# Mid-term Lab Assessment Task

| Submitted By: | | |
|---|---|---|
| **Name** | **ID** | **Sec** |
| **Rakibul Islam** | **20-42277-1** | **F** |

**Instructions:**

1. Write Name, ID, Sec, AMP1, AMP2, FREQ1, FREQ2, Assigned Task No.
2. Solve the assigned problem only in MATLAB/OCTAVE.
3. Add code in this file
4. Add Snapshot of the result.
5. Rename the file with "YOUR ID"
6. Finally submit it in PDF format.

**Parameters:**

Consider, your ID = **AB-CDEFG-H.**

[please use any random value if assigned value comes out zero]

| | |
|---|---|
| AMP1 = **A+B** | AMP2 = **E+F** |
| FREQ1= **BC** | FREQ2= **DE** |

## Put Value in the following Table:

| | |
|---|---|
| AMP1 = 2+0=**2** | AMP2 =2+7=**9** |
| FREQ1= **04** | FREQ2=**22** |

| **Assigned Task** | |
|---|---|

## Problem Statement:

**Suppose, you want to send information from two sources. Second signal is 30 degree shifted from the first signal and Amplitude of the signals are AMP1 and AMP2 respectively. Frequency of the signals are FREQ1 and FREQ2 respectively.** Show the signals in time domain in a figure titled **"Input signal"**.

**Task 1.** Make a composite signal from two source and convert it to frequency domain. Show the positive frequency in figure title "**Composite Signal**"

**Task 2.** Quantize the composite signal in 16 equally distributed levels and show at 2 cycle in a new figure titled **"Quantized Signal".**

**Task 3.** During the transmission, Signal suffered unwanted noise with amplitude of 0.2 V. Determine the Bandwidth, SNR and max. capacity of the composite signal considering SNR.

**Task 4.** consider the first source produced harmonic with $(1_4)^{th}$ of the main signal amplitude and second signal produce harmonic with $(1_2)^{th}$ of the main signal amplitude. Determine the Bandwidth, THD, Max. capacity of the signals considering THD.

**Code:**

**TASK 1:**

```
fs = 1000;
t = 0:1/fs:1-
1/fs; FREQ1 =
04; FREQ2
=22; AMP1 =
2; AMP2 = 9;
x1 = AMP1*sin(2*pi*FREQ1*t);
x2 = AMP2*sin(2*pi*FREQ2*t);
x3= x1+x2;
subplot(3,1,1)
plot(t,x3,'b','linewidth',1.5);
xlabel('time in seconds')
ylabel('Amplitude in volts')
title('Composite Signal');
subplot(3,1,2)
fx3 = fft(x3);
fx3 = fftshift(fx3)/(fs/2);
```

```
f = fs/2*linspace(-1,1,fs);
plot(f,abs(fx3),'LineWidth',1.5);
axis([-500 500 0 15])
xlabel('Frequency (Hz)');
ylabel('magnitude');
```

**TASK 2:**

```
a1 = 2;
a2 = 9;
f1 = 4;
f2 = 22;
P1=0;
P2 = 30*pi/180;
T1 = 1/f1;
T2 = 1/f2;
t1 = linspace(0,2*T1,1000);
t2 = linspace(0,2*T2,1000);
x1 = a1*sin(2*pi*f1*t1+P1);
x2 = a2*sin(2*pi*f2*t2+P2);
plot(t1,x1);
hold on
plot(t2,x2);
quatization_levels1 = linspace(-a1,a1,16);
quatization_levels2 = linspace(-a2,a2,16);
quatised_x1 = zeros(1,length(x1));
quatised_x2 = zeros(1,length(x2));
for i = 1:length(x1)
[~,index] = min(abs(quatization_levels1-x1(i)));
quatised_x1(i) = quatization_levels1(index);
end
for i = 1:length(x2)
[~,index] = min(abs(quatization_levels2-x2(i)));
quatised_x2(i) = quatization_levels2(index);
end
figure;
plot(t1,quatised_x1);
hold on
plot(t2,quatised_x2);
```

