# AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

**Course:** DATA COMMUNICATION
**Session:** Fall 2022-2023

**Experiment No:** 09

**Experiment Title:** Message Passing and Receiving Using Modulator (part 1: Transmitter Side)

**Section:** I
**Group No**: 07

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## Abstract:

This experiment is designed to understand the concept of message encoding and decoding, serial transmission, and reception of messages and to develop an understanding the of data transmission and reception process.


## Introduction:

Consider the problem of transmitting and receiving a text message, such as

**Data Communication is fun!**

over a waveform channel such as a twisted pair cable or a wireless RF (radio frequency) link. The design of a system that can accomplish this task requires the following ingredients:
In the transmitter side:

1. **Step 1:** Encoding the letters of the alphabet, the numbers, punctuation, etc. For example, "A" could be encoded as 0, "B" as 1, "C" as 2, etc.
2. **Step 2:** Conversion of the encoded message into a serial data stream, e.g., of 0's and 1's in the case of a binary transmission system.
3. **Step 3:** Modulation by the serial data stream of a CT waveform that can betransmitted through the waveform channel.

In the receiver side:

4. **Step 4:** Demodulation of the received waveform at the output of the waveformchannel to obtain the received serial data stream.
5. **Step 5:** Conversion of the received serial data stream to a sequence of character codes.
6. **Step 6:** Decoding of the received character codes to the received message.

**Step 1: Decimal to Serial Binary Conversion**: To transmit a message over a communication channel with one input and one output, the bits of each ASCII-encoded character need to be sent serially, one after another. One convention that needs to be established is whether the LSB (leastsignificant bit) or MSB (most significant bit) of each code is sent first.

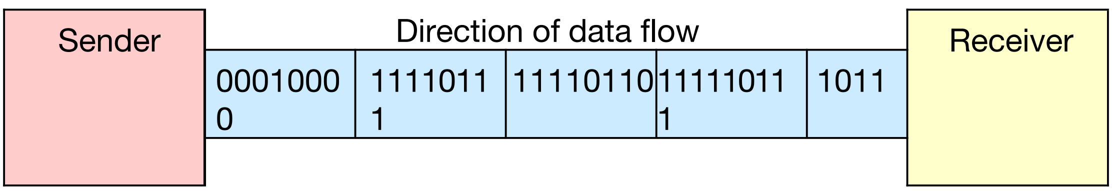


Figure 1: Synchronous transmission

Another consideration is how many bits should be sent per character. Even though the ASCII codehas seven bits, it is customary to send 8 bits per character and set the MSB to zero. Thus, if the convention of sending the LSB first is used, the word **Red** (decimal 82,101,100) is converted to the binary data sequence (commas are only shown for clarity, they are not part of the data sequence)

0 1 0 0 1 0 1 0, 1 0 1 0 0 1 1 0, 0 0 1 0 0 1 1 0

**Transmitted Message =**

**Red**

**The binary information at the Transmitter:**

**Columns 1 through 16**

**0 1 0 0 1 0 1 0 1 0 1 0 0 1 1 0**

**Columns 17 through 24**

**0 0 1 0 0 1 1 0**

**Step 2: Modulation of the serial data stream to waveform:** In Matlab, the asc2bin (See A Message Passing and Receiving Using PAM (Part 1)) function can convert a text string text to a binary data sequence. The binary data sequence is then converted into digital signals. Now, if we want to transmit the signal, we need to modulate the signal in analog.

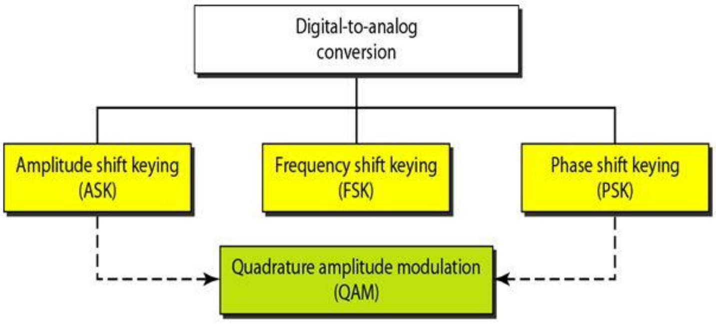


Figure :2

We will perform ASK modulation. ASK: In amplitude shift keying, the amplitude of the carrier signal is varied to create signal elements Both frequency and phase remain constant while the amplitude changes.

