CLASSMATE
Date
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Experiment - 6

18BIS0043
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ECE1018 - Lab
L21+L22

1. Write a MATLAB code to generate frequency spectrum of a periodic signal.
eg. Positive half square wave of period 2ms and amplitude 1V

2. Generate a signal as sum of two sinusoidal of frequency $f_1 = 400Hz$ and $f_2 = 800Hz$.
Use fft to find the fourier transform

3. Find the fourier transform of $e^{-2t}u(t)$. Plot original signal, magnitude and phase of its Fourier transform and verify

4. Convolve the signals $x_1(t) = e^{-at}$ and $x_2(t) = \sin(t)$ for 100 samples. Verify "convolution in time domain = multiplication in frequency domain"

5. Show that FT of rect is sinc. Plot graphs for time scaled version of rect signal.

1.

Editor - C:\Users\dr0hith\Desktop\exp6_1.m

exp6_2.m | exp6_1.m | 18BIS0043_1018_E6_3.m | 18BIS0043_1018_E6_2.m

```
t = 0:0.01:10;
%Train of Pulses
x = [ones(1,200),zeros(1,100),ones(1,200),zeros(1,100),ones(1,200),zeros(1,100),ones(1,101)];
T = 3;
w =2*pi/T;
dtau = 0.01;%Difference between two time intervals as taken in matlab;
for k=-10:10
    sum = 0; i=1;
    for tau=0:dtau:T
        exp_part = exp(-j*w*k*tau)*dtau;
        sum = sum + exp_part.*x(i);
        i=i+1;
    end
    a(k+11) = sum;
end
for i=1:21
    mag(i) = abs(a(i));
    phase(i) = angle(a(i));
end
```

```
k=-10:10;
%Original Signal
subplot(2,2,[1:2]);
plot(t,x,'r');
title('Input Signal (A Pulse Train)');
xlabel('Time');
ylabel('Amplitude of the signal');
grid on;
axis([0 10 -1 2]);

%Magnitude Spectra
subplot(2,2,3);
stem(k,mag,'b');
title('Magnitude Spectra');
xlabel('k\rightarrow');
ylabel('Magnitude');
grid on;

%Phase Spectra
subplot(2,2,4);
stem(k,phase,'Linewidth',1.2)
title('Phase spectra');
xlabel('k\rightarrow');
ylabel('Phase');
grid on;
```

