DSAA COMPUTER ASSIGNMENT-5

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PROBLEM 1:-

Analysis and Synthesis

For the given periodic signals with the period T = 2, compute the Fourier coefficients and then reconstruct the original signal.

For each signal plot the following :-

- **The original and reconstructed signal on the same plot**
- **The Fourier coefficients; both the real and imaginary components**

SECTION 1:-

x(t) = t^2 where t lies between -0.5 and 0.5 (-1/2<t<1/2)

MATLAB CODE:-

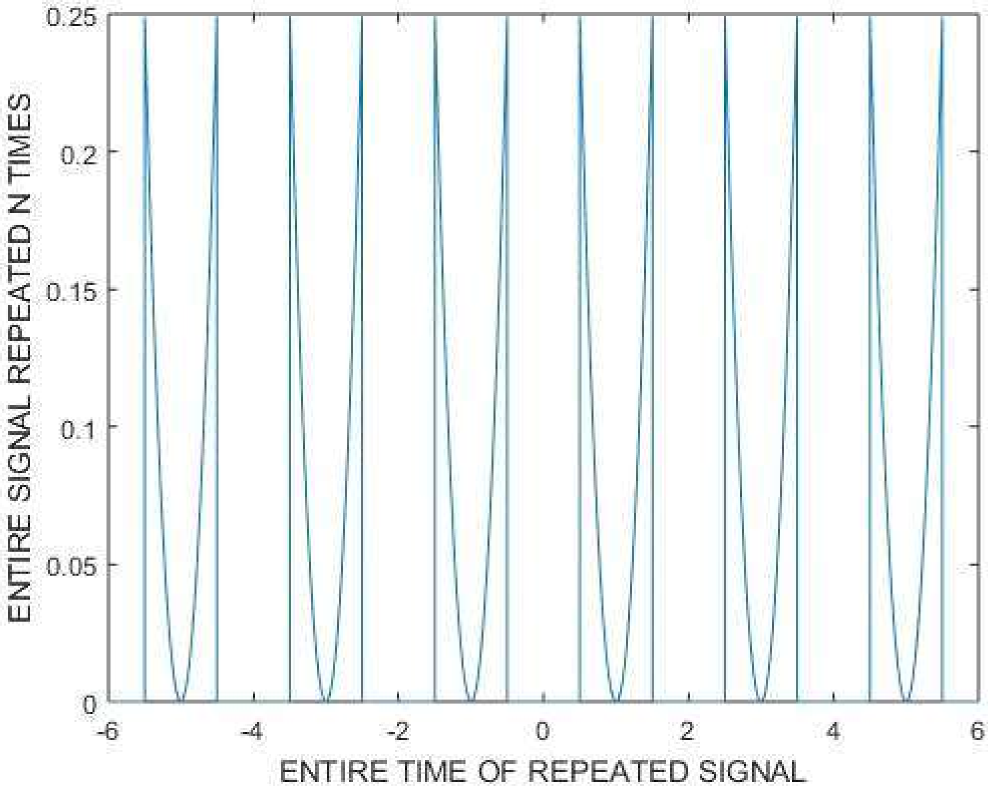
```
%%COMP ASSIGN-5
```

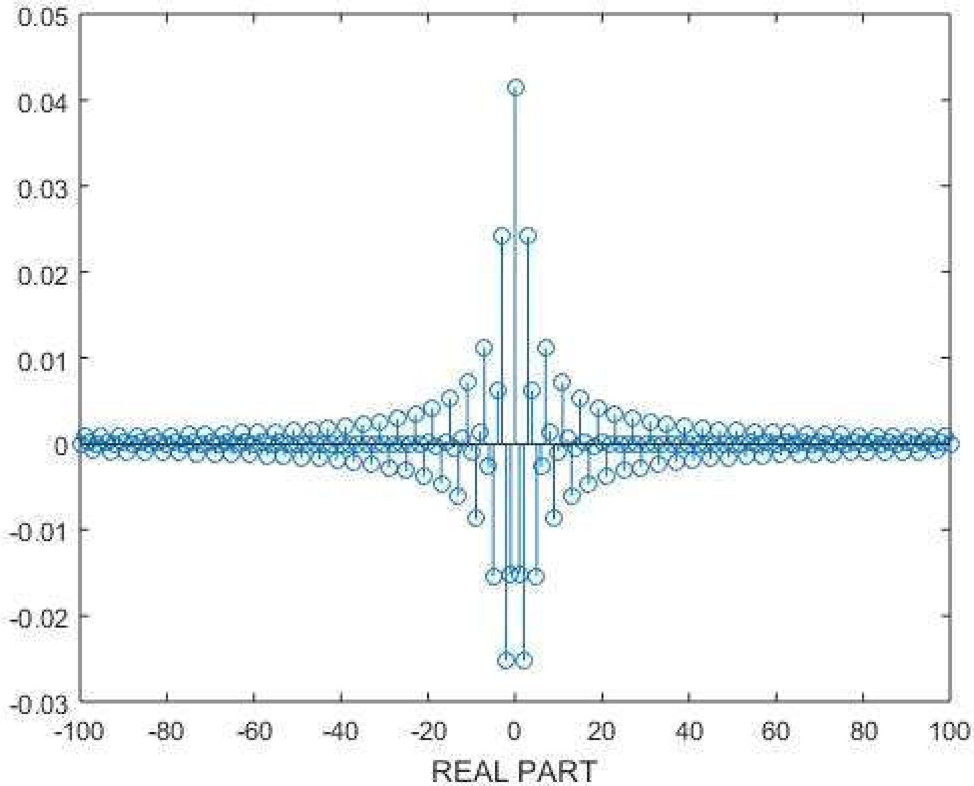
```
%%ANIRUDH KANNAN V P
%%201601004
%%UG2 CSE

clc;
close all;
clear all;

%DECLARING N
N=6;


%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;



%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec > leftend & tvec < rightend)=tvec(tvec > leftend & tvec
< rightend).^2;
%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;

%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
```

```
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();


%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end

subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```

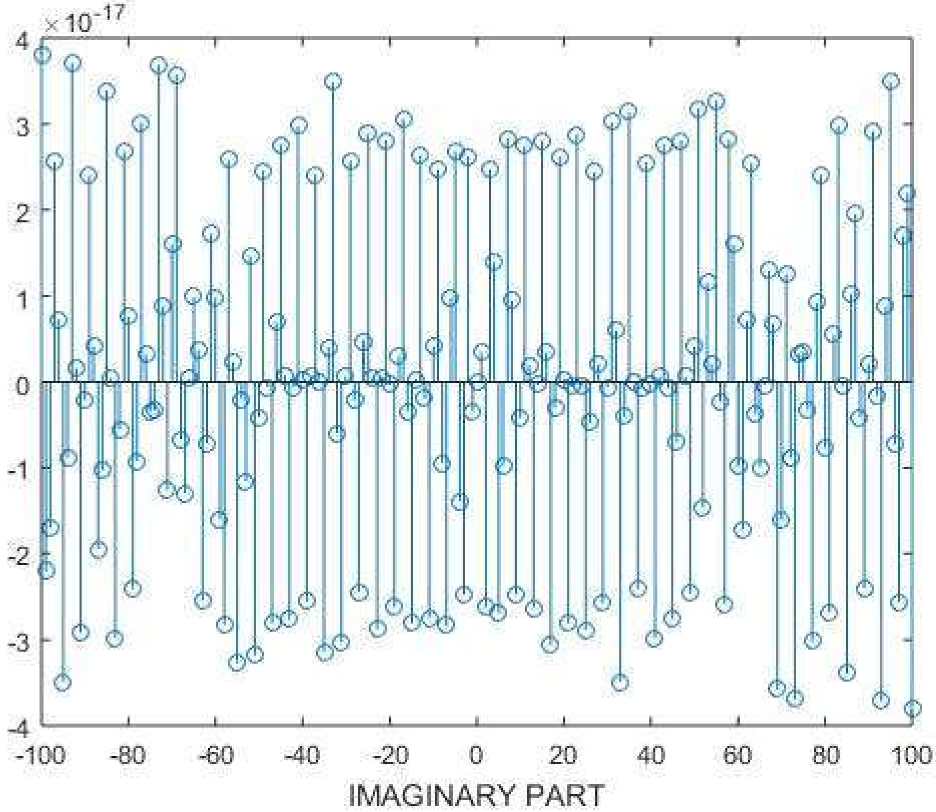
DISCUSSION:-

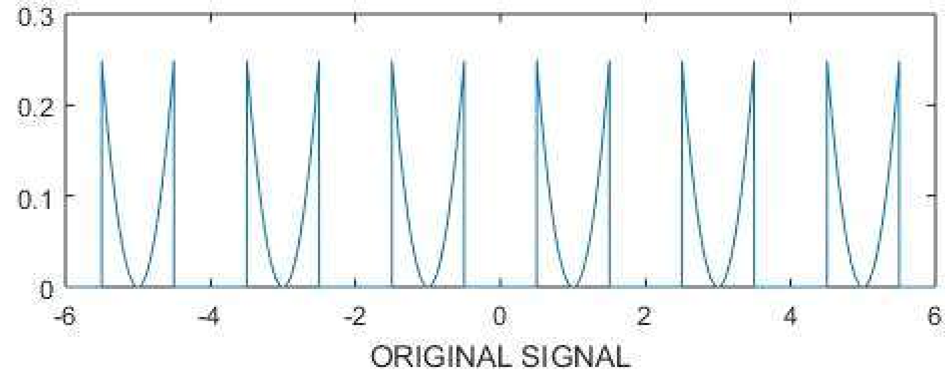
