^{-1}) / (1-1/2\,z^{-1})(1-1/4\,z^{-1}) = A / (1-1/2\,z^{-1}) + B / (1-1/4\,z^{-1})$$

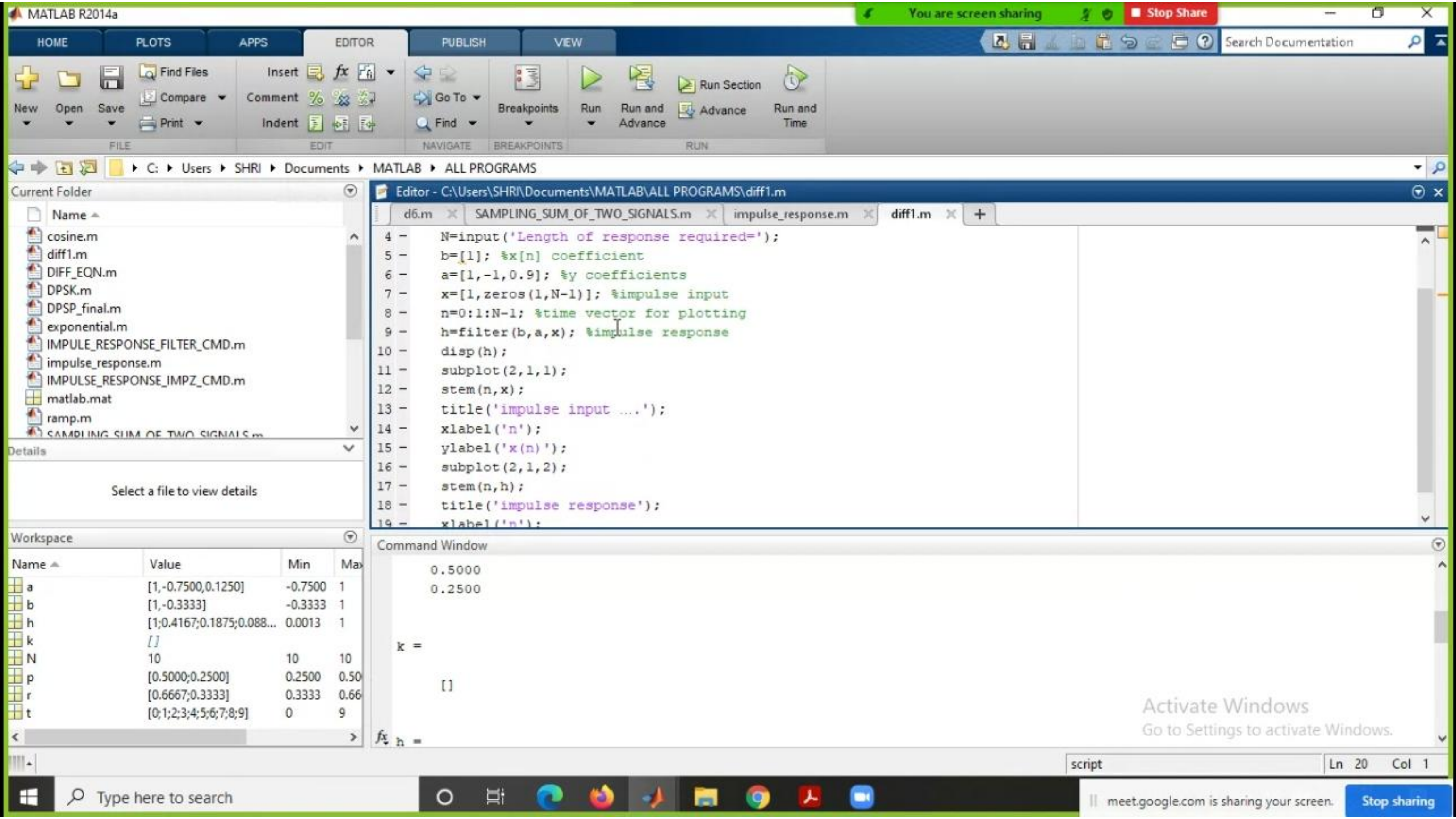
A=2/3;

