ECE251

Signals and System Fundamentals

Presented to Dr. Michael Ibrahim

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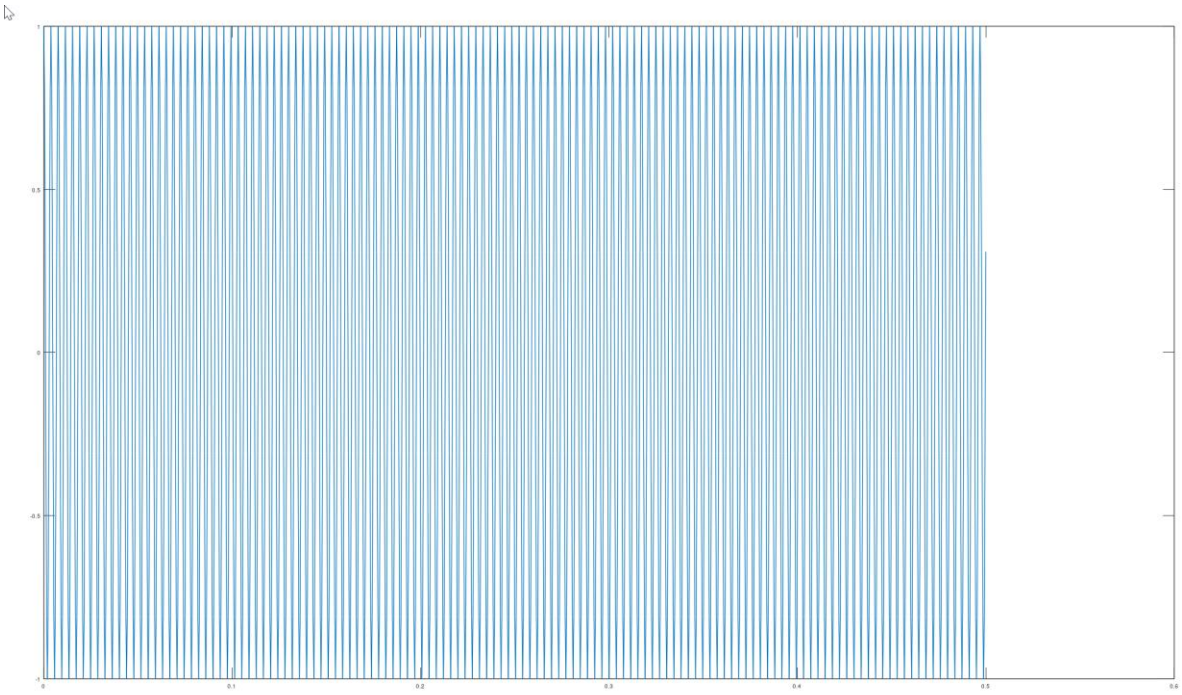
*Contribution of each team member is mentioned next to name and ID

Question 1

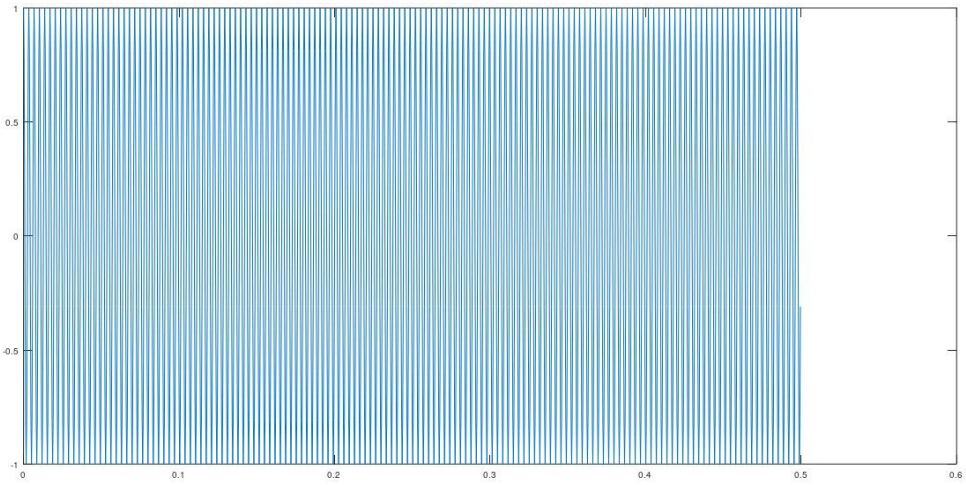
X1(t) DO



```
f1=261.6255653;
fs1= 10*f1;
frmsz1=0.5*fs1;
t1=(0:1/fs1:0.5);
x1=cos(2*pi*f1*t1);

figure1=figure;
plot(t1,x1);
```