**TASK 3:**

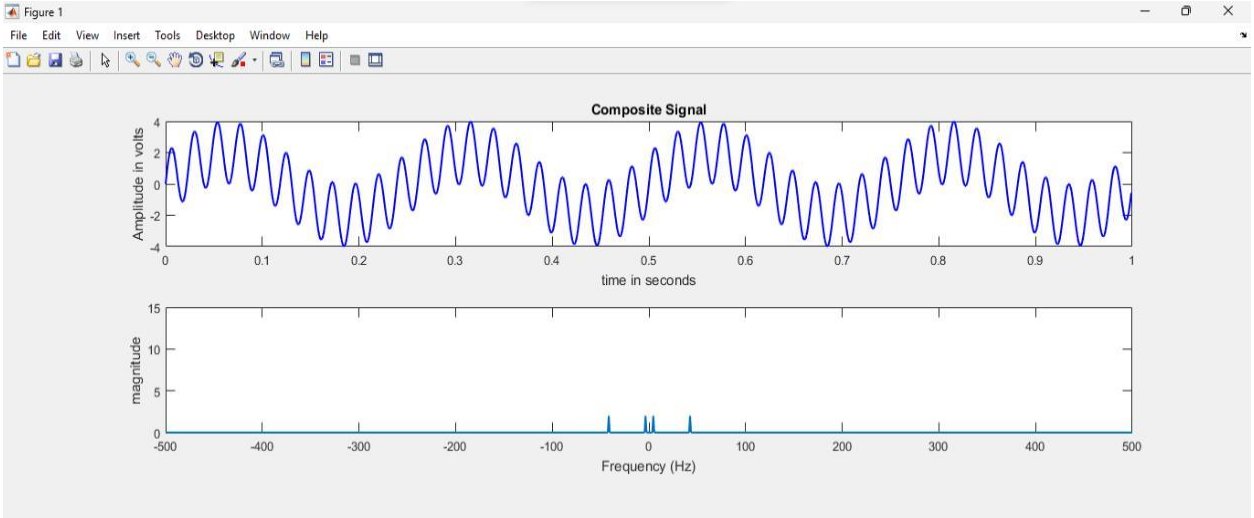
```
AMP1=2;
AMP2= 9;
fs=4000;
t = 0:1/fs:1-1/fs;
signal = AMP1*sin(2*pi*1000*t) + AMP2*cos(2*pi*1000*t);
noise= 0.1*randn(size(t));
noisySignal=signal+noise;
SNR=snr ( noisySignal)
bandwidth = obw(signal,fs)
maxCapacity=bandwidth*log2(1+SNR)
```

**TASK 4:**

```
fs=8000;
f=400;
t=0:1/fs:1-1/fs;
AMP1=2;
powfund=AMP1^2/2;
AMP2=9;
powharm = AMP2^2/2;
S1=0.25;
S2=0.5;
FREQ1=04;
FREQ2=22;
x1 = AMP1*cos(2*pi*FREQ1*t) + AMP2*sin(2*pi*FREQ2*t) + S1*randn(size(t));
THD1 = thd(x1)
BW1=obw(x1,fs)
Capacity1=BW1*log2(1+THD1)
x2 = AMP1*cos(2*pi*FREQ1*t) + AMP2*sin(2*pi*FREQ2*t) + S2*randn(size(t));
THD2 = thd(x2)
BW2=obw(x2,fs)
Capacity2=BW2*log2(1+THD2)
```

