

# AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH

FACULTY OF SCIENCE & TECHNOLOGY



Course Title: Data Communication

## Lab Report-4

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PROGRAM: BSc CSE

COURSE TITLE: Data Communication

Submitted to:

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### **Class Work:**

Our composite signal is,

signal =

```
1.5*sin(2*pi*2*t)+0.9*cos(2*pi*10*t)+1.1*sin(2*pi*20*t)+0.13*randn(size(t));
```

\*\*\*\*\*Calculate the SNR value of the signal.

### **Matlab Code:**

```
fs = 8000; % Sampling frequency
```

```
t = 0:1/fs:1-1/fs; %time array
```

```
signal = 1.5*sin(2*pi*2*t)+0.9*cos(2*pi*10*t)+1.1*sin(2*pi*20*t) ;
```

```
noise = 0.13*randn(size(t));
```

```
noisy_signal = signal+noise;
```

```
power_signal = sum(signal.^2)/length(signal);
```

```
power_noise = sum(noise.^2)/length(noise);
```

```
SNR = snr(signal,noise)
```

```
defSNR = 10*log10(power_signal/power_noise)
```

```
regularSNR = 10^(SNR/10)
```

Output:

Command Window

```
SNR =
```

```
21.0716
```

```
defSNR =
```

```
21.0716
```

```
regularSNR =
```

```
127.9846
```

```
fx >>
```

Performance Task for Lab Report: (your ID = **AB-CDEFG-H**)

**\*\*Generate a composite signal using two simple signals as,**

$$x = A1 \sin(2\pi((\mathbf{C+D+H}) * 100)t) + A2 \cos(2\pi((\mathbf{D+E+H}) * 100)t) + s * \text{randn}(\text{size}(t));$$

(a) Select the value of the amplitudes as follows: let  $A1 = (\mathbf{A+B+H})$ ,  $A2 = (\mathbf{B+C+H})$  and  $s = (\mathbf{C+D+H})/30$

(b) Calculate the SNR value of the composite signal.

(c) Find the bandwidth of the signal and calculate the maximum capacity of the channel.

### **Matlab Code:**

```
A=2;
B=0;
C=4;
D=2;
E=4;
F=7;
G=5;
H=1;
%(a)
A1=A+B+H;
A2=B+C+H;
s=(C+D+H)/30;
fs= 5000;% sampling frequency
t= 0:1/fs:1-1/fs;%time array
signal = A1*sin(2*pi*((C+D+H)*100)*t) + A2*cos(2*pi*((D+E+H)*100)*t) ;
noise = s*randn(size(t));
x = signal+noise;
%(b)
power_signal = sum(signal.^2)/length(signal);
power_noise = sum(noise.^2)/length(noise);

SNR_dB= snr(signal,noise);
```

```
regularSNR= power_signal/power_noise;
```

```
regularSNR2=10^(SNR_dB/10);
```

```
%(c)
```

```
bandwidth=obw(signal ,fs);
```

```
max_capacity = bandwidth*log2(1 + regularSNR);
```

```
%(d)
```

```
level = floor(2^(1/2*log2(1 + regularSNR)));
```

### **Output:**



A screenshot of the MATLAB Command Window. The window title is "Command Window". It shows the following commands and their outputs:

```
>> SNR
SNR =
    21.0716

>> regularSNR
regularSNR =
    316.5932

>> regularSNR2
regularSNR2 =
    316.5932

>> bandwidth
bandwidth =
    0.9900
```

At the bottom left, there is a prompt "fx >> |" and a vertical scrollbar on the right side.

```
>> max_capacity
```

```
max_capacity =
```

```
8.2279
```

```
>> level
```

```
level =
```

```
17
```

```
fx >> |
```