THE DIFFERENT PLOTS OBTAINED ARE SHOWN BELOW:-

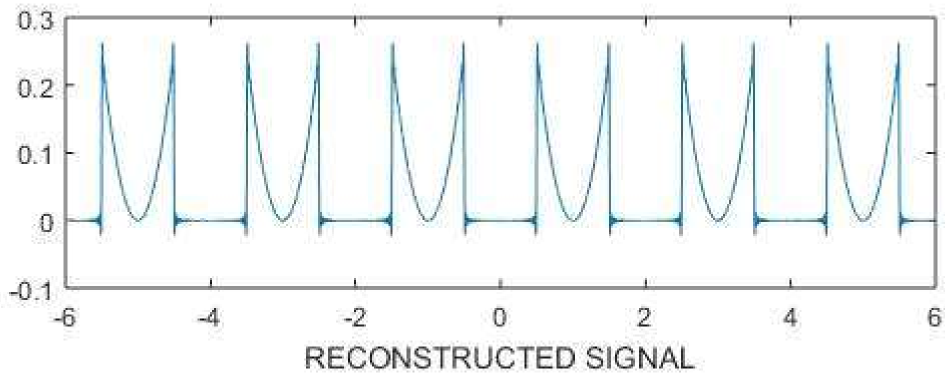

0.25
0.2
0.15
0.1
0.05
0
-6
-4
-2
0
2
4
6
ENTIRE SIGNAL REPEATED N TIMES
ENTIRE TIME OF REPEATED SIGNAL



0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-100 -80 -60 -40 -20 0 20 40 60 80 100
REAL PART


×10^-17
4
3
2
1
0
-1
-2
-3
-4
-100
-80
-60
-40
-20
0
20
40
60
80
100
IMAGINARY PART





The given signal is periodic with period T=2 and it is repeated 6 times with N=6 ; The angular frequency time vector and the signal are all defined.

```
%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL
```

```
%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec > leftend & tvec < rightend)=tvec(tvec > leftend & tvec
< rightend).^2;
```

The signal is then repeated and stored in a list which consists of the whole signal which is the whole signal.

```
%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;
```

Then the original signal is plotted. Then the fourier coefficients are got using trignometric formula of fourier coefficients and the real and imaginary parts are plotted.

```
%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
```

```
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();
```

Then the signal is reconstructed using fourier coefficients. and it is plotted.