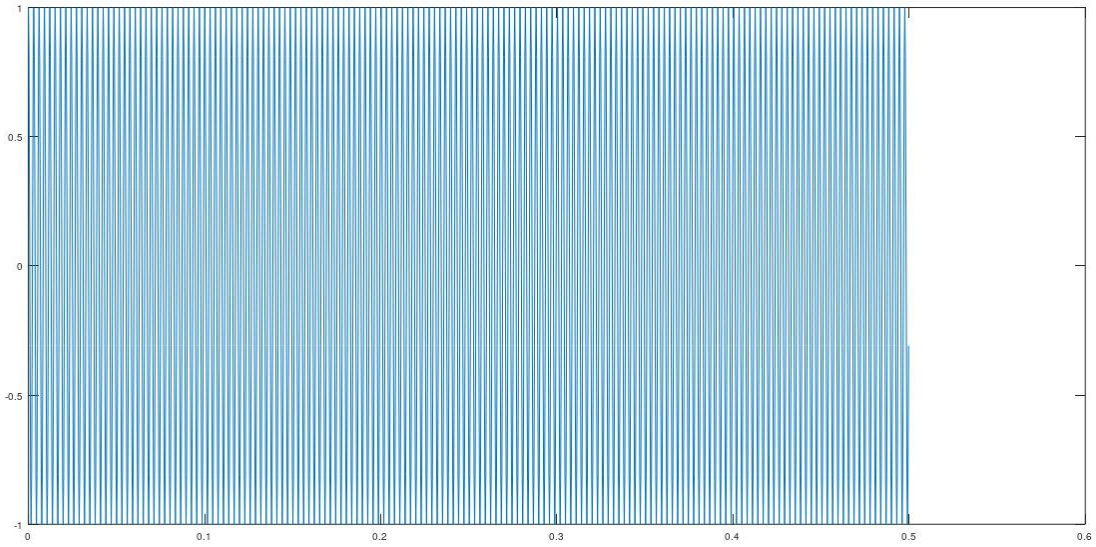
X2(t) RE




```
10 f2=293.6647679;
11 fs2=10*f2;
12 t1=(0:1/fs2:0.5);
13 x2=cos(2*pi*f2*t2);
14 figure2=figure;
15 plot(t2,x2);
```

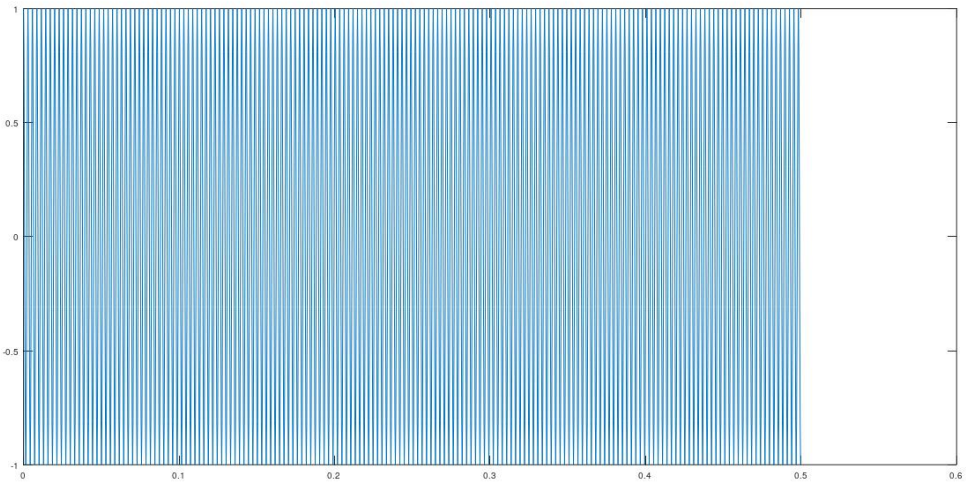
X3(t) MI

```
17 f3=329.6275569;
18 fs3=10*f3;
19 frmsz3=0.5*fs3;
20 t2=(0:1/fs3:0.5);
21 x3=cos(2*pi*f3*t3);
22 figure3=figure;
23 plot(t3,x3);
```



