DC AHP-3

Name: C.P.Sindhu
SRN: PES1UG21EC071
Semester: 4th
Section: 'B'

Code:

```
close all;

tr = 0.001; % Time resolution, for defining and plotting
the continuous-time signal x(t)
t = [0: tr :1]; % We consider the range 0 < t< 1.
x = cos(2*pi*t) + 2*sin(4*pi*t); % x(t) defined
Ts = 0.02; % Sampling period
n = [0:Ts:1]; % For plotting the sampled signal

Nfactor = round(Ts/tr);
BW = 10; % Bandwidth of the ideal LPF for reconstruction

% Generating the impulse train for ideal sampling
p = ones(1,length(x));
p = downsample(p,Nfactor);
p = upsample(p,Nfactor);
p = p(1:length(x));
xs = x.*p; % Multiplying x(t) with the impulse train to
obtain the sampled signal

% Plotting x(t) and its sampled version
subplot(311)
sgtitle('C.P.Sindhu(PES1UG21EC071)');
plot(t,x,'k');
hold on
stem(t,xs,'MarkerSize',1);
title('x(t) and its sampled version');

% Finding the spectrum of x(t) and its sampled version
Nfft = 2^ceil(log2(length(x)));
```

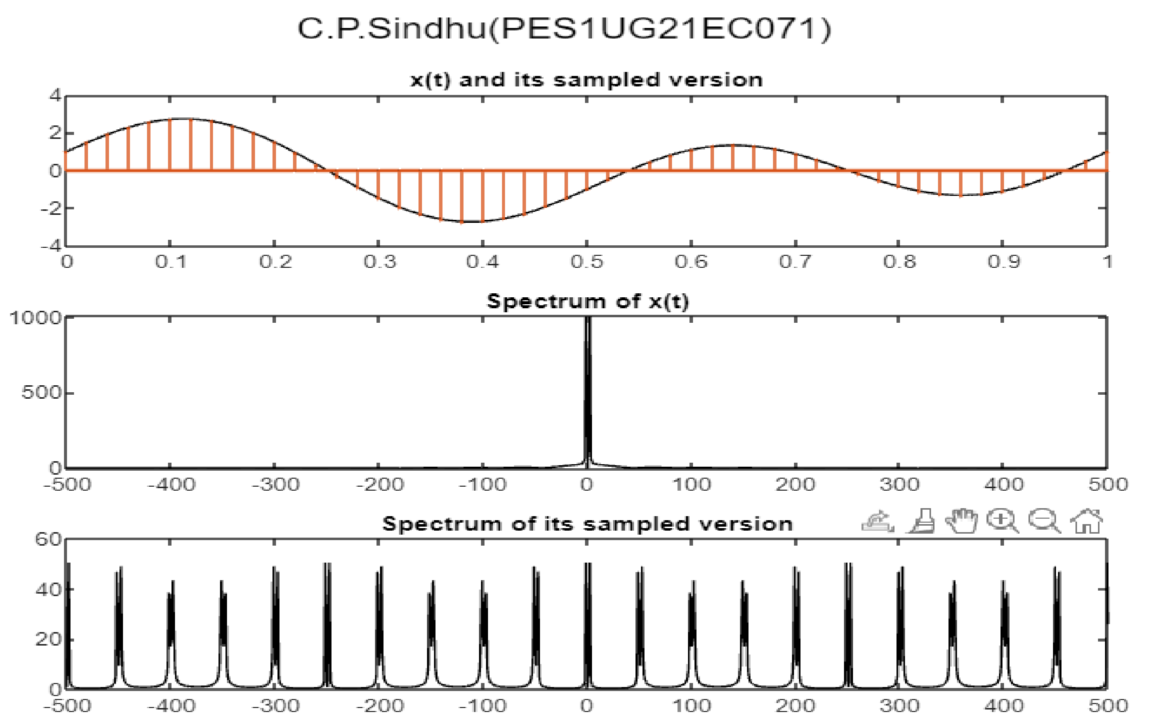
```
Fmax = 1/(2*tr);
Faxis = linspace(-Fmax,Fmax,Nfft); % Set the frequency
axis for plotting the spectra
X = fftshift(fft(x,Nfft)); % Spectrum of x(t)
Xs = fftshift(fft(xs,Nfft)); % Spectrum of its sampled
version

% Plotting the spectra
subplot(312)
plot(Faxis,abs(X),'k');
title('Spectrum of x(t)');
subplot(313)
plot(Faxis,abs(Xs),'k');
title('Spectrum of its sampled version');

% Defining and plotting the ideal LPF for reconstruction
Hlpf = zeros(1,Nfft);
Hlpf(Nfft/2-BW:Nfft/2+BW-1)=1;
figure;plot(Faxis,Hlpf);axis([-50,50,0,2]);
title('Ideal LPF for reconstruction');

% Reconstructing x(t)
Xr = Nfactor * Hlpf.*Xs; % Multiplying the spectrum of the
sampled signal with the ideal LPF response, along with
scaling.
xr = real(ifft(fftshift(Xr)));
xr = xr(1:length(x));
```

Output:



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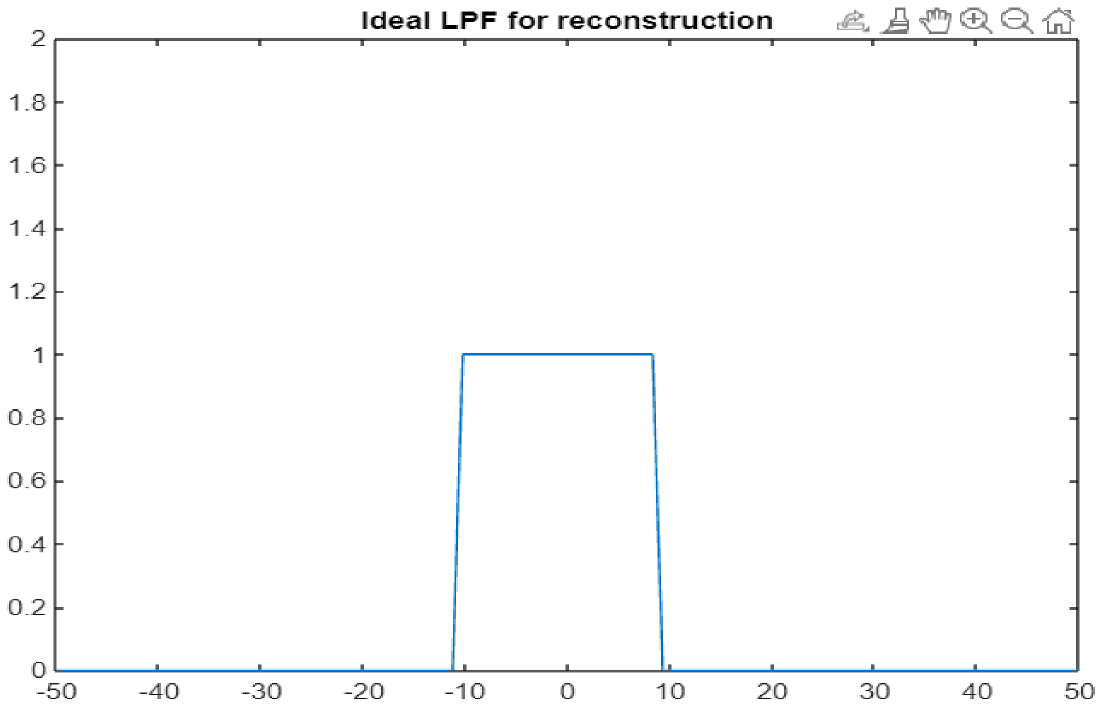
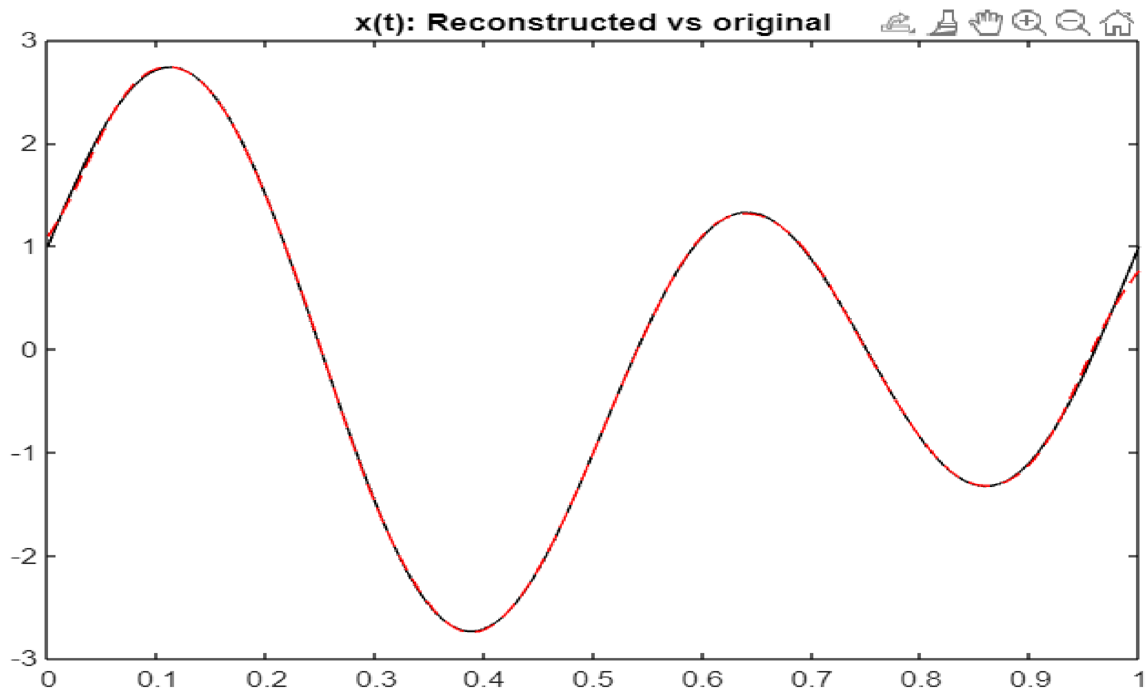
x(t) and its sampled version
4
2
0
-2
-4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Spectrum of x(t)
1000
500
0
-500
-400
-300
-200
-100
0
100
200
300
400
500
Spectrum of its sampled version
60
40
20
0
-500
-400
-300
-200
-100
0
100
200
300
400
500



Ideal LPF for reconstruction
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-50
-40
-30
-20
-10
0
10
20
30
40
50



x(t): Reconstructed vs original
3
2
1
0
-1
-2
-3
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1