```
%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end


subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```

SECTION 2:-

$x(t) = -t$ at $1/2<t< 0$

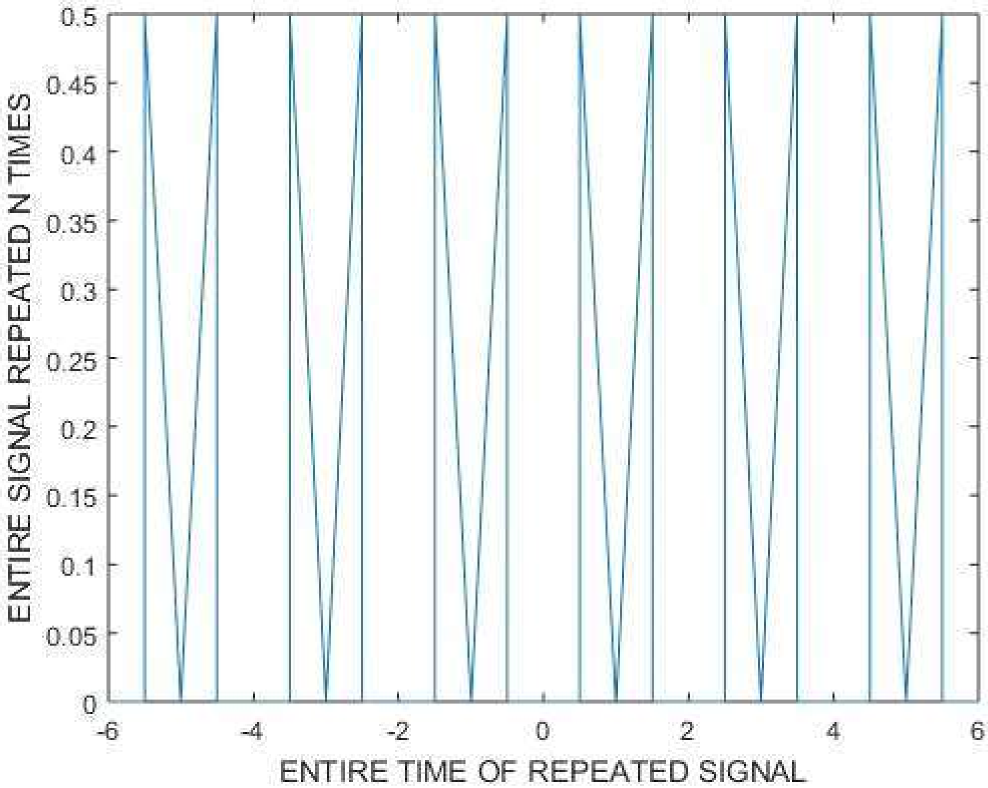
$= t$ $0<t<1/2$

MATLAB CODE:-

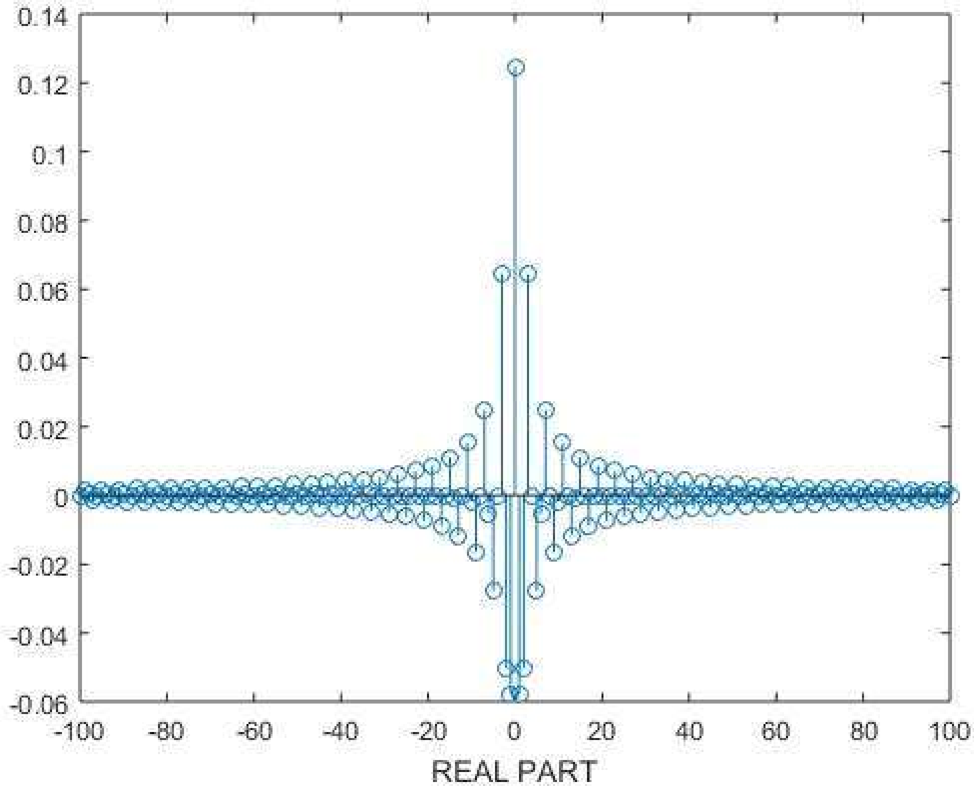
```
%%COMP ASSIGN-5
%%ANIRUDH KANNAN V P
%%201601004
%%UG2 CSE

clc;
close all;
```

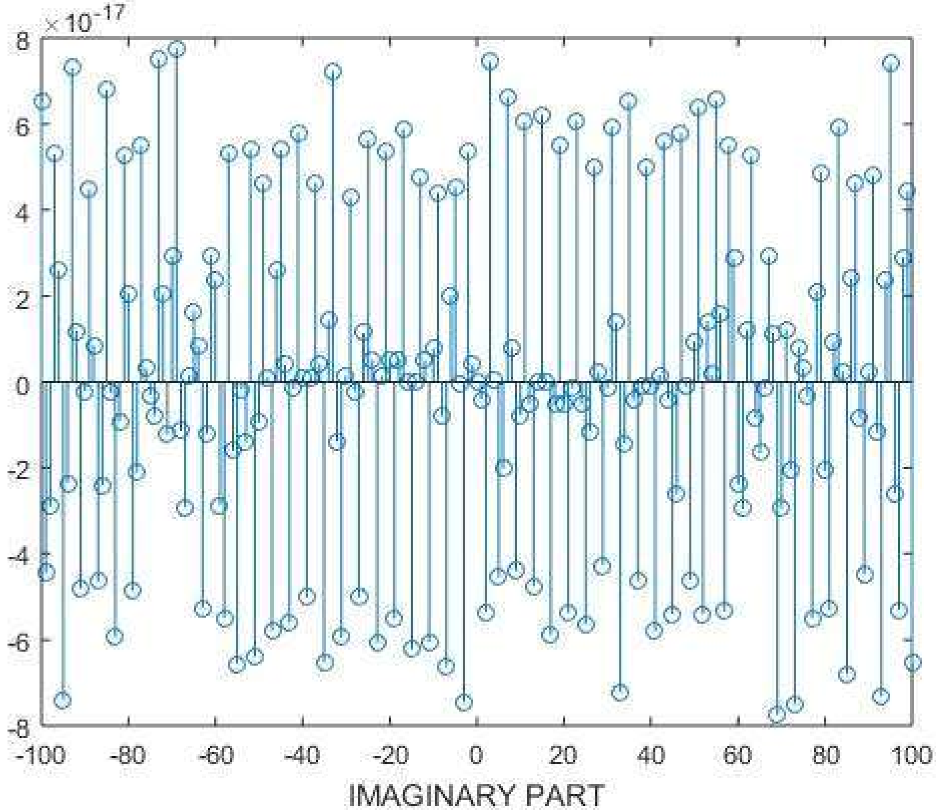
```
clear all;

%DECLARING N
N=6;


%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec > leftend & tvec < middle)= -tvec(tvec > leftend & tvec
< middle);
x(tvec > middle & tvec < rightend)= tvec(tvec > middle & tvec
< rightend);

%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;

%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
```