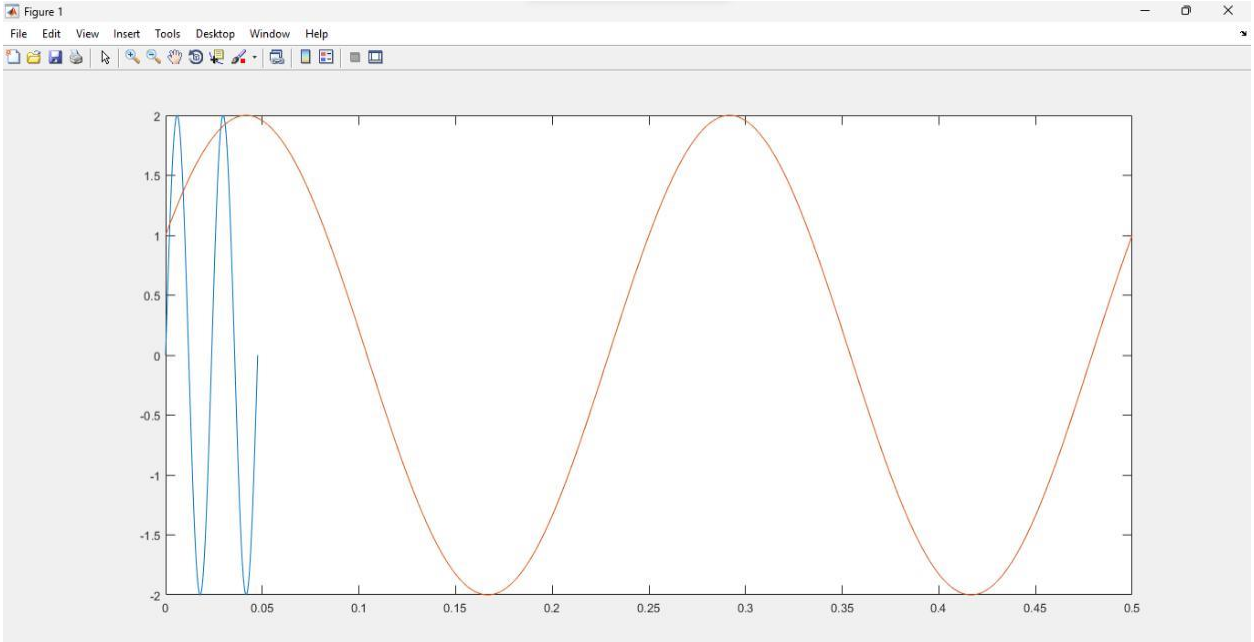
**Result:**

**TASK 1:**

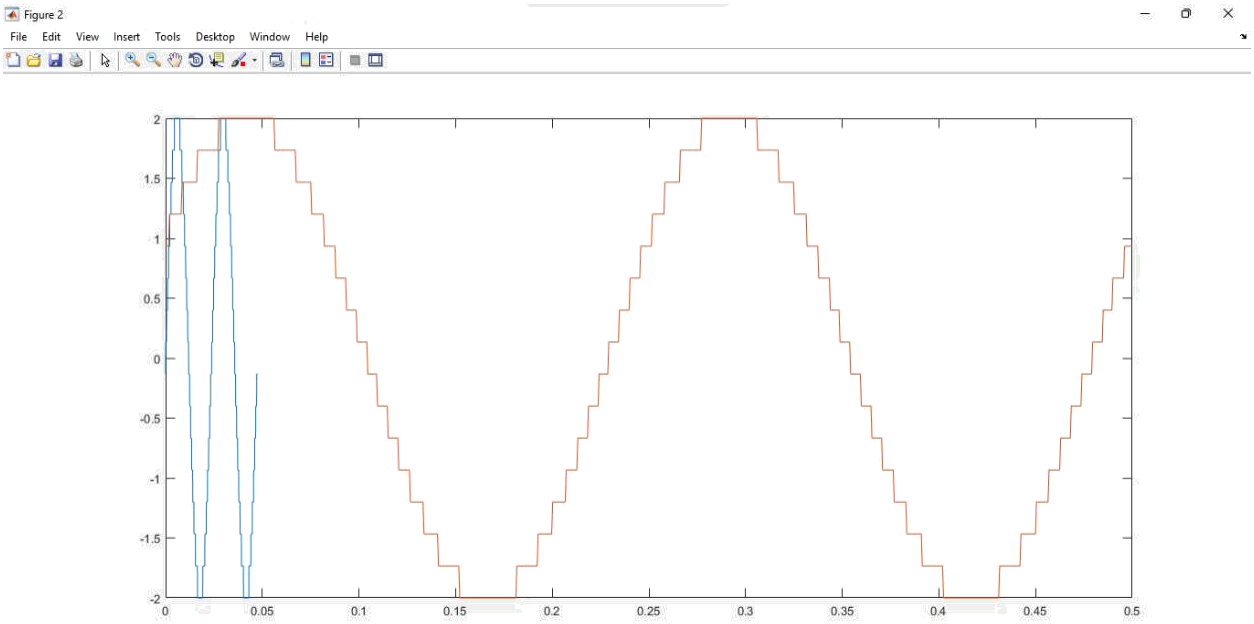



**TASK 2:**

**Input Signal**




**Quantized Signal**




**TASK 3:**

```
Command Window
>> Lab_task

SNR =

   26.2189


bandwidth =

    0.9900


maxCapacity =

    4.7189
```

**TASK 4:**

Command Window

```
>> Lab_task

THD1 =

   -9.9634


BW1 =

   2.6383e+03


Capacity1 =

   8.3476e+03 + 1.1958e+04i

THD2 =

  -10.1780


BW2 =

    3.6667e+03


Capacity2 =

   1.1727e+04 + 1.6619e+04i

fx >>
```