X4(t) FA

```
25 f4=349.2282314;
26 fs4=10*f4;
27 t4=(0:1/fs4:0.5);
28 x4=cos(2*pi*f4*t4);
29 figure4=figure;
30 plot(t4,x4);
```



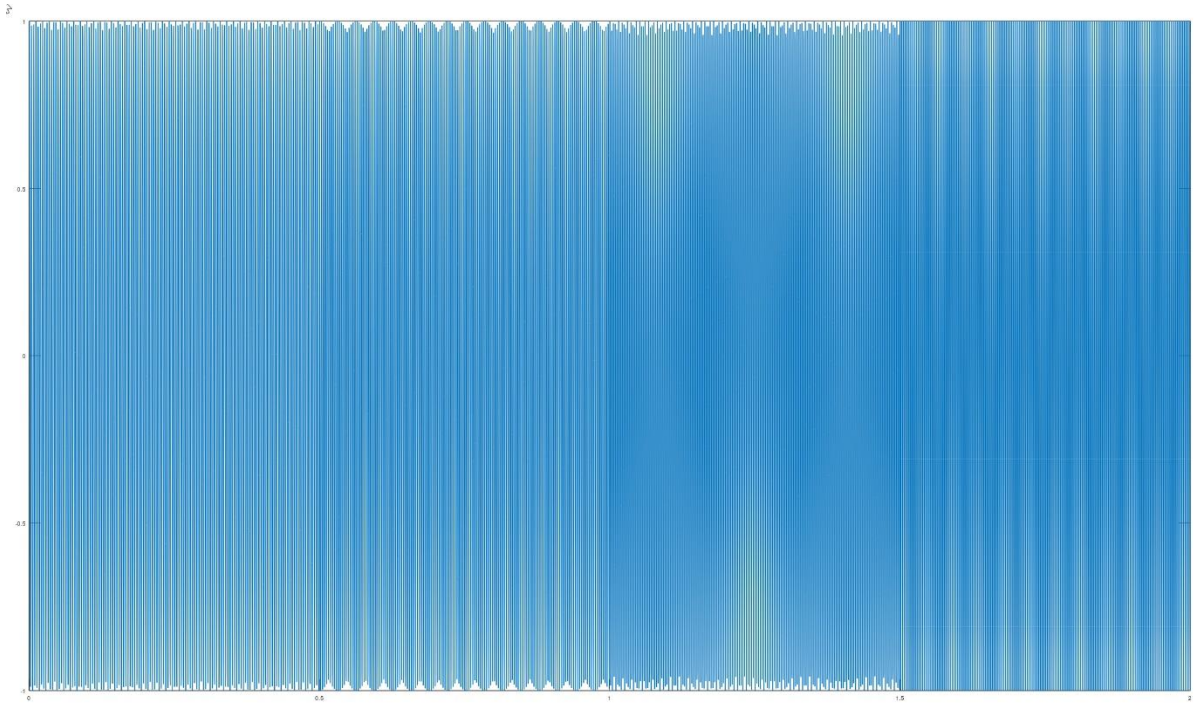
Question 2

```
46 sound(xt,fst);
47 filename='sound.wav';
48 audiowrite(filename,xt,fst);
```

