# AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH

FACULTY OF SCIENCE & TECHNOLOGY

## Course Title: Data Communication

## Final Term Lab Assignment


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COURSE TITLE: Data Communication


**Submitted to:**

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**Questions:**

Assume your ID is AB-CDEFG-H. Form a string of four characters, by taking any two letters and any two numbers of your choice. For example, your string can be ‘6Lm7’ or ‘4pT9’ or ‘U8q7’. Do not use any string from these examples. This is your text message. In this assignment you must show how we can transmit a text message and how we can recover the text message again at receiver.

a) Convert your text message into binary bit sequence.

**Code:**

```
clc

clear all;

close all;

A = 2;

b = 0;

C = 4;

D = 2;

E = 4;

F = 7;

G = 5;

H = 1;

am_00 = 0;

am_01 = (G+5);

am_10 = 2*(G+5);

am_11 = 3*(G+5);

% (a)

transmitted_Message= '6Sp9';

dec = double(transmitted_Message);

B = mod(floor(p2'*dec),2);

x = reshape(B,1,numel(B));
```

**Output:**

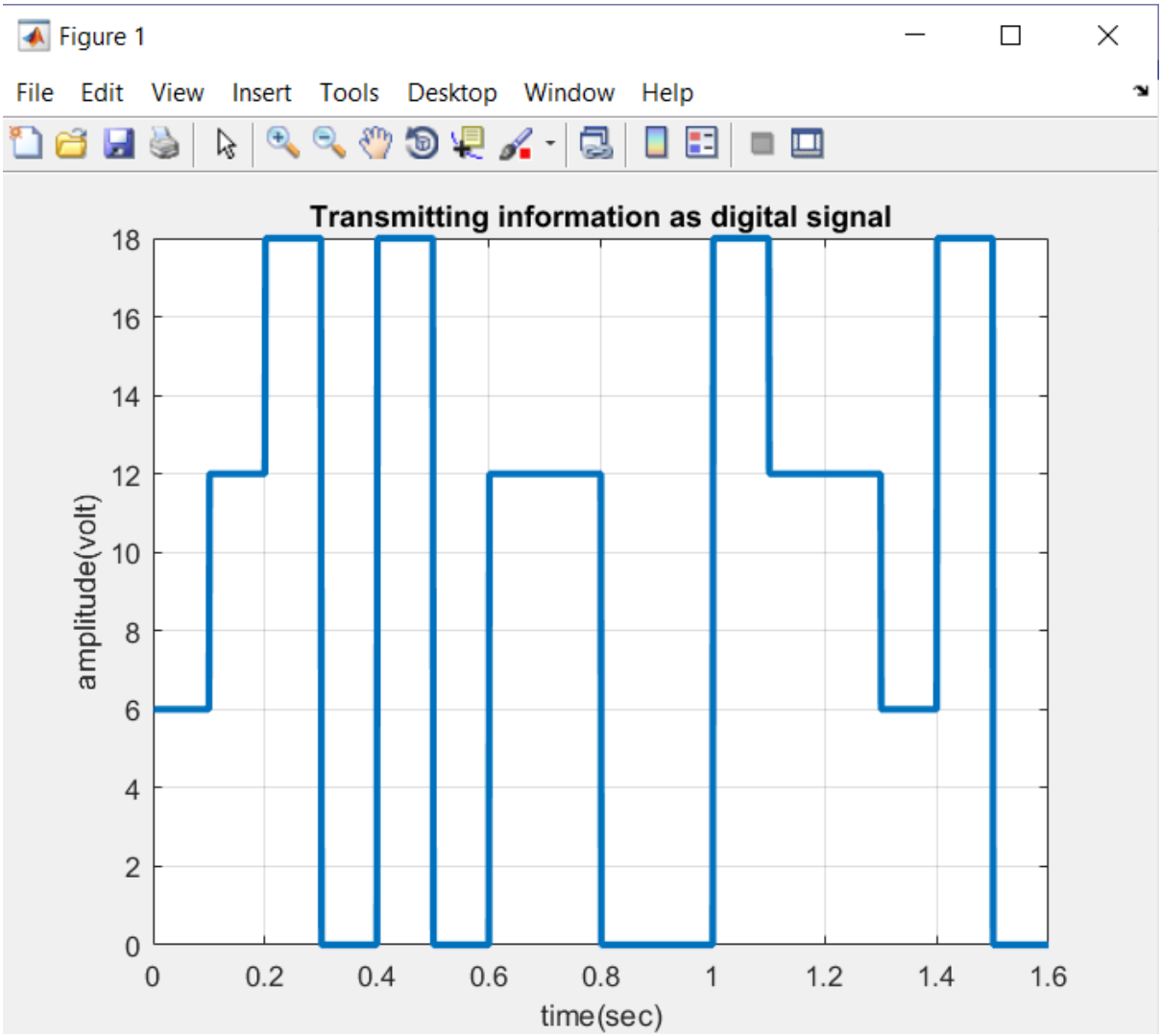
```
mn =

  Columns 1 through 26

     0     1     0     1     1     0     0     0     1     0     0     0     0     1     0     1     0     0     0     0     1     0     0     1     0     1

  Columns 27 through 32

     0     1     1     0     0     0
```