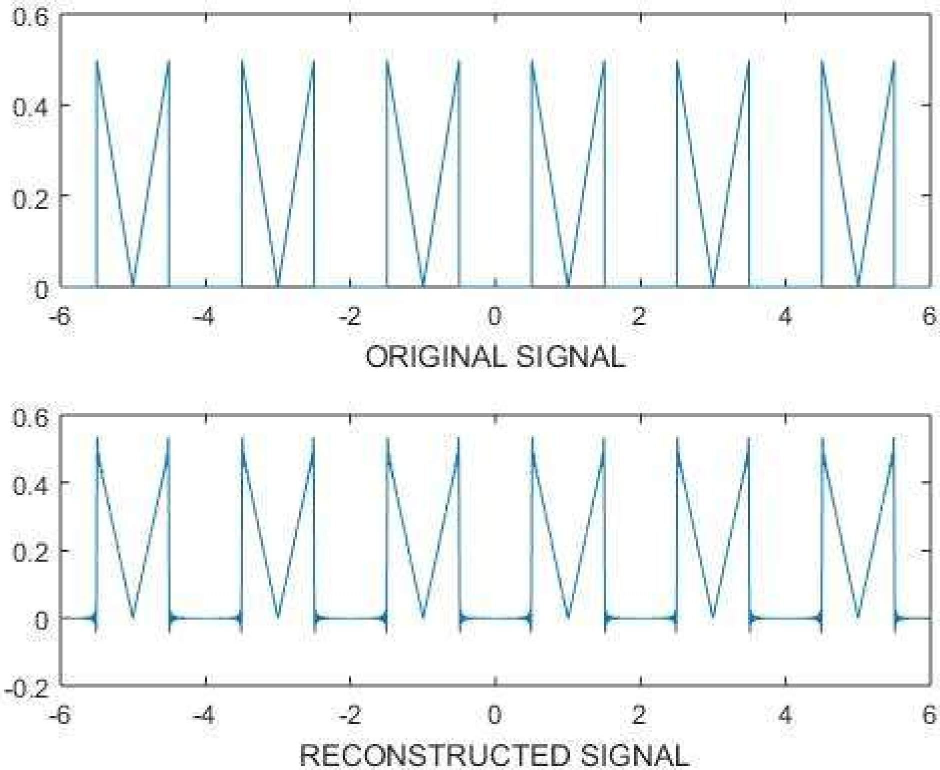
```
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();


%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end


subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```



0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-6
-4
-2
0
2
4
6
ENTIRE SIGNAL REPEATED N TIMES
ENTIRE TIME OF REPEATED SIGNAL


0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-100
-80
-60
-40
-20
0
20
40
60
80
100
REAL PART


×10^-17
8
6
4
2
0
-2
-4
-6
-8
-100
-80
-60
-40
-20
0
20
40
60
80
100
IMAGINARY PART



The given signal is periodic with period T=2 and it is repeated 6 times with N=6 ; The angular frequency time vector and the signal are all defined as shown below in the following matlab code.

```
%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;
```

```
%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec > leftend & tvec < middle)= -tvec(tvec > leftend & tvec
< middle);
x(tvec > middle & tvec < rightend)= tvec(tvec > middle & tvec
< rightend);
```

The signal is then repeated and stored in a list which consists of the whole signal which is the whole signal repeated N number of times.

```
%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;
```

Then the original signal is plotted. Then the fourier coefficients are got using trignometric formula of fourier coefficients and the real and imaginary parts are plotted. The formula is given beside the code and the real and imaginary parts of the signal is plotted.

```
%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
```

```
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();
```

Then the signal is reconstructed using fourier coefficients trignometric form and it is plotted.

```
%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end


subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```

SECTION 3:-

x(t) = exp(−|t|) -1/2<t<1/2

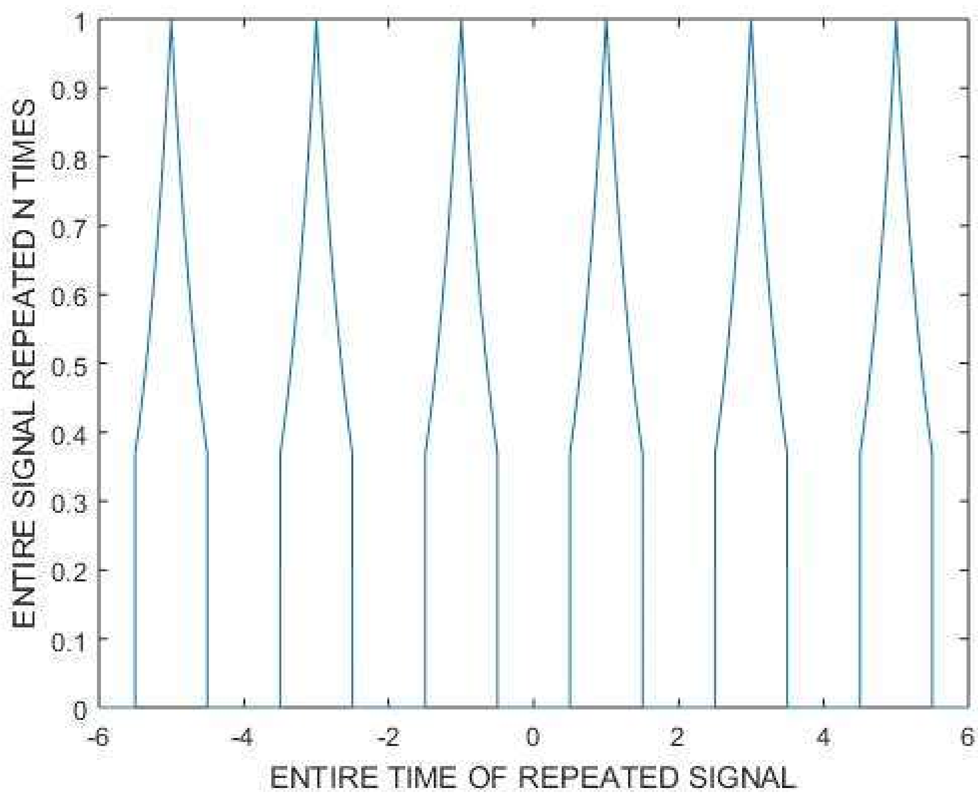
MATLAB CODE:-

```
%%COMP ASSIGN-5
%%ANIRUDH KANNAN V P
%%201601004
%%UG2 CSE

clc;
```