Question 3

```
33 fst= 10*f4;
34 frmsz= round(0.5*fst) ;
35 T=(0:1:frmsz-1)*(1/fst);
36 x1=cos(2*pi*f1*T);
37 x2=cos(2*pi*f2*T);
38 x3=cos(2*pi*f3*T);
39 x4=cos(2*pi*f4*T);
40 xt=[x1,x2,x3,x4];
41 frmsz=round(4*frmsz);
42 T=(0:1:frmsz-1)*(1/fst);
43 figure5=figure;
44 plot(T,xt);
45
```

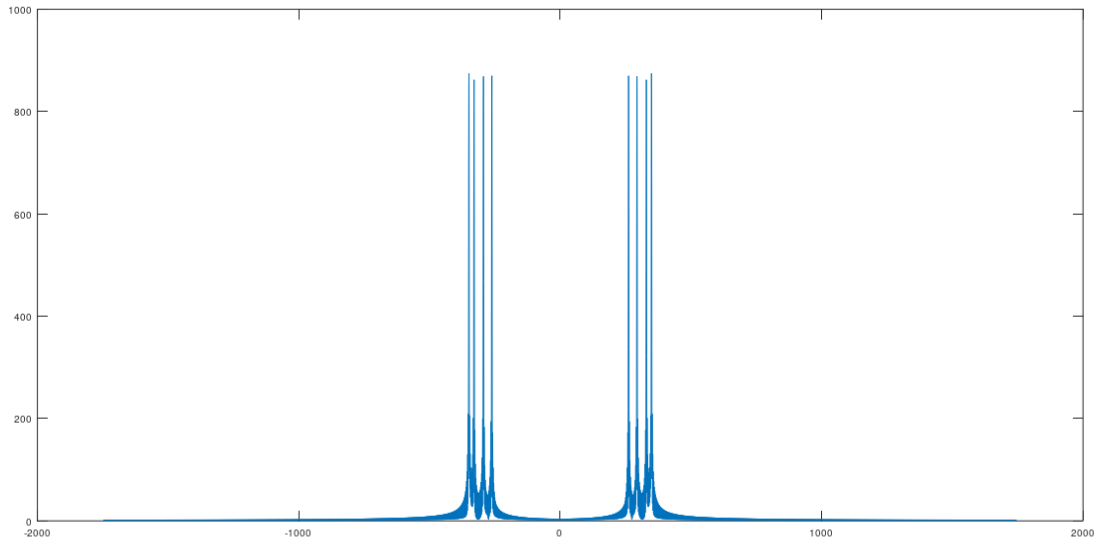
X(t)



Question 5

```
54  xt=[x1,x2,x3,x4];
55  F=(-frmsz/2:1:(frmsz/2)-1)*fst/frmsz;
56  XF= fft(xt);
57  figure6=figure;
58  plot(F,abs(fftshift(XF)));
```

X(F)



