

**AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH**

**Laboratory Report Cover Sheet**

Title: Study of Digital to Digital Conversion (Line Coding) Using MATLAB

Experiment Number: 04 Course Title: Data Communication

Course Code: COE3103 Course Instructor: Nowshin Alam

Semester: Spring 2023-2024 Section: E Date of Submission: 19-03-2024

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Group no: 06  Submitted by: Abir Bokhtiar ID: 22-47038-1

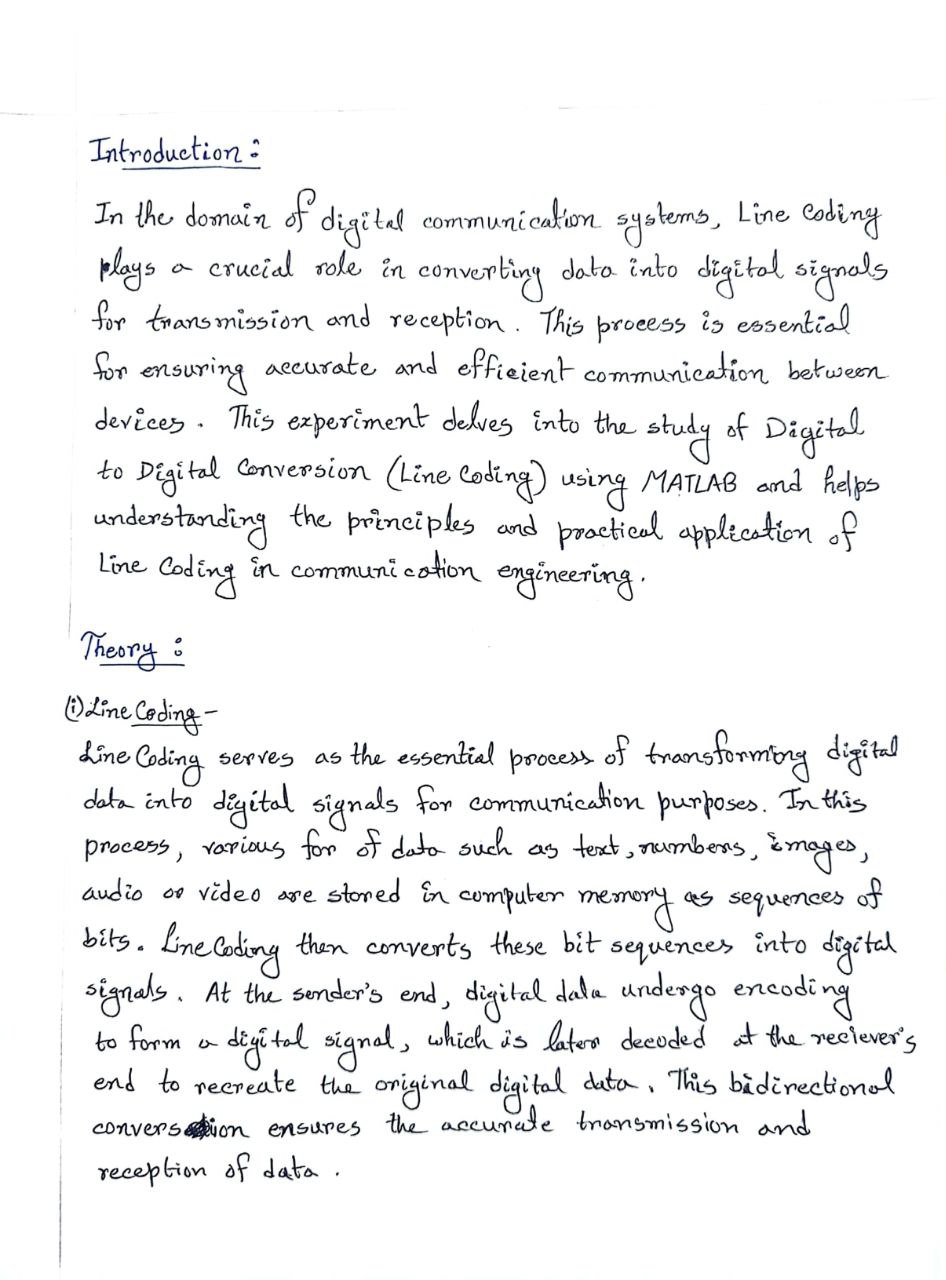


**No Name ID Program Signature**

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| --- | --- | --- | --- |
| 1 | Maeed Ahammed | 22-46280-1 | CSE |
| 2 | Riad Al Hasan | 22-46732-1 | CSE |
| 3 | Assadulla Ill Galib | 20-42434-1 | CSE |
| 4 | Sharanya Das | 19-41299-3 | CSE |