B=1/3;

$$H(z) = (2/3) / (1-1/2\,z^{-1}) + (1/3) / (1-1/4\,z^{-1})$$

$$h(n) = (2/3)\,(1/2)^n u(n) + (1/3)\,(1/4)^n u(n)$$

h(0)=1	**h(4)=0.0429**	**h(8)=0.0026**
h(1)=0.416	**h(5)=0.02116**	**h(9)=0.0013**
h(2)=0.187	**h(6)=0.0105**	
h(3)=0.088	**h(7)=0.0052**	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DIFF_EQN.m
DPSK.m
DPSP_final.m
exponential.m
IMPULE_RESPONSE_FILTER_CMD.m
impulse_response.m
IMPULSE_RESPONSE_IMPZ_CMD.m
matlab.mat
ramp.m
Select a file to view details
Editor - C:\Users\SHRI\Documents\MATLAB\ALL PROGRAMS\diff1.m
d6.m
SAMPLING_SUM_OF_TWO_SIGNALS.m
impulse_response.m
diff1.m
N=input('Length of response required=');
b=[1]; %x[n] coefficient
a=[1,-1,0.9]; %y coefficients
x=[1,zeros(1,N-1)]; %impulse input
n=0:1:N-1; %time vector for plotting
h=filter(b,a,x); %impulse response
disp(h);
subplot(2,1,1);
stem(n,x);
title('impulse input ....');
xlabel('n');
ylabel('x(n)');
subplot(2,1,2);
stem(n,h);
title('impulse response');
Workspace
Name | Value | Min | Max
a | [1,-0.7500,0.1250] | -0.7500 | 1
b | [1,-0.3333] | -0.3333 | 1
h | [1;0.4167;0.1875;0.088... | 0.0013 | 1
k | [] | |
N | 10 | 10 | 10
p | [0.5000;0.2500] | 0.2500 | 0.50
r | [0.6667;0.3333] | 0.3333 | 0.66
t | [0;1;2;3;4;5;6;7;8;9] | 0 | 9
Command Window
0.5000
0.2500
k =
[]
h =
Activate Windows
Go to Settings to activate Windows.
script
Ln 20 Col 1
Type here to search
meet.google.com is sharing your screen.
Stop sharing