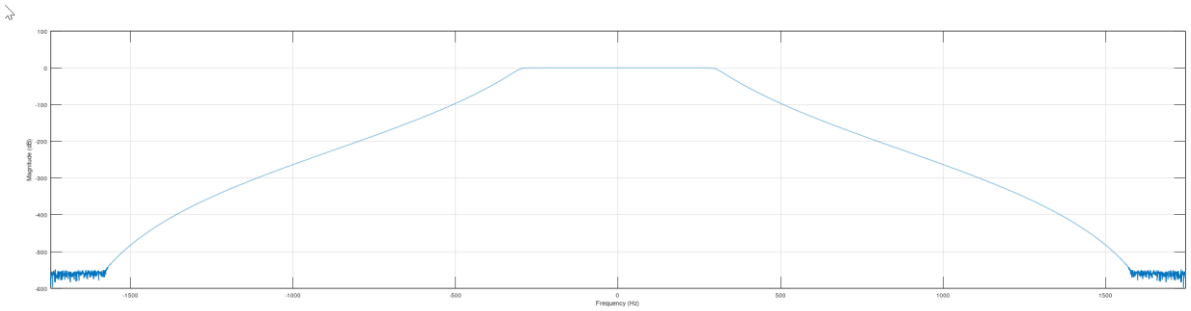
Question 8 and 11

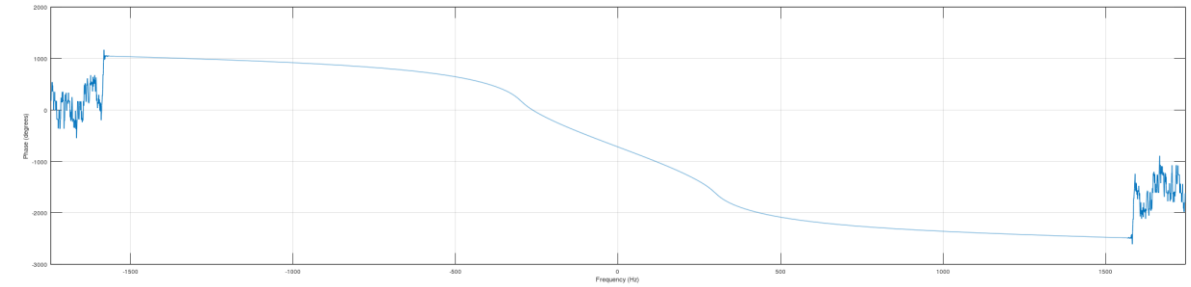
```
66 [y, x] = butter(20 ,300/(fst/2));
67 y1_t = filter(y, x, xt);

69 figure7=figure;
70 freqz(y,x,F,fst);
71 sound(y1_t,fst);
72 filename='do.wav';
73 audiowrite(filename,y1_t,fst);
74
75 figure8= figure;
76 plot(y1_t);
```