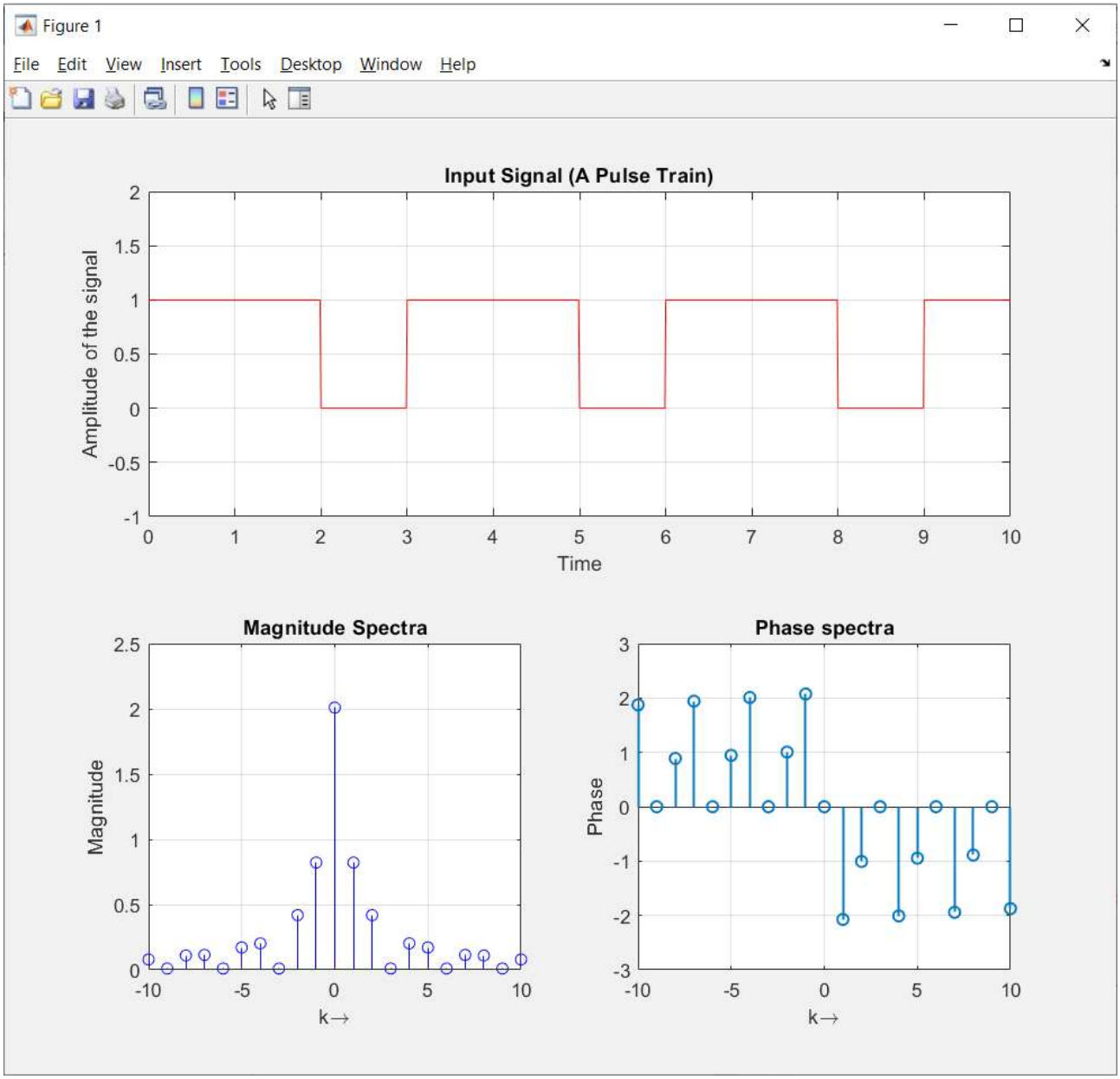


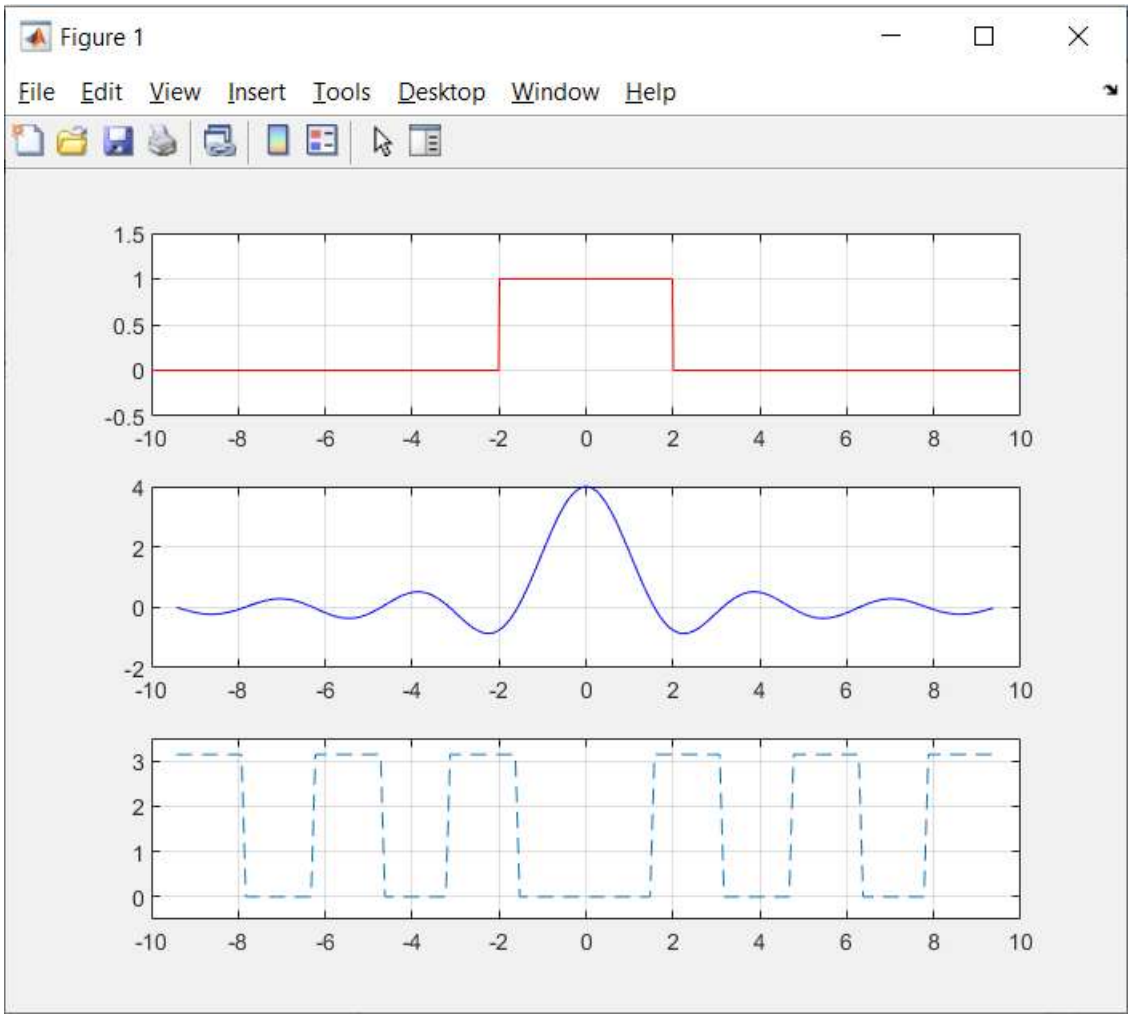
Figure 1
File Edit View Insert Tools Desktop Window Help
Input Signal (A Pulse Train)
Amplitude of the signal
Time
Magnitude Spectra
Magnitude
k→
Phase spectra
Phase
k→

2.

Editor - C:\Users\dr0hith\Desktop\exp6_2.m*

exp6_2.m* | exp6_1.m | 18BIS0043_1018_E6_3.m | 18BIS0043_1018_E6_2.m

```
1 -    syms t
2 -    x=heaviside(t+2)-heaviside(t-2);
3 -    f=fourier(x)
4 -    t=[-10:0.01:10];
5 -    w=[-3*pi:.1:3*pi];
6 -    x=heaviside(t+2)-heaviside(t-2);
7 -    f=2./w.*sin(2.*w);
8 -    subplot(3,1,1), plot(t,x,'r'),axis([-10 10 -0.5 1.5]), grid on
9 -    subplot(3,1,2), plot(w,f,'b'), grid on
10 -   subplot(3,1,3), plot(w,angle(f),'--'), axis([-10 10 -0.5 3.5]),grid on
```