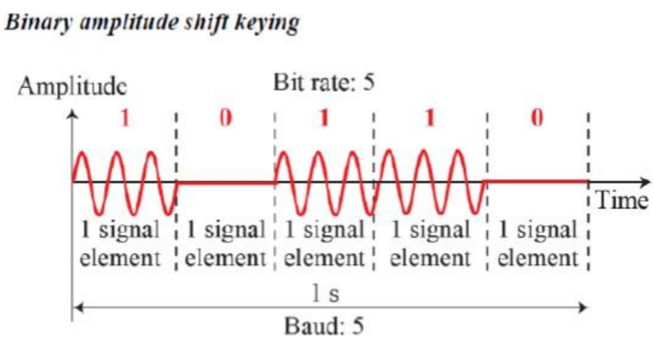

Figure :3

## Exercise:

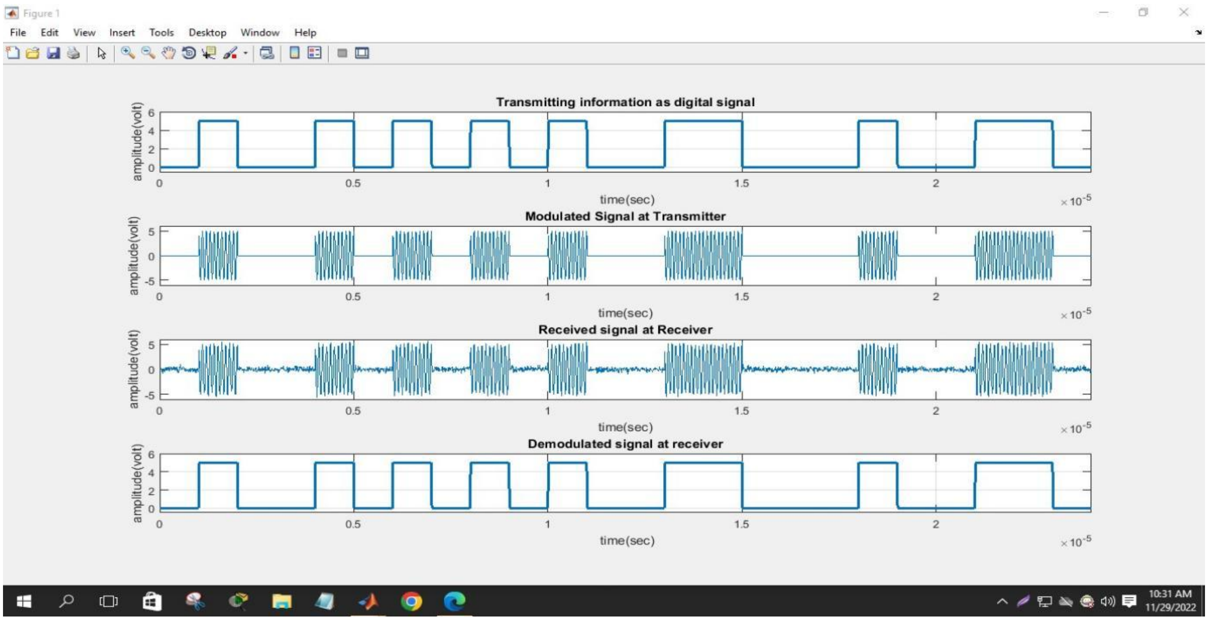


Figure 4: Digital and analog signal.

# Performance Task:

## asc2bn Function:

```
function dn = asc2bn(txt)
dec=double(txt) %Text to ASCII (decimal)
p2=2.^(0:-1:-7) % 2^0,2^-1,.......,2^-7
B=mod(floor(p2'*dec),2) %Decimal to binary conversion
%Columns of B are bits of chars
dn=reshape(B,1,numel(B));%Bytes to serial conbversion
end
```

## Bin2asc Function:

```
function txt = bin2asc(dn)
%bin2asc Serial binary to ASCII to text conversion
% 8 bits per char , LSB first
% >> txt= bin2asc(dn) <<
% where dn is binary input sequence
% txt is output text string
L=length(dn); %Length of input string
L8=8*floor(L/8); %Multiple of 8 Length
B=reshape(dn(1:L8),8,L8/8); %Cols of B are bits of chars
p2=2.^(0:7); %power of 2
```

```
dec=p2*B; %Binary to decimal conversion
txt=char(dec); %ASCII (decimal) to txt
end
```