b) Display the bit sequence from (a) as four level unipolar digital signal. Use 0 volt for binary ‘0 0’, use (G+5) volt for binary ‘0 1’, use 2*(G+5) volt for binary ‘1 0’, use 3*(G+5) volt for binary ‘1 1’. Bit rate of your digital signal must be (G+1)*10 bps.

**Code:**

```
G=1;
br=(G+1)*10;
bp=1/br;%Bit Period
bit=[];
for n=1:2:length(x)
   if x(n)==0 && x(n+1)==0
      se = 0*zeros(1,100);
   elseif x(n)==0 && x(n+1)==1
      se=(G+5)*ones(1,100);
   elseif x(n)==1 && x(n+1)==0
       se=2*(G+5)*ones(1,100);
   else
       se=3*(G+5)*ones(1,100);
   end
   bit=[bit se];
end
t1 = bp/50:bp/50:50*length(x)*(bp/50);
figure;
plot (t1,bit,'lineWidth',2.5);
grid on;
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Transmitting information as digital signal');
```

**Output:**



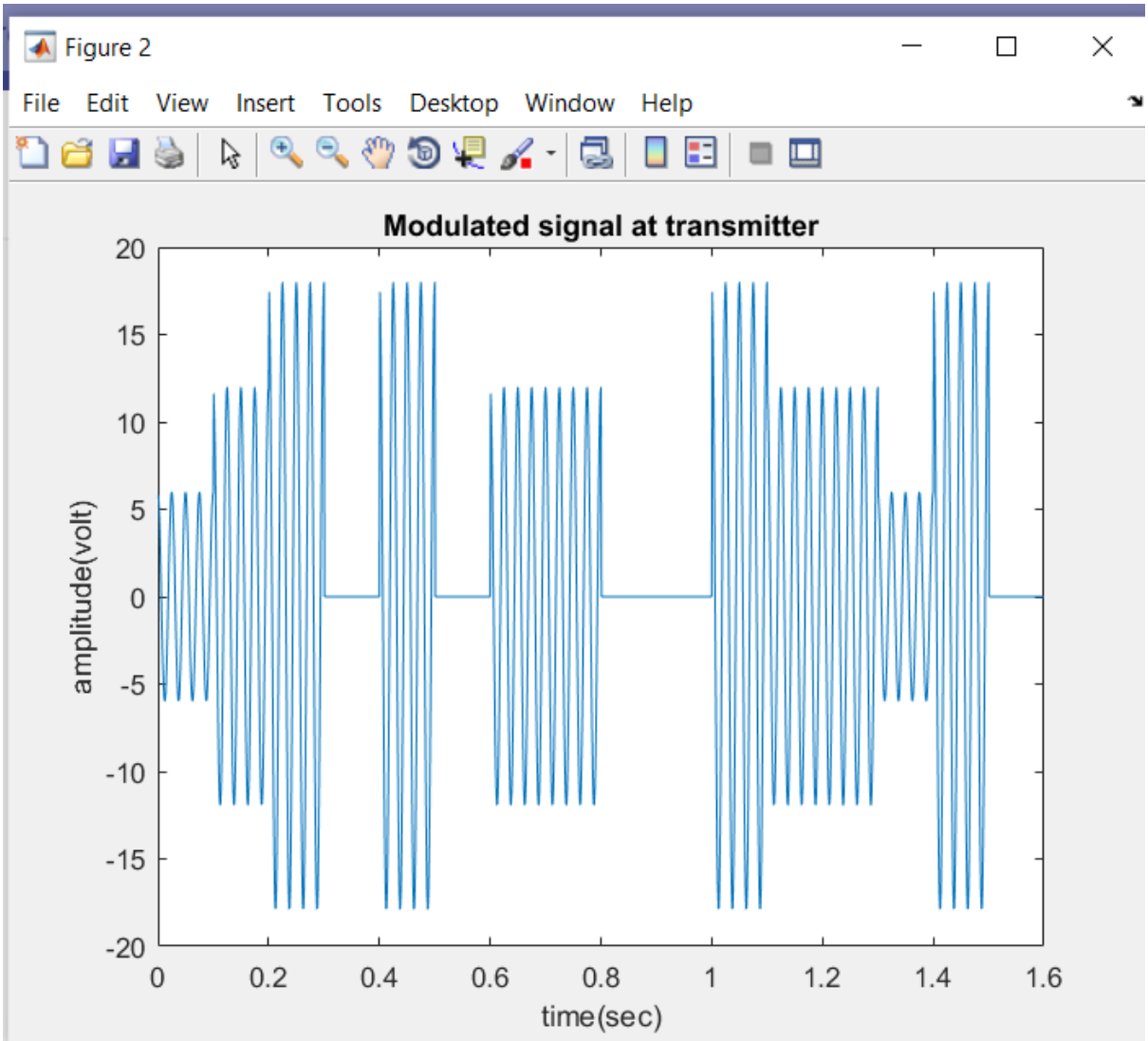

c) Apply QASK on digital signal from (b). Use a carrier frequency of (G+1)*40 Hz. Assume we are transmitting this analog signal.

**Code:**

```
G=1;

cf = (G+1)*40;

t2 = bp/100:bp/100:bp;

ss = length(t2);

m = [];

for i=1:2:length(x)

   if x(i)==0 && x(i+1)==0

      y = 0*cos(2*pi*cf*t2);

   elseif x(i)==0 && x(i+1)==1
```

```
    y = (G+5)*cos(2*pi*cf*t2);
  elseif x(i)==1 && x(i+1)==0
    y = 2*(G+5)*cos(2*pi*cf*t2);
  else
    y = 3*(G+5)*cos(2*pi*cf*t2);
  end
  m=[m y];
end
t3 = bp/50:bp/50:bp*length(x);
figure;
plot(t3,m);
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Modulated signal at transmitter');
```