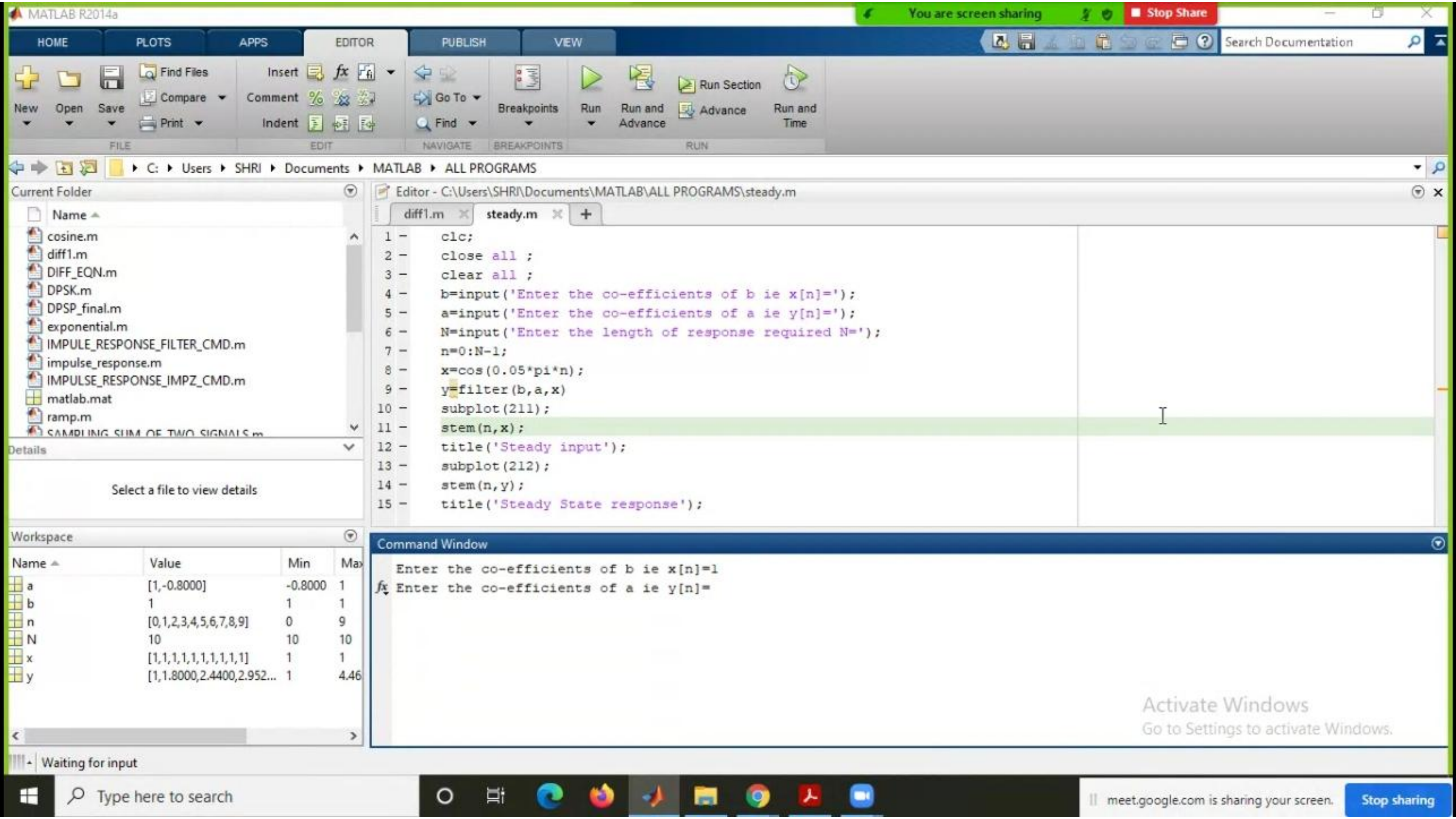
2b.2 To find step response:

```
clc;    close all;    clear all
b=input('Enter the co-efficients of b ie x[n]=');
a=input('Enter the co-efficients of a ie y[n]=');
N=input('Enter the length of response required N=');
n=0:1:N-1;
x=[ones(1,N)];
y=filter(b,a,x)
subplot(211);    stem(n,x);    title('Step input');
subplot(212);    stem(n,y);    title('Step response');
```

Result:

Enter the co-efficients of b ie x[n]=[1]

Enter the co-efficients of a ie y[n]=[1 -1 0.9]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cosine.m
diff1.m
DIFF_EQN.m
DPSK.m
DPSP_final.m
exponential.m
IMPULE_RESPONSE_FILTER_CMD.m
impulse_response.m
IMPULSE_RESPONSE_IMPZ_CMD.m
matlab.mat
ramp.m
Select a file to view details
Editor - C:\Users\SHRI\Documents\MATLAB\ALL PROGRAMS\steady.m
diff1.m
steady.m
clc;
close all ;
clear all ;
b=input('Enter the co-efficients of b ie x[n]=');
a=input('Enter the co-efficients of a ie y[n]=');
N=input('Enter the length of response required N=');
n=0:N-1;
x=cos(0.05*pi*n);
y=filter(b,a,x)
subplot(211);
stem(n,x);
title('Steady input');
subplot(212);
stem(n,y);
title('Steady State response');
Workspace
Name Value Min Max
a [1,-0.8000] -0.8000 1
b 1 1 1
n [0,1,2,3,4,5,6,7,8,9] 0 9
N 10 10 10
x [1,1,1,1,1,1,1,1,1,1] 1 1
y [1,1.8000,2.4400,2.952... 1 4.46
Command Window
Enter the co-efficients of b ie x[n]=1
Enter the co-efficients of a ie y[n]=
Activate Windows
Go to Settings to activate Windows.
Waiting for input
Type here to search
meet.google.com is sharing your screen.
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