Question 9

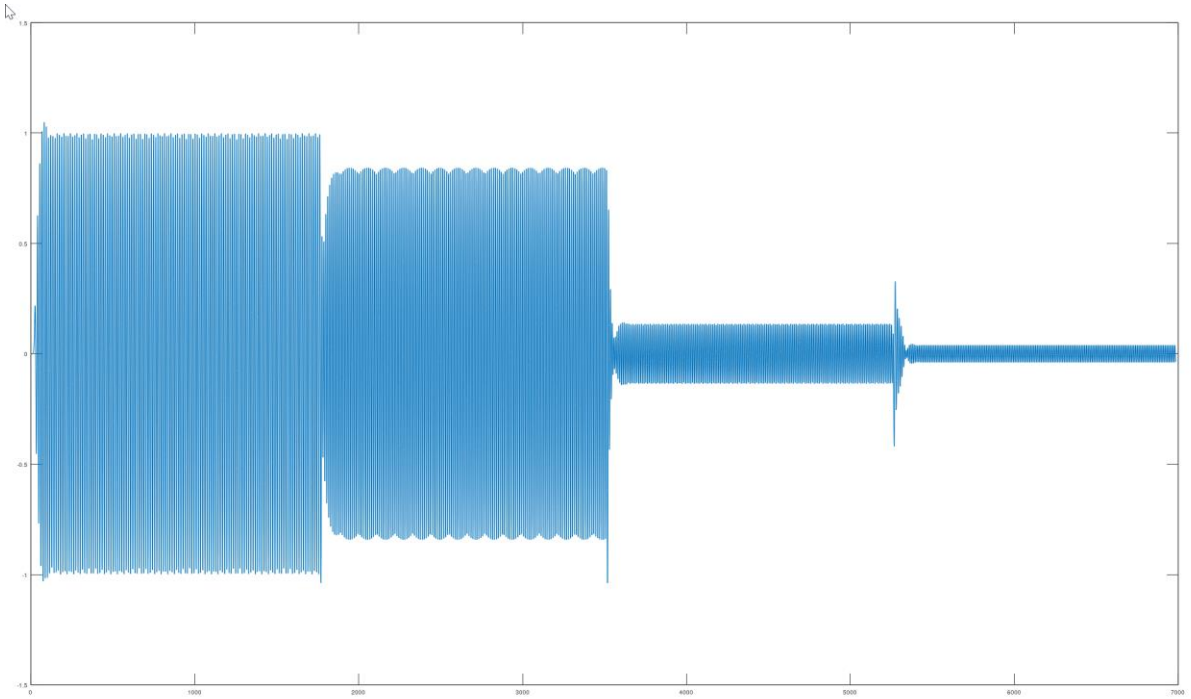
Low pass filter





Question 10 and 12

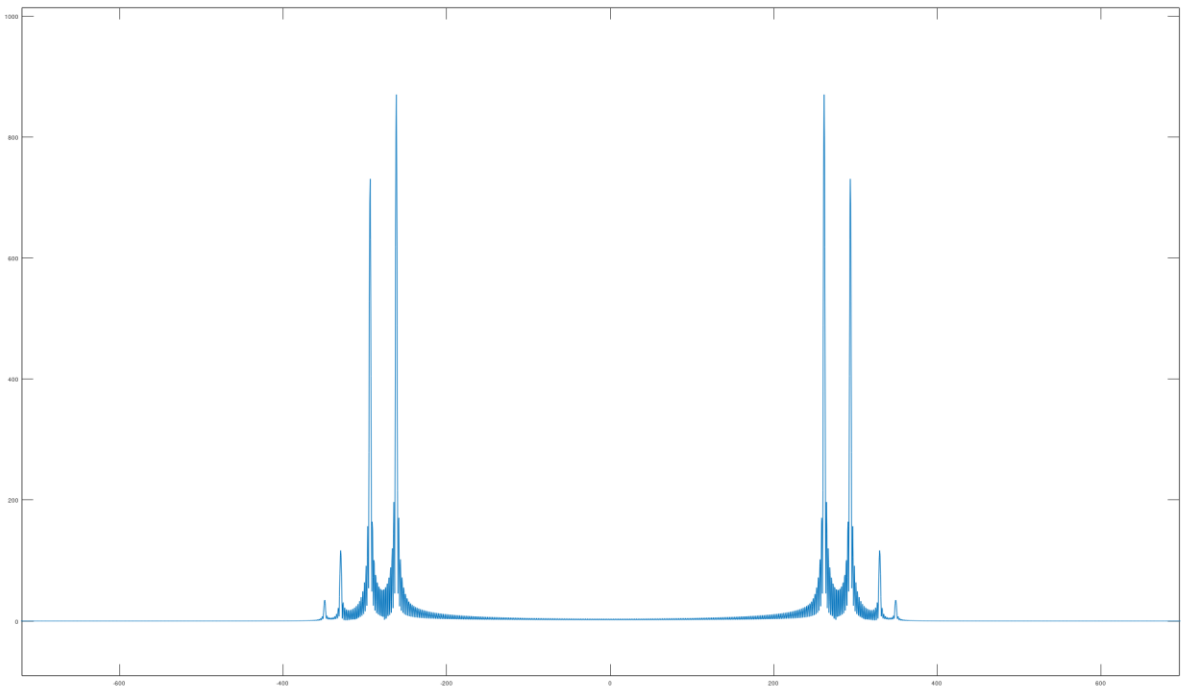
y1(t)



Question 14,15

```
78 N=length(y1_t);
79 EY1=sum((abs(y1_t)).^2)/fst;#timedomain
80 display(EY1);
81 Y1F=fft(y1_t);
82 figure9=figure;
83 plot(F,abs(fftshift(Y1F)));
84
85 EYP_1=sum((abs(Y1F).^2)/N)/fst;#parseval
86 display(EYP_1);
```

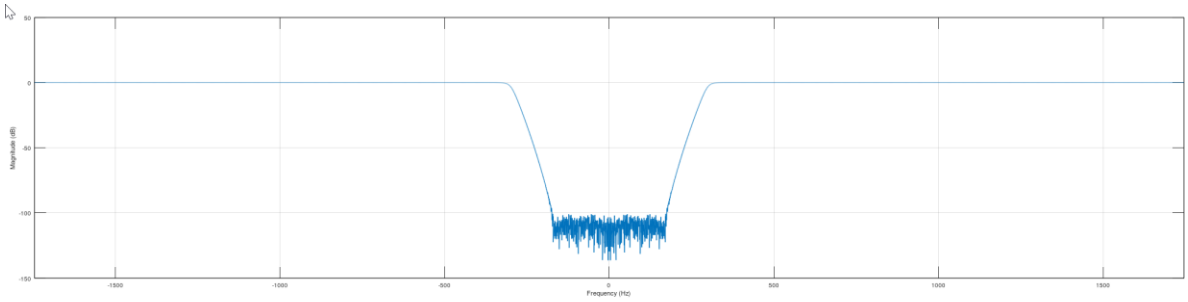
Y1(F)