**Output:**

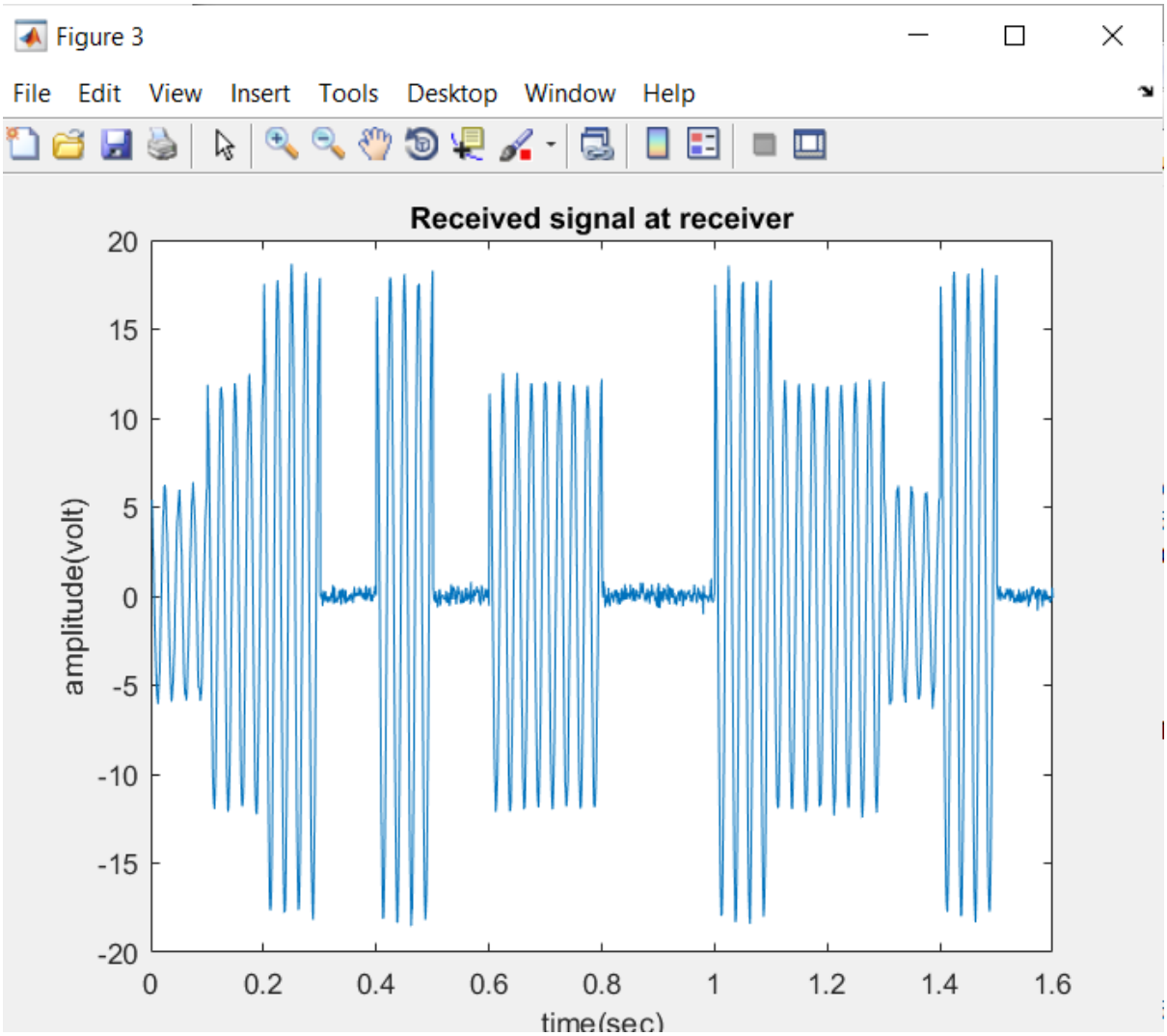



d) Add noise to your modulated signal and assume that the noisy signal is your received signal.

**Code:**

```
t4 = bp/50:bp/50:bp*length(x);

Rec = awgn(m,10);

figure;

plot(t4,Rec);

xlabel('time(sec)');

ylabel('amplitude(volt)');

title('Received signal at receiver');
```