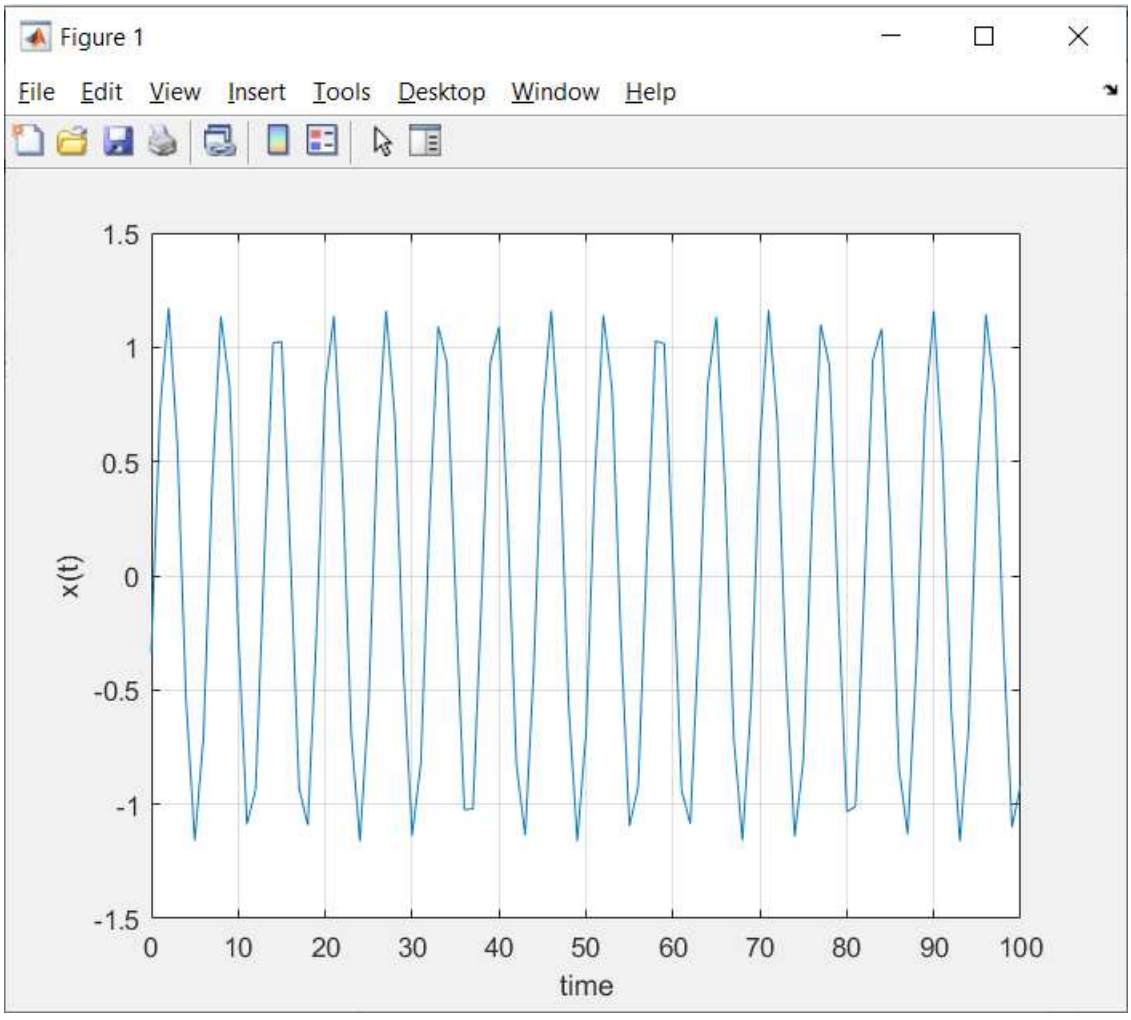


3.

Editor - C:\Users\dr0hith\Desktop\18BIS0043_1018_E6_3.m*

exp6_2.m | exp6_1.m | 18BIS0043_1018_E6_3.m*

```
1 -    clear all
2 -    clc
3 -    t = 0:100;
4 -    a = 1;
5 -    x = exp(-a*t);
6
7 -    h = sin(t);
8 -    f1 = fft(x);
9 -    f2 = fft(h);
10 -   f3 = ifft(f1.*f2);
11
12 -   plot(t,f3);
13 -   axis([0 100 -1.5 1.5])
14 -   xlabel('time');
15 -   ylabel('x(t)');
16 -   grid on;
17
```



4.

Editor - C:\Users\dr0hith\Desktop\18BIS0043_1018_E6_2.m

exp6_2.m | exp6_1.m | 18BIS0043_1018_E6_3.m | 18BIS0043_1018_E6_2.m

```
1 -    t =  0:100;
2 -    a = 1;
3 -    x = exp(-a*t);
4 -    h = sin(t);
5 -    ny = t(1)+t(1) : t(end)+t(end);
6 -    y  = conv(x,h);
7
8 -    plot(ny,y);
9 -    title('Convolution in Time Domain');
10 -   axis([0 100 -1.5 1.5])
```