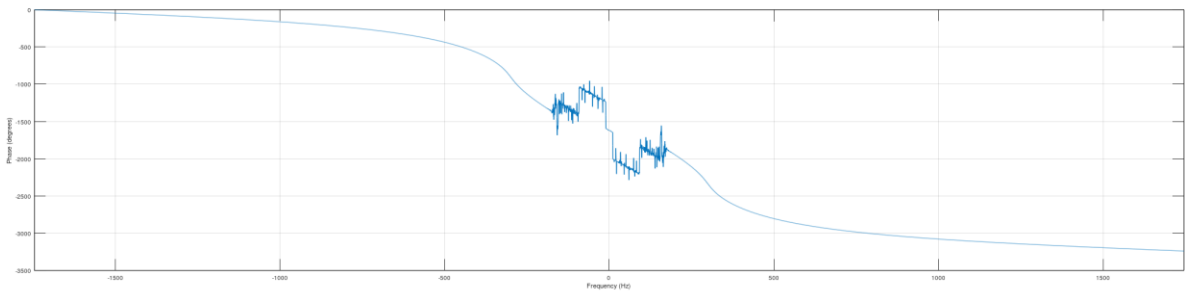


Question 17-25

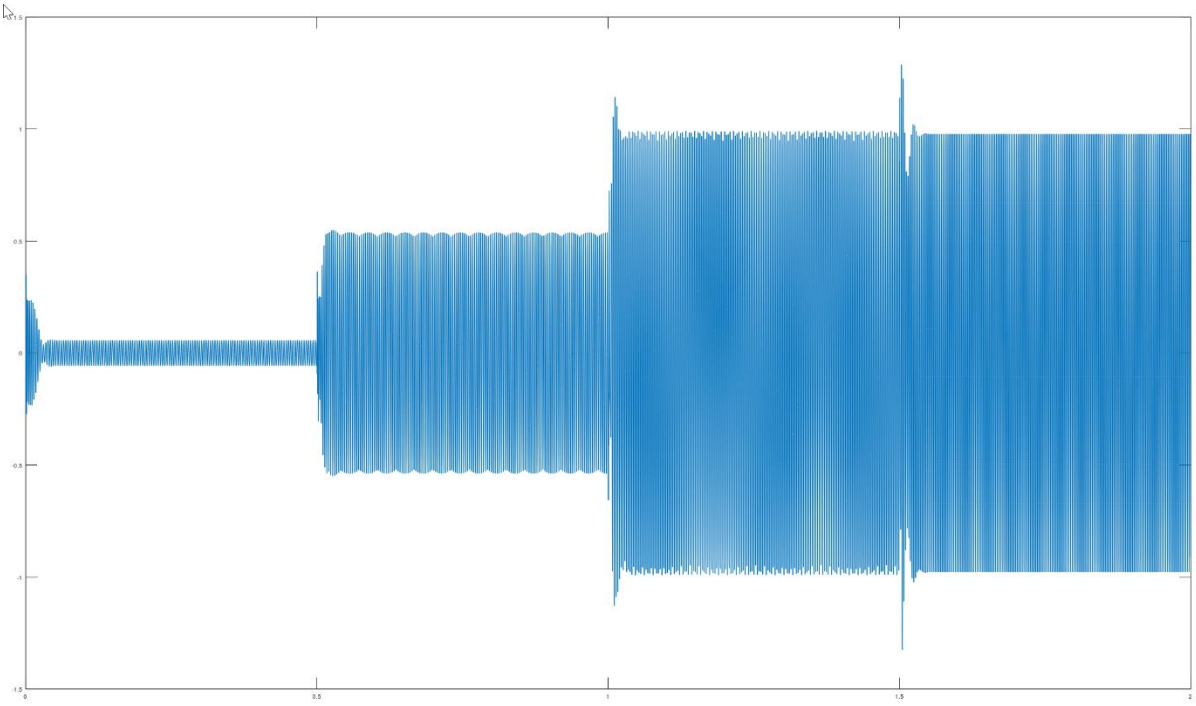
```
[b, a] = butter(20 ,2*pi*300/fst/pi,'high');
freqz(b,a,F,f);
Y2T=filter(b,a,xt);
figure9=figure;
plot(T,Y2T);
#sound(Y2T,fst);
filename='do2.wav';
audiowrite(filename,Y2T,fst);
N=length(Y2T);
EY_2=sum((abs(Y2T)).^2)*(1/fst);
display(EY_2);
F=(-frmsz/2:1:(frmsz/2)-1)*fst/frmsz;
Y2F= fft(Y2T);
figure10= figure;
plot(F,abs(fftshift(Y2F)));
```