**Output:**



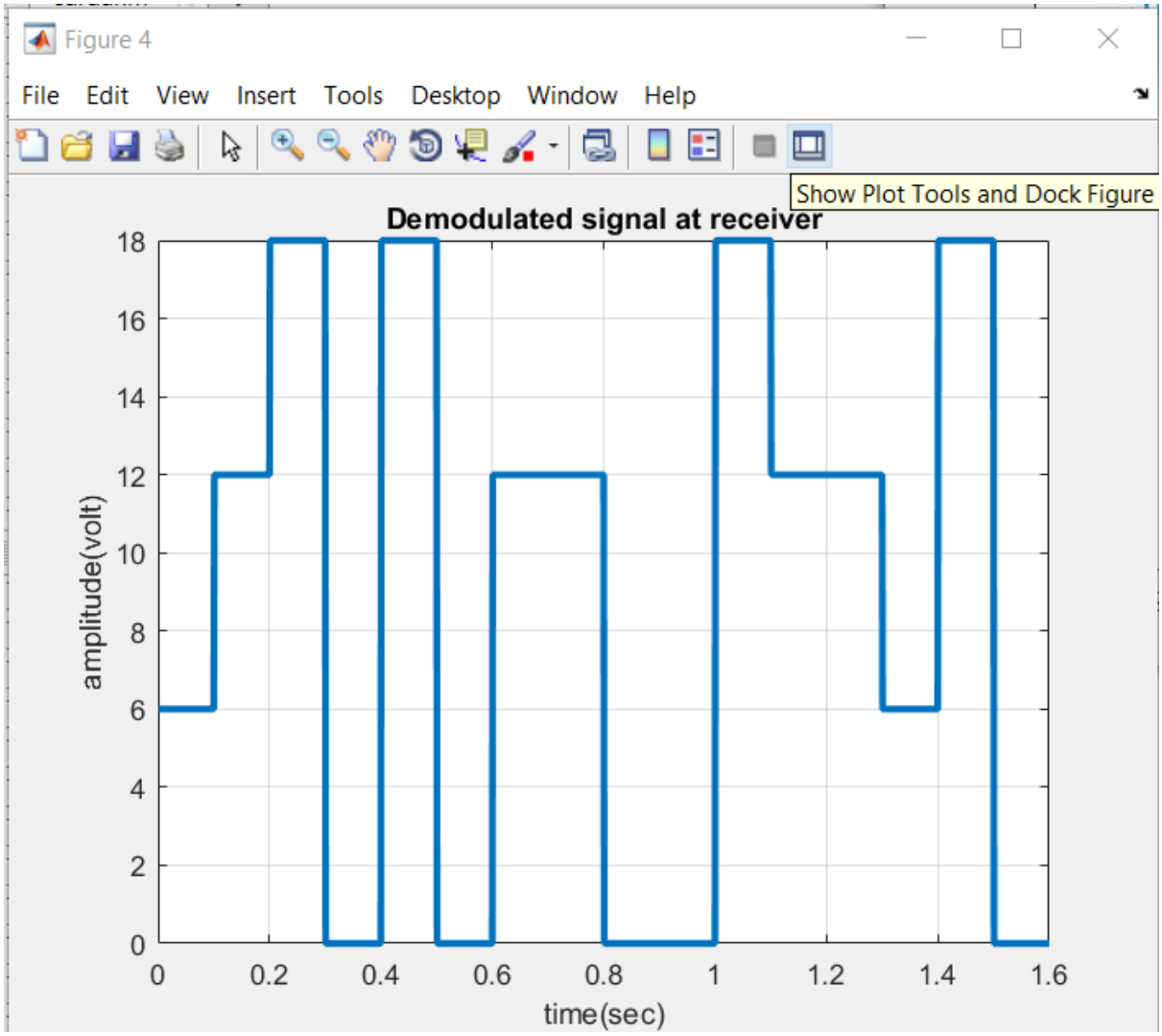

e) Recover the bit sequence from the received noisy signal.

**Code:**

```
mn = [];
for n=ss:ss:length(Rec)
    y = cos(2*pi*cf*t2);
    mm = y.*Rec((n-(ss-1)):n);
    t5 = bp/100:bp/100:bp;
    z = trapz(t5,mm);
    zz = round((2*z/bp));
    if(zz<=(am_00+am_01)/2)
        a1 = 0;
```

```
        a2 = 0;
    elseif(zz>(am_00+am_01)/2 && zz<=(am_01+am_10)/2)
        a1 = 0;
        a2 = 1;
    elseif(zz>(am_01+am_10)/2 && zz<=(am_10+am_11)/2)
        a1 = 1;
        a2 = 0;
    else
        a1 = 1;
        a2 = 1;
    end
    mn = [mn a1 a2];
end
disp('Recovered bit sequence : ');
disp(mn);
```

**Output:**




f) Display the recovered bit sequence from (e) as four level unipolar digital signal. Use 0 volt for binary '0 0', use (G+5) volt for binary '0 1', use 2*(G+5) volt for binary '1 0', use 3*(G+5) volt for binary '1 1'. Bit rate of your digital signal must be (G+1)*10 bps.

**Code:**

```
bit=[];

for n=1:2:length(x)

   if x(n)==0 && x(n+1)==0

      se = 0*zeros(1,100);

   elseif x(n)==0 && x(n+1)==1

      se=(G+5)*ones(1,100);

   elseif x(n)==1 && x(n+1)==0

       se=2*(G+5)*ones(1,100);

   else
```

```
        se=3*(G+5)*ones(1,100);
    end
    bit=[bit se];
end

t5 = bp/50:bp/50:50*length(x)*(bp/50);
figure;
plot (t5,bit,'lineWidth',2.5);
grid on;
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Demodulated signal at receiver');
```

**Output:**

```
mn =

  Columns 1 through 26

     0     1     0     1     1     0     0     0     1     0     0     0     0     1     0     1     0     0     0     0     1     0     0     1     0     1

