AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Faculty of Science & Technology

Undergraduate Program

Course: DATA COMMUNICATION

Fall 2022-23

Section:I

Group: 3

Lab Report-04

Submitted by

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Ans to the Question number 1:

```
clc
%20-42954-1
%AB-CDEFG-H
%E=9
%F=5
%G=4
%bit=[1 0 0 1 0 1 0 1 0 1 0 0]
clear all
close all
bit_stream = [1 0 0 1 0 1 0 1 0 1 0 0];
no_bits = length(bit_stream);
bit_rate = 4000; % 4 kbps
pulse_per_bit = 1; % for polar nrz
pulse_duration = 1/((pulse_per_bit)*(bit_rate));
no_pulses = no_bits*pulse_per_bit;
samples_per_pulse = 500;
fs = (samples_per_pulse)/(pulse_duration); %sampling frequency
% including pulse duration in sampling frequency
% ensures having enough samples in each pulse
t = 0:1/fs:(no_pulses)*(pulse_duration); % sampling interval
% total duration = (no_pulse)*(pulse_duration)
no_samples = length(t); % total number of samples
dig_sig = zeros(1,no_samples);
max_voltage = 5;
min_voltage = -5;
for i = 1:no_bits
if bit_stream(i) == 1
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
max_voltage*ones(1,samples_per_pulse);
else
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
min_voltage*ones(1,samples_per_pulse);
end
end
plot(t,dig_sig,'linewidth',1.5)
grid on
xlabel('time in seconds')
ylabel('Voltage')
ylim([(min_voltage - (max_voltage)*0.2)
(max_voltage+max_voltage*0.2)])
title(['Polar NRZ-L for ',num2str(bit_stream),''])
```