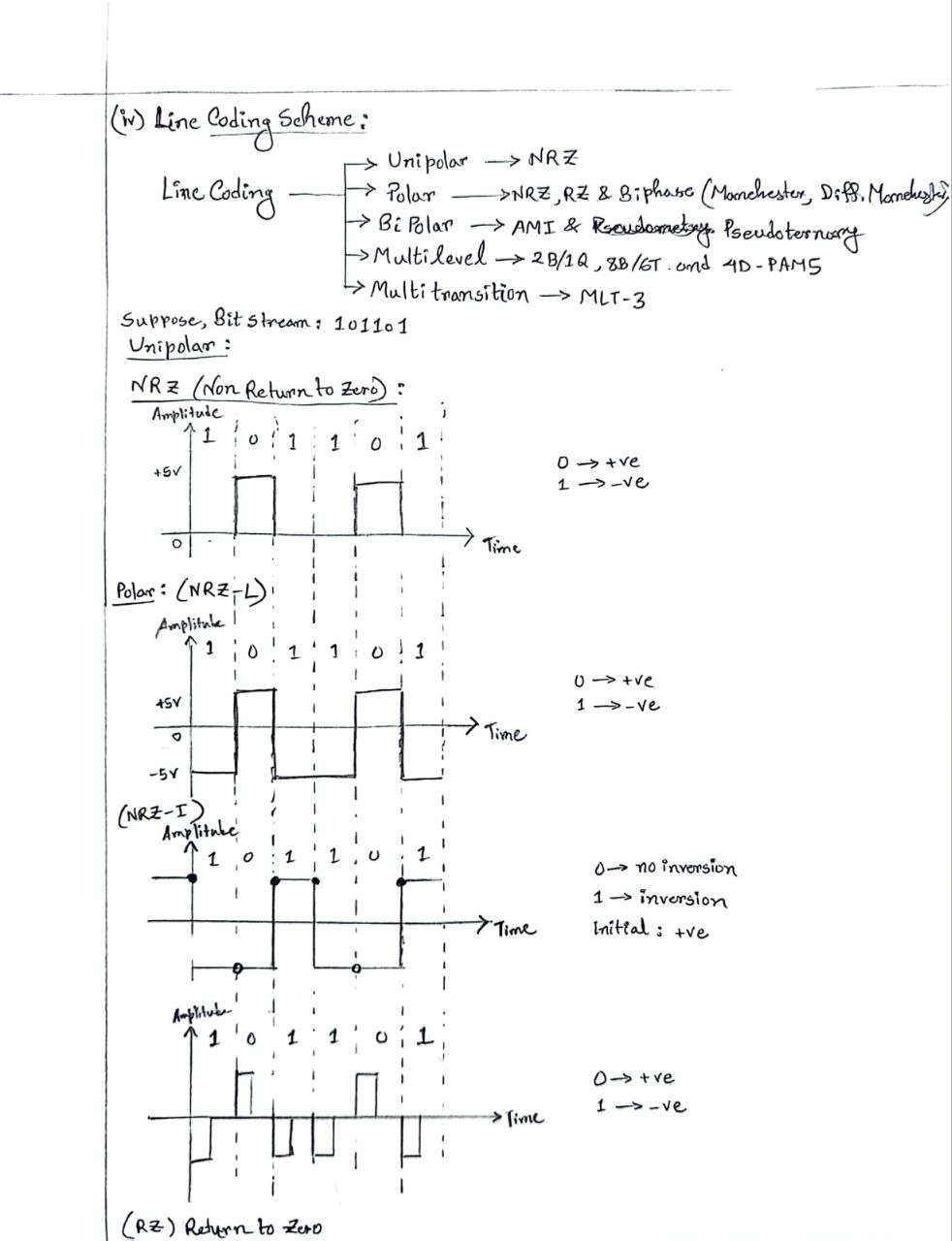
|  |  |  |
| --- | --- | --- |
| ***Faculty use only*** | | |
| *Faculty Comments* | **Marks Obtained** |  |
|  |
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|  | **Total Marks** |  |
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| --- | --- | --- | --- | --- | --- |
| Category | Proficient  [6] | Good  [5-4] | Acceptable  [3-2] | Unacceptable [1] | Secured Marks |
| **Introduction and/or Theory** | * Explains all necessary and relevant theoretical background information, measures, and variables. | * Explains the important parts of theoretical background information, may be partially irrelevant or need more details. | * Explains some theoretical background information, but some information may be missing, irrelevant or inaccurate. | * A lot of information is missing, out of context and/or inaccurate. |  |
| **Experimental procedure/Code** | * Working procedure or code is clearly presented and is supported by proper comments. * Simulation program file is provided which runs properly and shows the expected result. * Methods are clearly written, including all steps in sufficient detail for the experiment to be repeated. | * Working procedure or code is given for the experiment to be sufficient. * Simulation program file is provided which runs properly but the output does not perfectly align with expected result. * Methods are correct but the steps may be lacking in detail, making the experiment hard to be repeated. | * Working procedure or code is missing some steps and/or contains some mistakes. * Simulation program file is provided which runs properly but the output has many problems. | * Working procedure or code is absent or missing major steps and/or contains mistakes. * Simulation program file is not provided/is completely wrong. |  |
| **Block Diagrams and Graphical Results** | * Clear, accurate diagrams and graphs are labeled neatly and accurately with excellent detail. * Simulated result meets all criteria; outcomes are described clearly and accurately. | * Diagrams and plots are included and are correctly labeled in brief, but there may be some lack of