  Columns 27 through 32

     0     1     1     0     0     0
```

g) Regenerate your text message from recovered bit sequence of (e).

**Code:**

```
L = length(mn);
L8 = 8*floor(L/8);
B = reshape(mn(1:L8),8,L8/8);
p2 = 2.^(0:7);
dec = p2*B;
txt = char(dec);
disp('Text message at receiver : ');
disp(txt);
```

**Output:**

```
mn =

  Columns 1 through 26

     0     1     0     1     1     0     0     0     1     0     0     0     0     1     0     1     0     0     0     0     1     0     0     1     0     1

  Columns 27 through 30

     0     1     1     0

mn =

  Columns 1 through 26

     0     1     0     1     1     0     0     0     1     0     0     0     0     1     0     1     0     0     0     0     1     0     0     1     0     1

  Columns 27 through 32

     0     1     1     0     0     0

txt =

6Sp9
```

h) Increase and decrease noise power at step (d) to analyze its impact on communication quality. What is your observation about impact of noise?

**Ans:** By increase the value of noise power, the signal get low noise. But decrease the value of noise power, the signal get high noise. And high noise is bad for communication. Because, in communication, if the signal have high noise, sender and receiver can't communicate each other perfectly. Sender send a message, and receiver will got another message.noiserefers to anything that interferes with thecommunication processbetween aspeakerand anaudience. It's also called interference. Noise can be external (a physical sound) or internal (a mental disturbance), and it can disrupt the communication process at any point