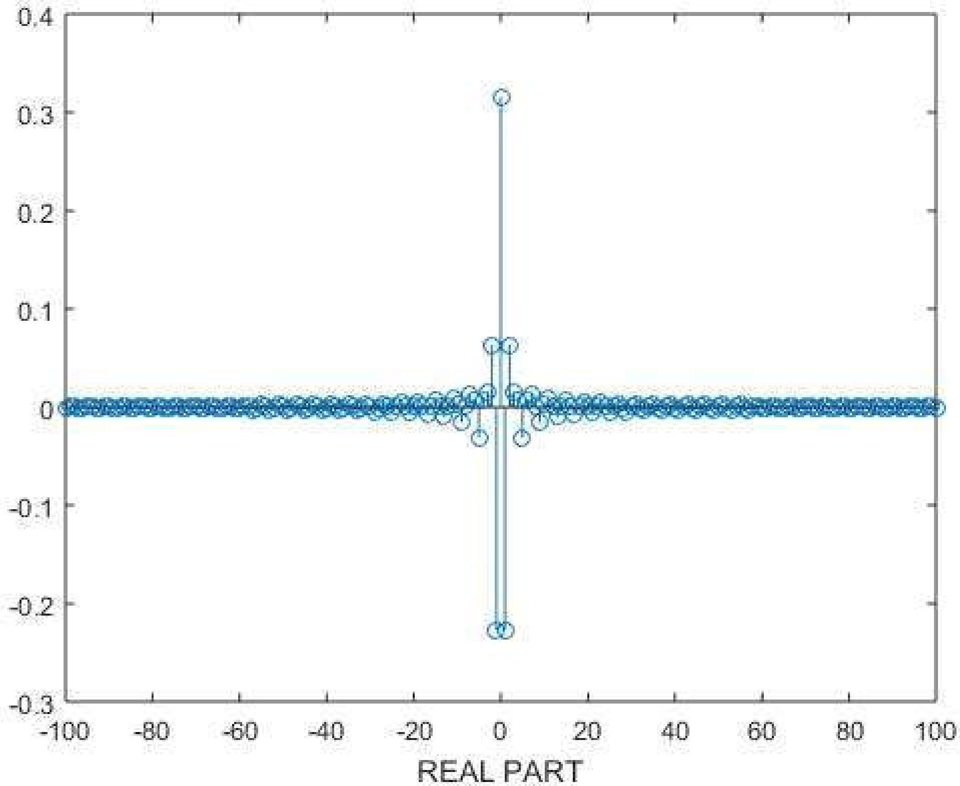
```
close all;
clear all;

%DECLARING N
N=6;


%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;



%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec> leftend & tvec<rightend) = exp(-abs(tvec(tvec> leftend &
tvec<rightend))).^2

%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;

%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;
```

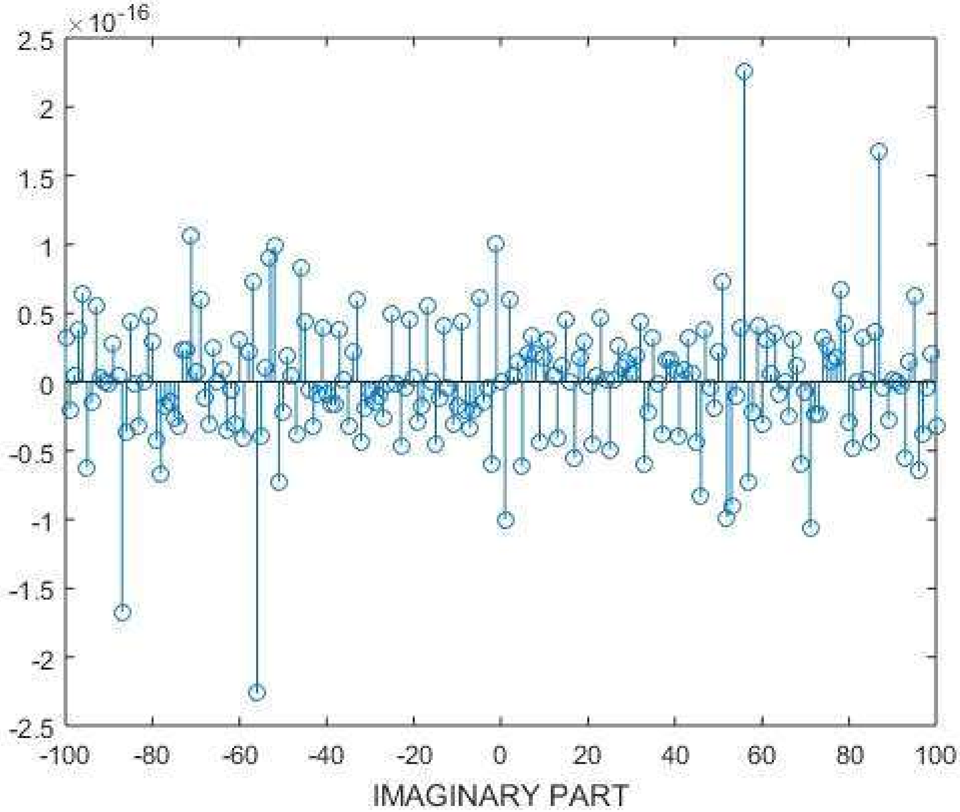
```
%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();


%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end


subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```

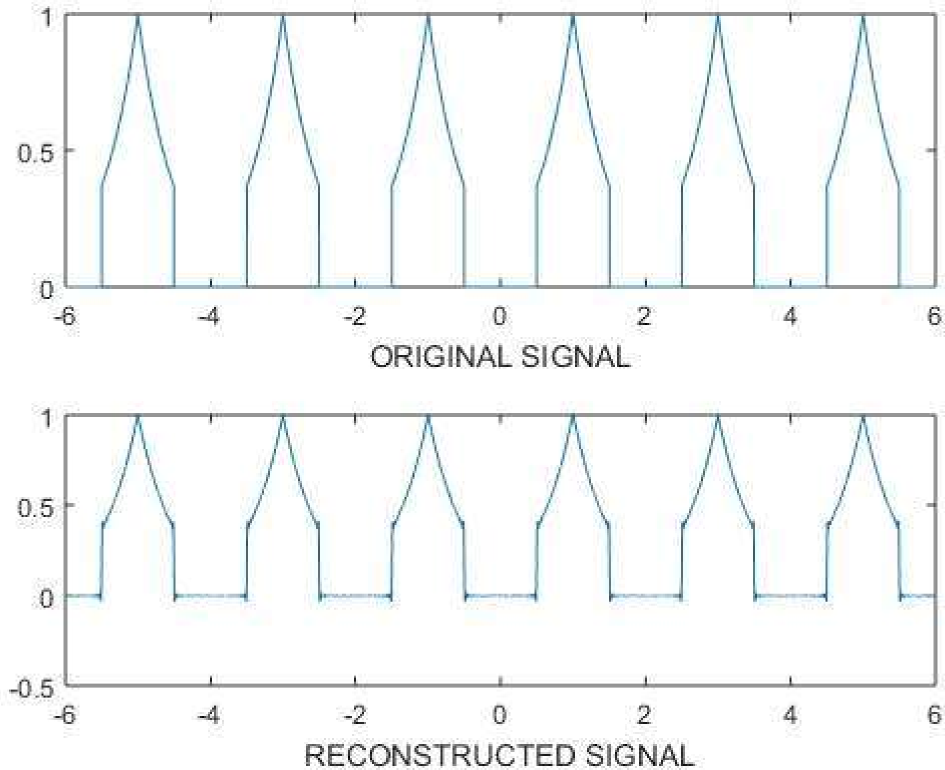
DISCUSSION:-



ENTIRE SIGNAL REPEATED N TIMES
ENTIRE TIME OF REPEATED SIGNAL
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-6
-4
-2
0
2
4
6


0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-100
-80
-60
-40
-20
0
20
40
60
80
100
REAL PART


×10^-16
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-100
-80
-60
-40
-20
0
20
40
60
80
100
IMAGINARY PART



The given signal is exponential signal with period T=2 and it is repeated 6 times with N=6 for plotting; The angular frequency time vector and the signal are all defined as shown below in the following matlab code.(initialisation of variables)