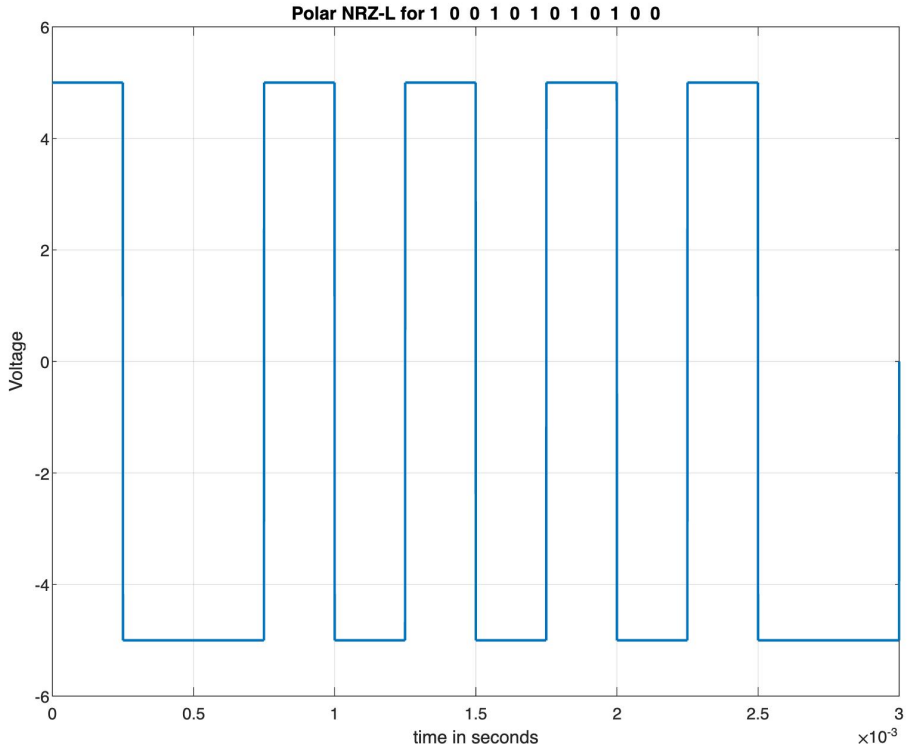

Figure :1

Ans to the Question number 2:

```
clc
close all
%20-42954-1
%AB-CDEFG-H
%E=9
%F=5
%G=4
%bit=[1 0 0 1 0 1 0 1 0 1 0 0]
bit_stream = [1 0 0 1 0 1 0 1 0 1 0 0];
no_bits = length(bit_stream);
bit_rate = 2000;
pulse_per_bit = 2;
pulse_duration = 1/((pulse_per_bit)*(bit_rate));
no_pulses = no_bits*pulse_per_bit;
samples_per_pulse = 1000;
fs = (samples_per_pulse)/(pulse_duration);
t = 0:1/fs:(no_pulses)*(pulse_duration);
no_samples = length(t);
dig_sig = zeros(1,no_samples);
```

```
max_voltage = +2;
min_voltage = -2;
for i = 1:no_bits
j = (i-1)*2;
if bit_stream(i) == 1
dig_sig((j*(samples_per_pulse)+1):(j+1)*(samples_per_pulse)) =
min_voltage*ones(1,samples_per_pulse);
dig_sig(((j+1)*(samples_per_pulse)+1):(j+2)*(samples_per_pulse)) =
max_voltage*ones(1,samples_per_pulse);
else
dig_sig((j*(samples_per_pulse)+1):(j+1)*(samples_per_pulse)) =
max_voltage*ones(1,samples_per_pulse);
dig_sig(((j+1)*(samples_per_pulse)+1):(j+2)*(samples_per_pulse)) =
min_voltage*ones(1,samples_per_pulse);
end
end
plot(t,dig_sig,'linewidth',1.5)
grid on
xlabel('time in seconds')
ylabel('Voltage')
ylim([(min_voltage - (max_voltage)*0.2)
(max_voltage+max_voltage*0.2)])
title(['Manchester ',num2str(bit_stream),''])
```