High Pass Filter

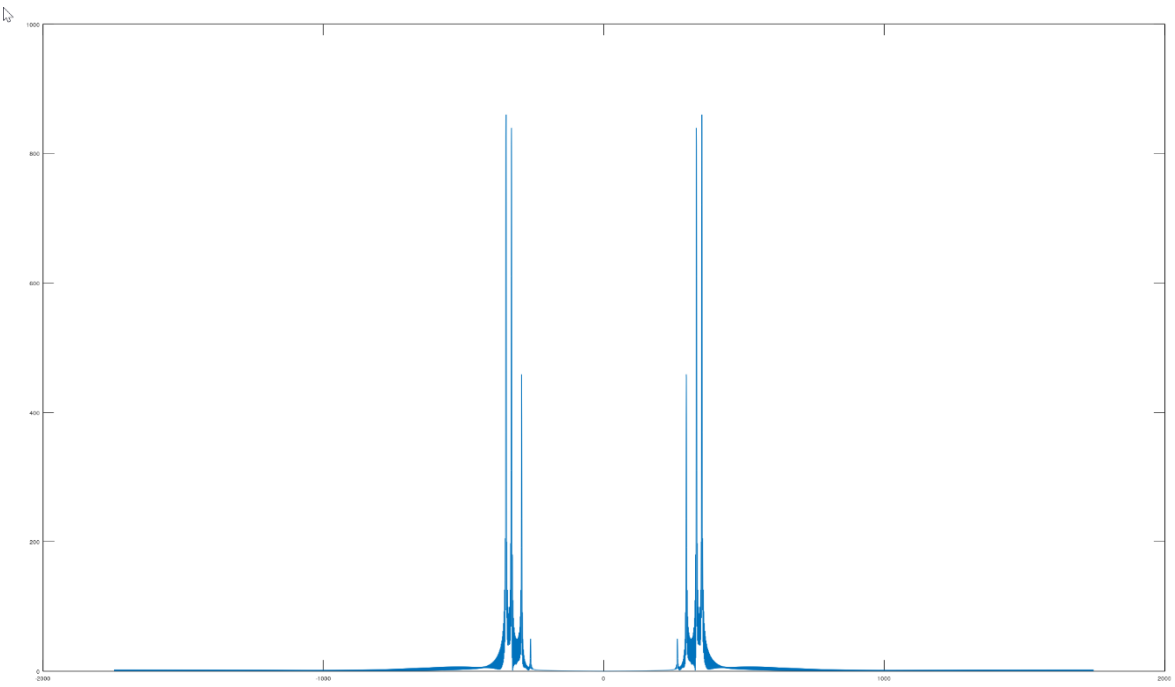




y2(t)



Y2(F)



Energy values of E(x(t)),E(y1(t)),E(y2(t)) respectively

```
E_p = 1.0002
E = 1.0002
EY1 = 0.4287
EYP_1 = 0.4287
EY_2 = 0.5675
EYP_2 = 0.5675
>>
```

Name	Class	Dimension	
E	double	1x1	1.0002
EY1	double	1x1	0.4287
EYP_1	double	1x1	0.4287
EYP_2	double	1x1	0.5675
EY_2	double	1x1	0.5675
E_p	double	1x1	1.0002