## Main Source Code:

```
clc;
clear all;
close all;
Transmitted_Message= 'Data Comm'
%Converting Information Message to bit%
x=asc2bn(Transmitted_Message); % Binary Information
bp=.000001;
% bit period
disp(' Binary information at Trans mitter :');
disp(x);

%XX representation of transmitting binary information as digital signal XXX
bit=[];
for n=1:1:length(x)
if x(n)==1;
se=5*ones(1,100);
else x(n)==0;
se=zeros(1,100);
end
bit=[bit se];
end
t1=bp/100:bp/100:100*length(x)*(bp/100);
subplot(4,1,1);
plot(t1,bit,'lineWidth',1.5);grid on;
axis([ 0 bp*length(x) -.5 6]);
ylabel('amplitude(volt)');
xlabel(' time(sec)');
title('Transmitting information as digital signal');

% Binary-ASK modulation %
A1=5; % Amplitude of carrier signal for information 1
A2=0; % Amplitude of carrier signal for information 0
br=1/bp;
% bit rate
f=br*10; % carrier frequency
t2=bp/99:bp/99:bp;
ss=length(t2);
m=[];
for (i=1:1:length(x))
if (x(i)==1)
y=A1*cos(2*pi*f*t2);
else
y=A2*cos(2*pi*f*t2);
end
```

```
m=[m y];
end
t3=bp/99:bp/99:bp*length(x);
subplot(4,1,2);
plot(t3,m);
axis([ 0 bp*length(x) -6 6]);
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Modulated Signal at Transmitter');

disp('**********')
disp(' Message transmitted through a Transmission medium');
disp('**********')
%Channel Noise%
t4=bp/99:bp/99:bp*length(x);
Rec=awgn(m,10);
subplot(4,1,3);
plot(t4,Rec);
axis([ 0 bp*length(x) -6 6]);
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Received signal at Receiver');

% Binary ASK demodulation
mn=[];
for n=ss:ss:length(Rec)
t=bp/99:bp/99:bp;
y=cos(2*pi*f*t); % carrier siignal
mm=y.*Rec((n-(ss-1)):n);
t5=bp/99:bp/99:bp;
z=trapz(t5,mm) ;
% intregation
zz=round((2*z/bp));
if(zz>2.5) % logic level = (A1+A2)/2=7.5
a=1;
else
a=0;
end
mn=[mn a];
end
disp(' Binary information at Reciver :');
disp(mn);
%Representation of binary information as digital signal which achived
%after ASK demodulation
bit=[];
for n=1:length(mn);
if mn(n)==1;
se=5*ones(1,100);
else mn(n)==0;
se=zeros(1,100);
```

```
end
bit=[bit se];
end
t5=bp/100:bp/100:100*length(mn)*(bp/100);
subplot(4,1,4)
plot(t5,bit,'LineWidth',1.5);grid on;
axis([ 0 bp*length(mn) -.5 6]);
ylabel('amplitude(volt)');
xlabel(' time(sec)');
title('Demodulated signal at receiver');
Received_Message=bin2asc(mn)
```