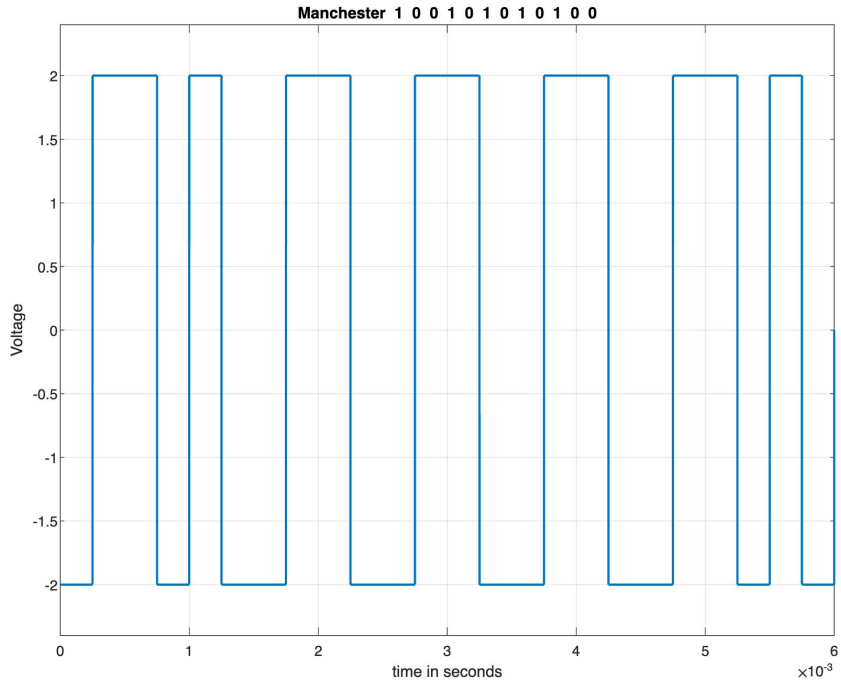

Figure :2

Answer to the Question number 3:

```
clc
%20-42954-1
%AB-CDEFG-H
%E=9
%F=5
%G=4
%bit=[1 0 0 1 0 1 0 1 0 1 0 0]
close all
bit_stream = [1 0 0 1 0 1 0 1 0 1 0 0];
no_bits = length(bit_stream);
bit_rate = 1000; % 1 kbps
pulse_per_bit = 1; % for polar AMI
pulse_duration = 1/((pulse_per_bit)*(bit_rate));
no_pulses = no_bits*pulse_per_bit;
samples_per_pulse =500;
fs = (samples_per_pulse)/(pulse_duration);%sampling frequency
% including pulse duration in sampling frequency
% ensures having enough samples in each pulse
t = 0:1/fs:(no_pulses)*(pulse_duration);% sampling interval
% total duration = (no_pulse)*(pulse_duration)
no_samples = length(t);% total number of samples
dig_sig = zeros(1,no_samples);
max_voltage = +5;

min_voltage = -5;
last_bit = 0;
for i = 1:no_bits
if bit_stream(i) == 1
if last_bit == 0
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
max_voltage*ones(1,samples_per_pulse);
last_bit = 1;
else
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
min_voltage*ones(1,samples_per_pulse);
last_bit = 0;
end
end
end
plot(t,dig_sig,'linewidth',1.5)
grid on
xlabel('time in seconds')
```

```
ylabel('Voltage')
ylim([(min_voltage - (max_voltage)*0.2)
(max_voltage+max_voltage*0.2)])
title(['AMI ',num2str(bit_stream),''])
```