```
%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;
```

```
%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec> leftend & tvec<rightend) = exp(-abs(tvec(tvec> leftend &
tvec<rightend))).^2
```

The signal is then repeated and stored in a list which consists of the whole signal which is the whole signal repeated N number of times.Thus the whole list contains our repeated signal.

```
%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;
```

Then the original signal is plotted. Then the fourier coefficients are got using trignometric formula of fourier coefficients and the real and imaginary parts are plotted. The formula is given beside the code and the real and imaginary parts of the signal is plotted in the figures shown above.

```
%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
```

```
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();
```

Then the signal is reconstructed using fourier coefficients trignometric form and it is plotted. The reconstructed signal is stored in a seperate list which is further used to calculate error in the following question and the original signal and reconstructed signal is plotted using subplot.

```
%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
end


subplot(2,1,1);
plot(t,wholesignal);
xlabel('ORIGINAL SIGNAL');
subplot(2,1,2);
plot(t, reconstructed);
xlabel('RECONSTRUCTED SIGNAL');
```

QUESTION(2) SECTION 4:-

Convergence

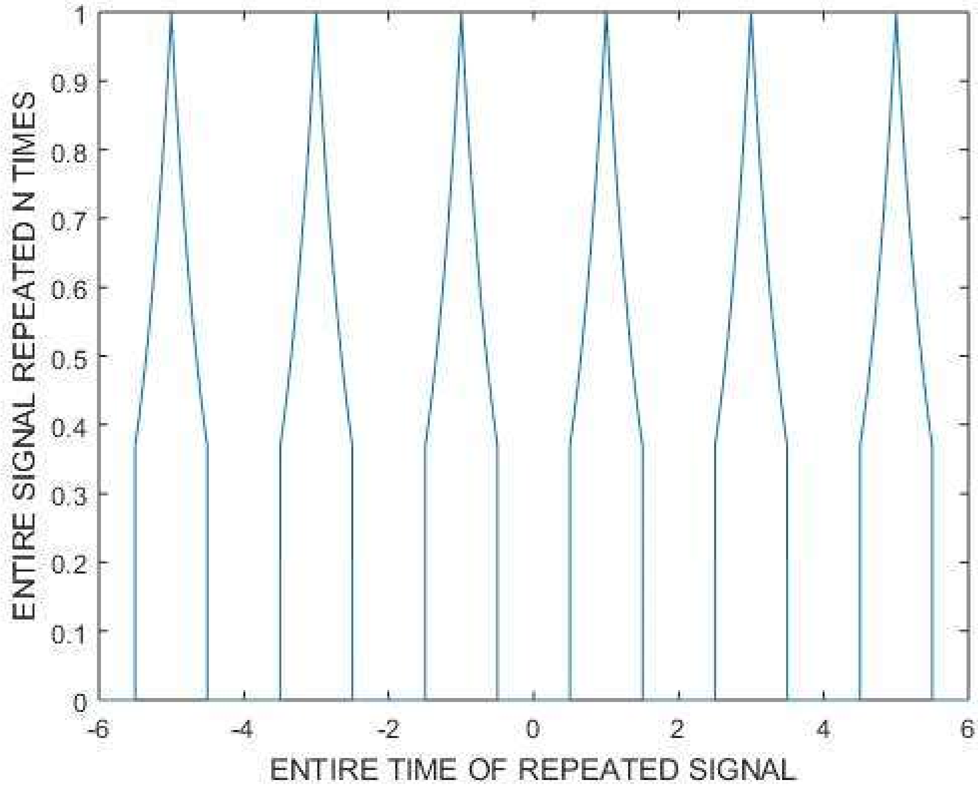
For the signal (3), demonstrate the convergence of the reconstructed signal with respect to the original signal.

MATLAB CODE:-

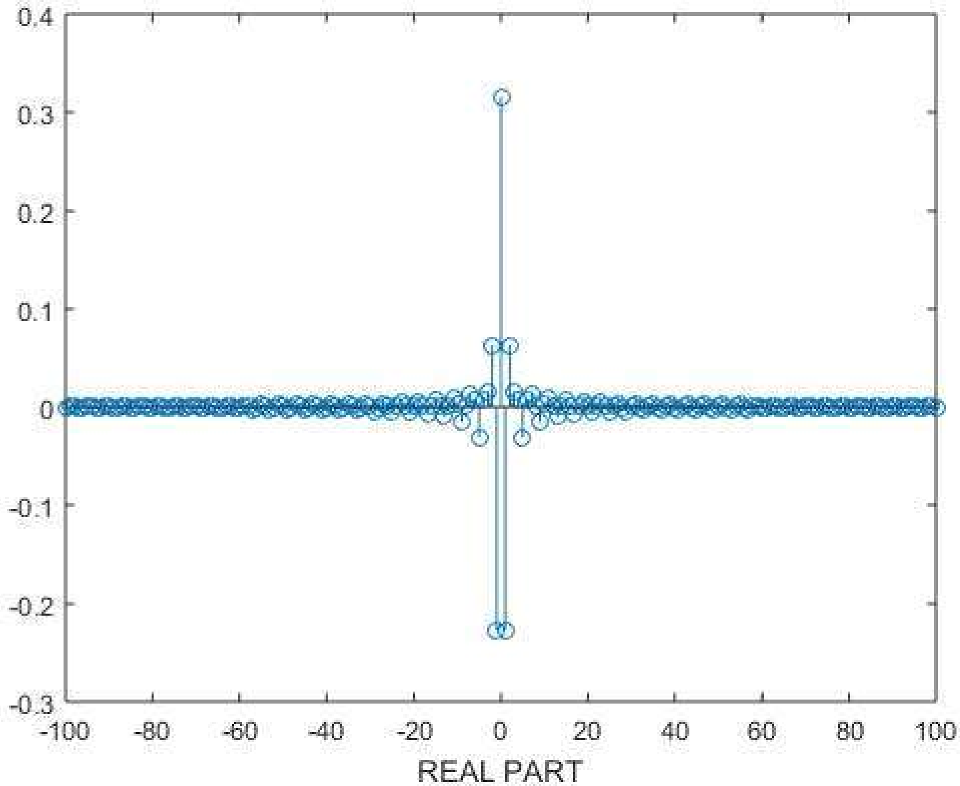
```
%%COMP ASSIGN-5
%%ANIRUDH KANNAN V P
%%201601004
%%UG2 CSE