## Result:

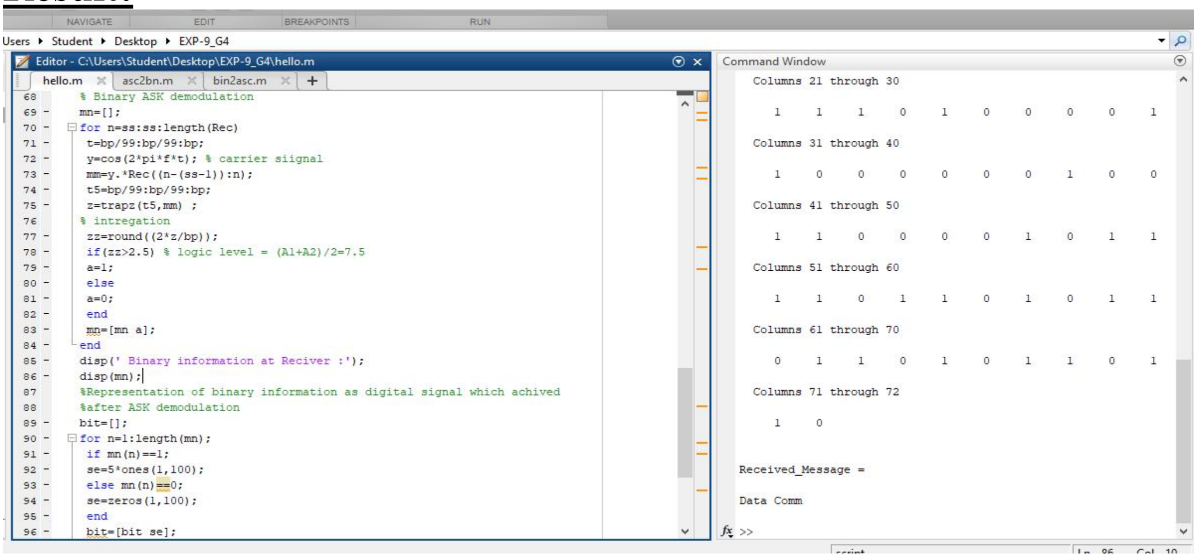


Figure 5: Recover the text ‘Data Comm’ from the received signal.

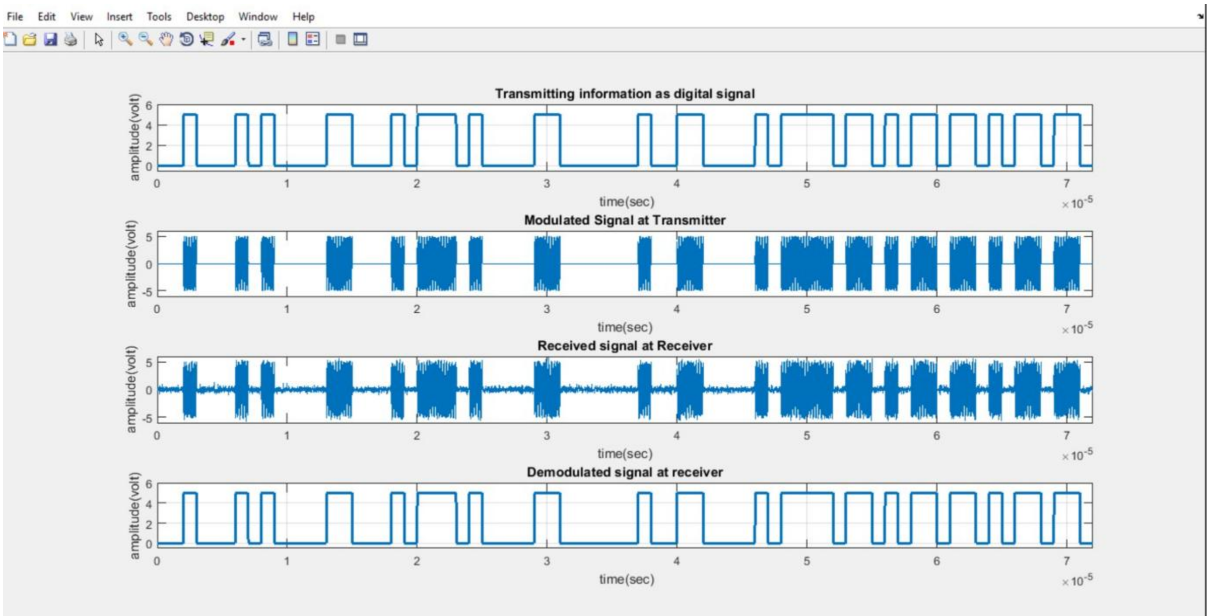


Figure 6: Digital and analog signal.

## Discussion and Conclusion:

MATLAB was used in this experiment to solve the problem of transmitting and receiving a text message. In this experiment, we have sent a message over a waveform channel such as a twisted pair cable or a wireless RF (radio frequency) link. During the whole experiment we have gone through 6 different major steps which help us to find the actual solution. While working on this experiment, some grammatical errors occurred. Expect that everything will be in its proper place and that absolute value show up.

### References:


1. Forouzan, B. A. “Data Communications and Networking”, 4th edition.
2. Agarwal, Rajneesh “Data Communication and Computer Networks.”
3. Prakash C. Gupta, “Data communications”, Prentice Hall India Pvt.