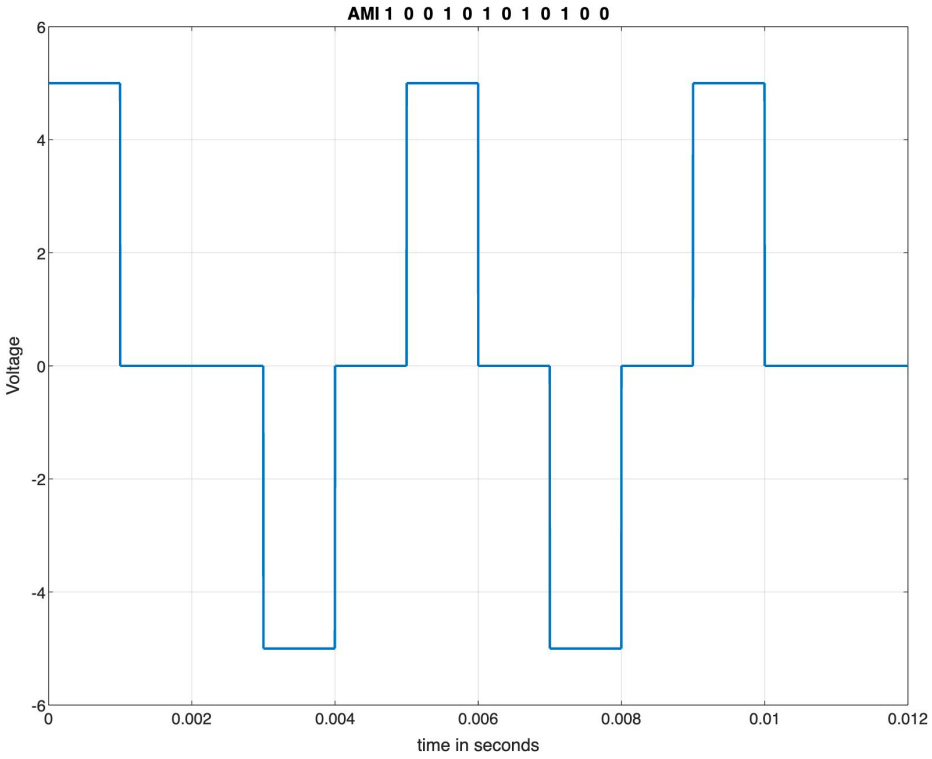

Figure :3

Answer to the question number 4:

```
clc
%20-42954-1
%AB-CDEFG-H
%E=9
%F=5
%G=4
%bit=[1 0 0 1 0 1 0 1 0 1 0 0]
clear all
close all
bit_stream = [1 0 0 1 0 1 0 1 0 1 0 0];
no_bits = length(bit_stream);
bit_rate = 10000;
pulse_per_bit = 1;
```

```
pulse_duration = 1/((pulse_per_bit)*(bit_rate));
no_pulses = no_bits*pulse_per_bit;
samples_per_pulse = 1000;
fs = (samples_per_pulse)/(pulse_duration);%sampling frequency
% including pulse duration in sampling frequency
% ensures having enough samples in each pulse
t = 0:1/fs:(no_pulses)*(pulse_duration);% sampling interval
% total duration = (no_pulse)*(pulse_duration)
no_samples = length(t);% total number of samples
dig_sig = zeros(1,no_samples);
max_voltage = +5;
avg_voltage = 0;
min_voltage = -5;
last_b = 0;
current_level = avg_voltage;
last_nzero_level = min_voltage;
for i = 1:no_bits
if bit_stream(i) == 1
if last_b == 0
if last_nzero_level == min_voltage
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
max_voltage*ones(1,samples_per_pulse);
last_nzero_level = max_voltage;
current_level = max_voltage;
last_b = 1;
else
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
min_voltage*ones(1,samples_per_pulse);
last_nzero_level = min_voltage;
last_b = 1;
current_level = min_voltage;
end
else
if last_nzero_level == max_voltage
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
avg_voltage*ones(1,samples_per_pulse);
last_b = 0;
current_level = avg_voltage;
elseif last_nzero_level == min_voltage
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
avg_voltage*ones(1,samples_per_pulse);
last_b = 0;
current_level = avg_voltage;
else
```

```
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
current_level*ones(1,samples_per_pulse);
last_b = 1;
current_level = last_nzero_level;

last_nzero_level = current_level;
end
end
else
dig_sig(((i-1)*(samples_per_pulse)+1):i*(samples_per_pulse)) =
current_level*ones(1,samples_per_pulse);
end
end
plot(t,dig_sig,'linewidth',1.5)
grid on
xlabel('time in seconds')
ylabel('Voltage')
ylim([(min_voltage - (max_voltage)*0.2)
(max_voltage+max_voltage*0.2)])
title(['MLT-3 ',num2str(bit_stream),''])
```

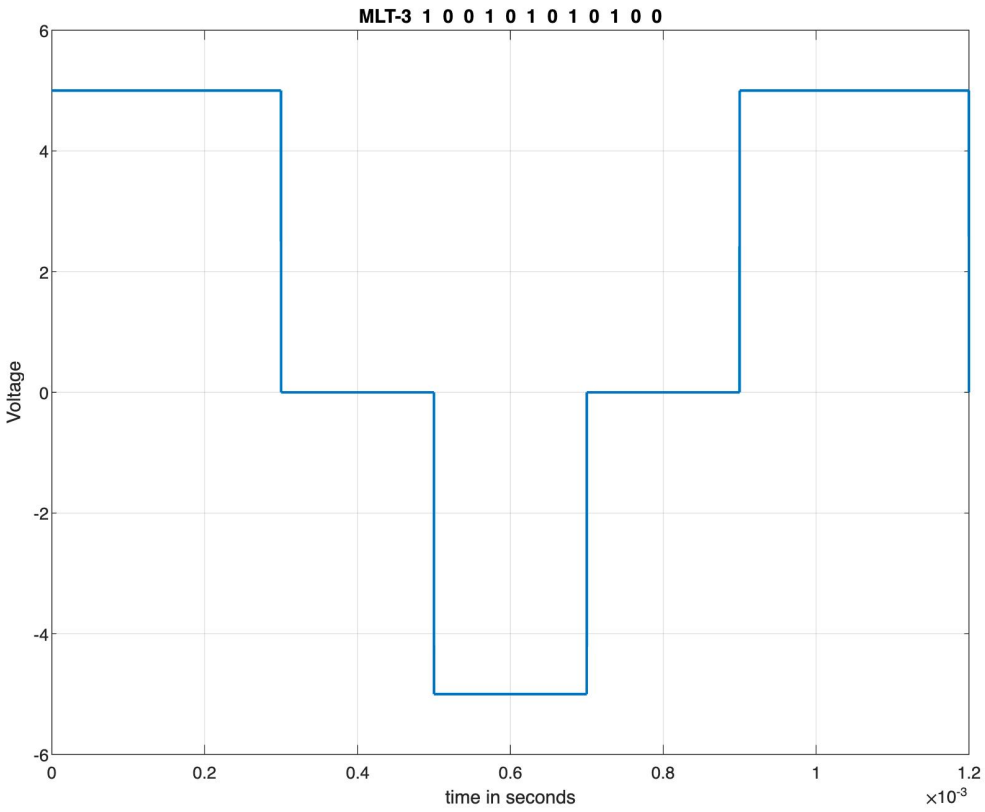

Figure :4