clarity. * Most criteria are met, but there may be some lack of clarity and/or incorrect information. | * Diagrams and plots are included and are labeled, minor mistakes may be present. * Results do not match exactly with the theoretical values and/or analysis is unclear. | * Needed plots/ diagrams are missing or are missing important labels. * Experimental results are missing or completely incorrect. |  |
| **Data Interpretation and**  **analysis** | * Interpretation and analysis of related outcomes (consequences and implications) are logical and reflect student’s informed evaluation and ability to place evidence. * Any report questions are properly answered with detailed justification or calculations. | * Analysis is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes are not clear. * Report questions are answered correctly but may be lacking detail or contain minor logical error. | * Analysis is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified. * Report questions are answered but contain wrong information or major logical error. | * Only the data was reported, there is no analysis. * Report questions are missing or are completely wrong. |  |
| **Overall writing quality** | * Demonstrates thorough and sophisticated understanding. Conclusions drawn are appropriate for analyses; * Writing is strong and easy to understand; ideas are fully elaborated and connected; effective transitions between sentences; no typographic, spelling, or grammatical errors. | * Hypotheses are clearly stated, but some concluding statements not supported by data or data not well integrated. * Writing is clear and ideas are connected; effective transitions between sentences; minor typographic, spelling, or grammatical errors. | * Some hypotheses missing or misstated; conclusions not supported by data. * Writing lacks clarity, noticeable amount of typographic, spelling, or grammatical errors are present. | * Conclusions do not match hypotheses, not supported by data; no integration of data from different sources. * Very unclear language, many grammatical and spelling errors. |  |
| Comments: |  | | | Total Marks  (Out of 30): |  |