clc;
close all;
clear all;

%DECLARING N
N=6;


%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec> leftend & tvec<rightend) = exp(-abs(tvec(tvec> -0.5 &
tvec<0.5))).^2

%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
```

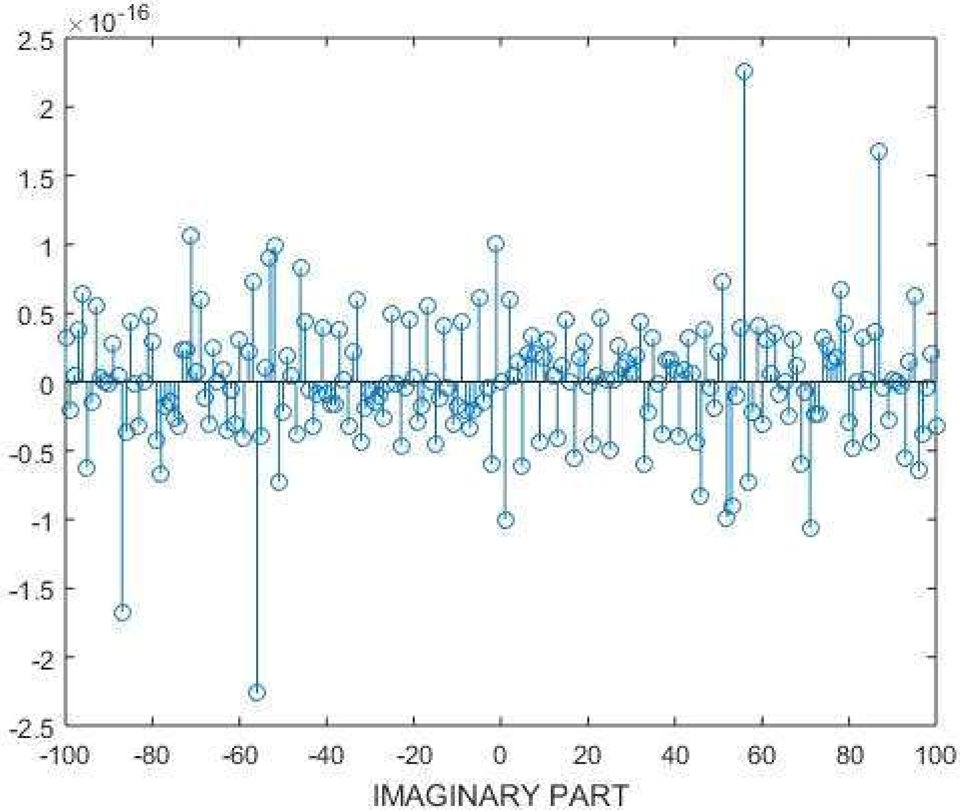
```
end;

%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();


%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG


for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2) * exponentpart;
    errorvector(o2)= (1/T).*immse(wholesignal,reconstructed);
end






formulaerror=(1/T).*(trapz(t,(abs(wholesignal-reconstructed)).^2));
disp(formulaerror);
semilogx(formulaerror,kvector);
xlabel('ERROR USING FORMULA');