A close-up of a paper

Description automatically generated



A close-up of a paper

Description automatically generated

A diagram of a graph

Description automatically generated with medium confidence

## Simulated Results:

ID: AB-CDEFG-H  
ID: 22-47038-1

(Task 1) Polar NRZ-L assuming bit rate is 4 kbps.

Code-

% polar NRZ-L

% 22-47038-1

% AB-CDEFG-H

clc

clear all

close all

bit\_stream = [0 0 0 0 0 0 1 1 1 0 0 0];

no\_bits = length(bit\_stream);

bit\_rate = 4000; % 4 kbps

pulse\_per\_bit = 1; % for polar NRZ-L

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) == 0

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(['NRZ - L for ',num2str(bit\_stream),''])

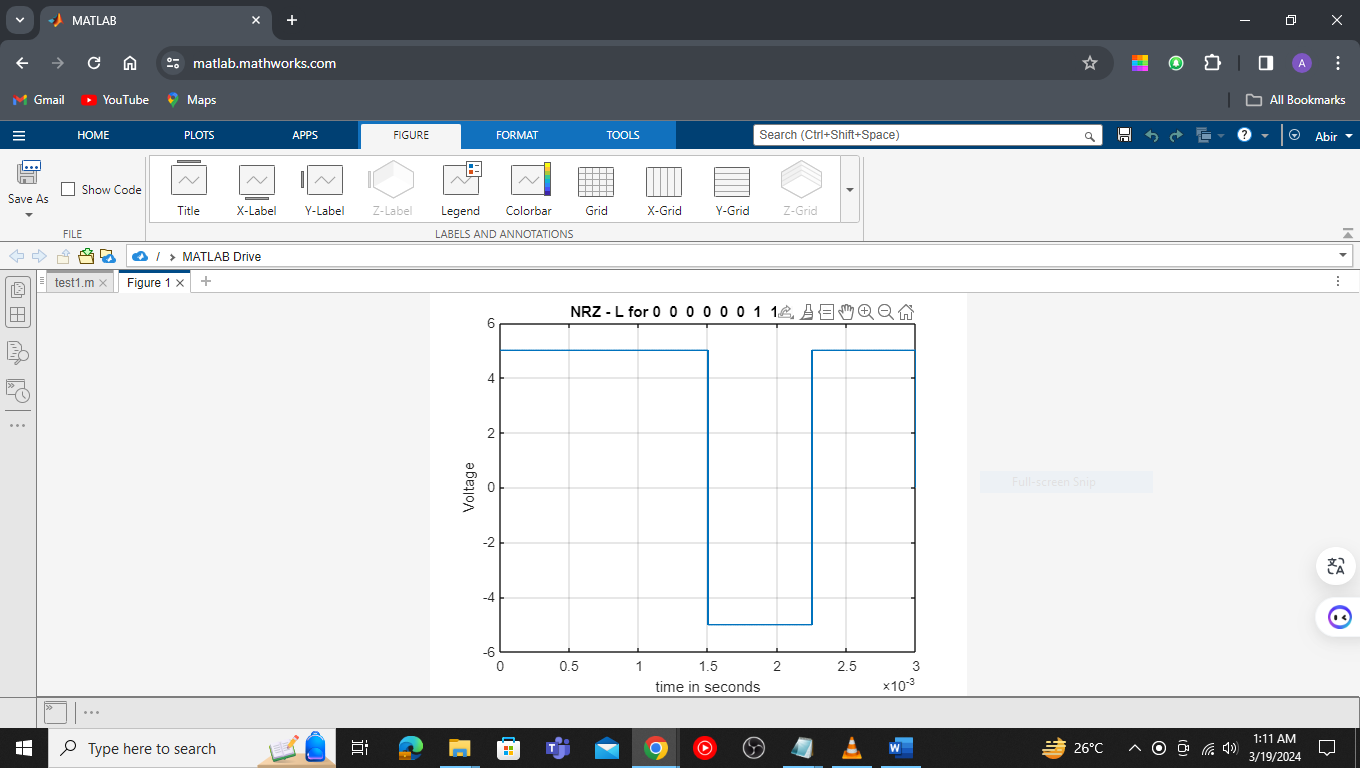


Figure 1- NRZ-L for Bit stream: 0 0 0 0 0 0 1 1 1 0 0 0

(Task 2) Manchester assuming bit rate is 2 kbps.

Code –

% Manchester

% 22-47038-1

% AB-CDEFG-H

clc

clear all

close all

bit\_stream = [0 0 0 0 0 0 1 1 1 0 0 0];

no\_bits = length(bit\_stream);

bit\_rate = 2000; % 2 kbps

pulse\_per\_bit = 2; % for Manchester

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

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 for ',num2str(bit\_stream),''])

A screenshot of a computer

Description automatically generated

Figure 2- Manchester for Bit stream: 0 0 0 0 0 0 1 1 1 0 0 0

(Task 3) AMI assuming bit rate is 5 kbps

Code –

% AMI

% 22-47038-1

% AB-CDEFG-H

clc

clear all

close all

bit\_stream = [0 0 0 0 0 0 1 1 1 0 0 0];

no\_bits = length(bit\_stream);

bit\_rate = 5000; % 5 kbps

pulse\_per\_bit = 1; % for 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 = 0;

sign = 1;

for i = 1:no\_bits

if bit\_stream(i) == 1

dig\_sig(((i-1)\*(samples\_per\_pulse)+1):i\*(samples\_per\_pulse)) = sign\*max\_voltage\*ones(1,samples\_per\_pulse);

sign = (-1)\*sign;

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')

title(['AMI for ',num2str(bit\_stream),''])

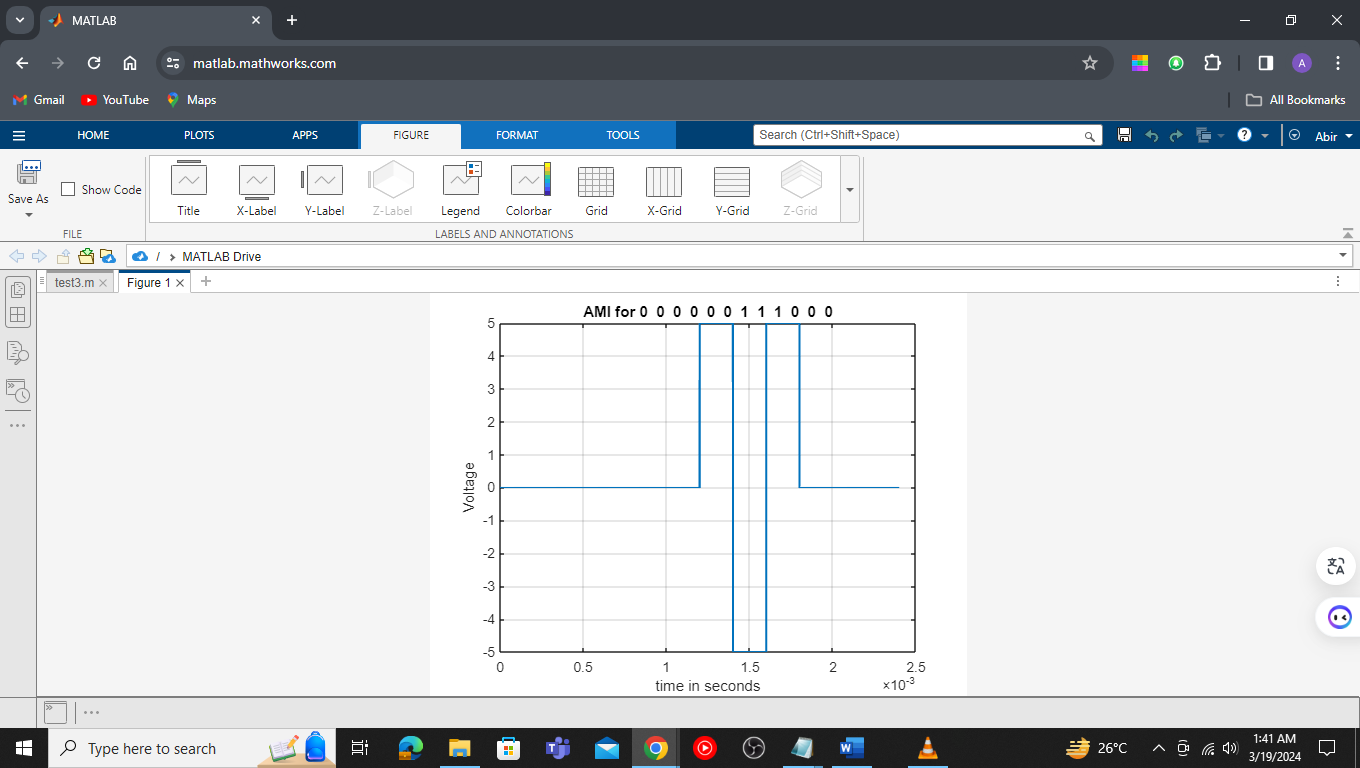


Figure 3- AMI for Bit stream: 0 0 0 0 0 0 1 1 1 0 0 0