%THE ERROR VECTOR IS PLOTTED WITH K VECTOR
semilogx(kvector,errorvector);
```

DISCUSSION:-

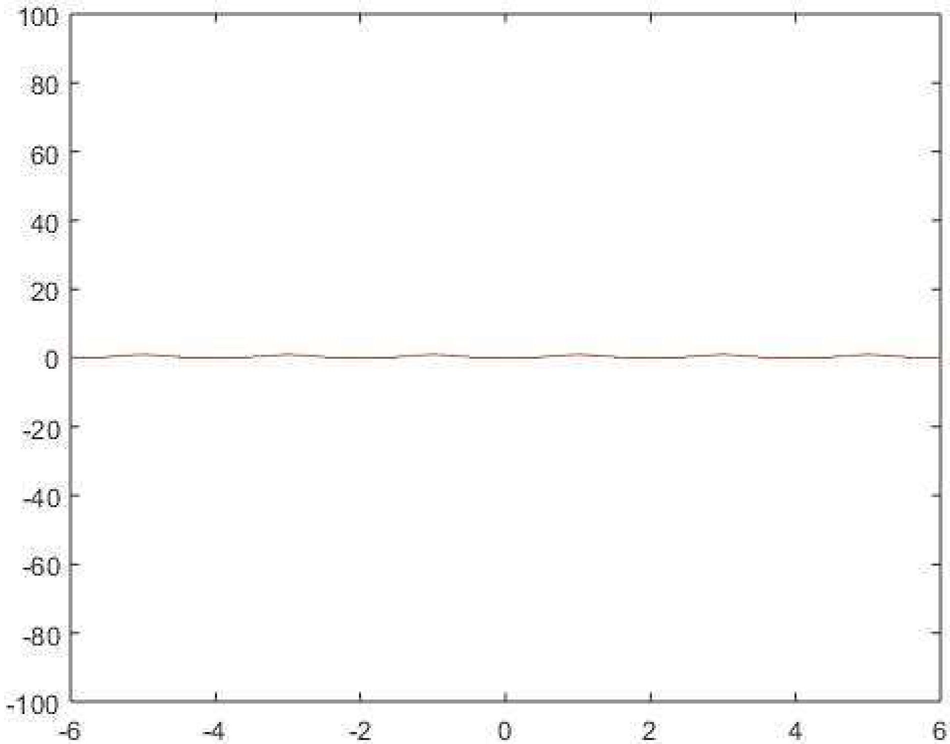


ENTIRE SIGNAL REPEATED N TIMES
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-6
-4
-2
0
2
4
6
ENTIRE TIME OF REPEATED SIGNAL

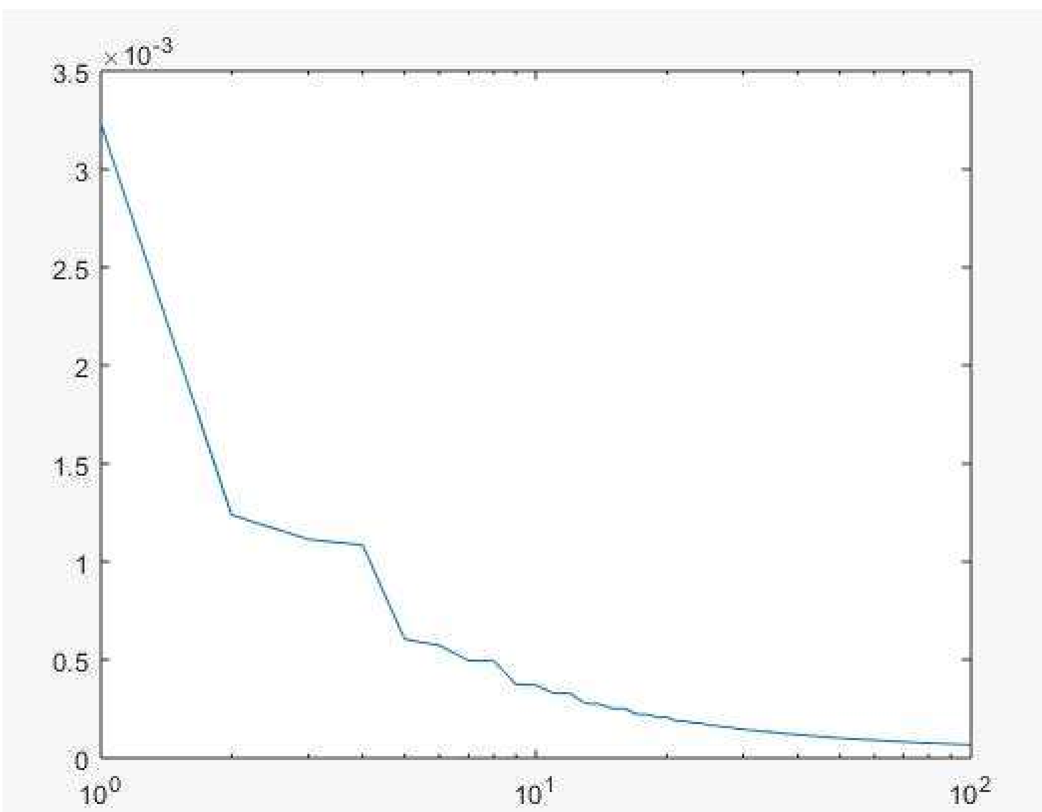

0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-100
-80
-60
-40
-20
0
20
40
60
80
100
REAL PART



× 10^-16
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-100
-80
-60
-40
-20
0
20
40
60
80
100
IMAGINARY PART



ERROR USING FORMULA



The given signal is exponential signal with period T=2 and it is repeated 6 times with N=6 for plotting; The angular frequency time vector and the signal are all defined as shown below in the following matlab code.(initialisation of variables)

```
%GIVEN TIME PERIOD IN QUESTION T=2
T=2;

%ANGULAR FREQUENCY
om0=(2*pi)/T;


%Fs
Fs=1/1000;
t=-N*T/2:Fs:N*T/2-Fs;

%tvec
tvec=-1:Fs:1-Fs;

%x -- GIVEN SIGNAL

%INITIALISING x
x=zeros(size(tvec));

%DECLARING SIGNAL
rightend=0.5;
leftend=-0.5;
middle=0;
x(tvec> leftend & tvec<rightend) = exp(-abs(tvec(tvec> leftend &
tvec<rightend))).^2
```

The signal is then repeated and stored in a list which consists of the whole signal which is the whole signal repeated N number of times.Thus the whole list contains our repeated signal.

```
%REPEATING THE SIGNAL
wholesignal=[];
i=1;
while (i < N+1 )
    wholesignal = [wholesignal x];
    i = i + 1;
end;
```

Then the original signal is plotted. Then the fourier coefficients are got using trignometric formula of fourier coefficients and the real and imaginary parts are plotted. The formula is given beside the code and the real and imaginary parts of the signal is plotted in the figures shown above.

```
%PLOTTING THE ORIGINAL SIGNAL
plot(t,wholesignal);
xlabel('ENTIRE TIME OF REPEATED SIGNAL');
ylabel('ENTIRE SIGNAL REPEATED N TIMES');
figure();
%INITIALISING KVECTOR
kvector=-100:100;

%FINDING FOURIER COEFFICIENTS BY USING TRIGNOMETRIC FORM
for o=1:length(kvector)
    k=kvector(o);
    exponentpart=exp(-1i * k * om0 * t);%e^-jkwot
    coeff(o)=(1/(N*T))*trapz(t, wholesignal.*exponentpart );%Trapezium
is integration function
end;

%figure();
%stem(kvector,coeff);

%PLOTTING THE REAL PART OF FOURIER COEFFICIENT
stem(kvector,real(coeff));
xlabel('REAL PART');
figure();
%PLOTTING THE IMAGINARY PART OF FOURIER COEFFICIENT
stem(kvector,imag(coeff));
xlabel('IMAGINARY PART');
figure();
```

Then the signal is reconstructed using fourier coefficients trignometric form and it is plotted. The reconstructed signal is stored in a seperate list which is further used to calculate error.

```
%RECONSTRUCTION OF SIGNAL
reconstructed= zeros(size(t));%INITITALISNG
```

```
for o2=1:length(kvector)
    k=kvector(o2);
    exponentpart=exp(1i * k * om0 *t);%e^jkwot
    %RECONSTRUCTING USING GIVEN FORMULA
    reconstructed= reconstructed + coeff(o2)*exponentpart;
    errorvector(o2)= (1/T).*immse(wholesignal,reconstructed);
end
```

```
formulaerror=(1/T).*(trapz(t,(abs(wholesignal-reconstructed)).^2));
disp(formulaerror);
semilogx(formulaerror,kvector);
xlabel('ERROR USING FORMULA');

%THE ERROR VECTOR IS PLOTTED WITH K VECTOR
semilogx(kvector,errorvector);
```

The signals fourier coefficients are found then the signal is reconstructed using the fourier coefficients as shown in question 3. Then the convergence of the signal is shown by creating a vector errorvector and storing the error for different values of k.It is then plotted using a semilogx function. The formula error is also found and plotted and it is clearly seen that the difference between the given signal and reconstructed signal is approximately zero.

xxxxxxxxxxxxxxxxxx-END-xxxxxxxxxxxxxxxxxxxx