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| **ASSIGNMENT** | |
| **Course Code** | ECC201A |
| **Course Name** | Signals and Systems |
| **Programme** | B.Tech |
| **Department** | CSE |
| **Faculty** | FET |

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| **Reg. No** | 17ETCS002159 |
| **Semester/Year** | 04/2019 |
| **Course Leader/s** | Ms Prafulla Kumari |

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| **Declaration Sheet** | | | | | | | | |
| Student Name | Satyajit Ghana | | | | | | | |
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| Programme | B.Tech | | | | | Semester/Year | 04/2019 | |
| Course Code | ECC201A | | | | | | | |
| Course Title | Signals and Systems | | | | | | | |
| Course Date |  | | to | |  | | | |
| Course Leader | Ms. Prafulla Kumari | | | | | | | |
| **Declaration**  The assignment submitted herewith is a result of my own investigations and that I have conformed to the guidelines against plagiarism as laid out in the Student Handbook. All sections of the text and results, which have been obtained from other sources, are fully referenced. I understand that cheating and plagiarism constitute a breach of University regulations and will be dealt with accordingly. | | | | | | | | |
| Signature of the Student | |  | | | | | Date |  |
| Submission date stamp  (by Examination & Assessment Section) | |  | | | | | | |
| Signature of the Course Leader and date | | | | Signature of the Reviewer and date | | | | |
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# **Question No. 1**

**Solution to Question No. 1 Part A:**

## A 1.1 Introduction:

Overview to the question (students are expected to give a brief introduction to the context on which the question is set, applications, limitations, new developments happening and students own views on the question and the paragraph should not exceed 200 words and references should be cited and it should be authored by the students means to say students should not be borrowing sentences as they are from any referred literature)

## A 1.2 Role of difference equation in the analysis of time series:

Students are expected to provide the solution to the question considering the points mentioned in the marking scheme of the assignment question

## A 1.3 Conclusion:

Students are expected to discuss the solutions obtained in section 1.2 and present their views/suggestions/recommendations (not to exceed 150 words)

# **Question No. 2**

**Solution to Question No. 1 Part B:**

Given:

ASCII String: **VN**

Transmission rate: 1Mbps

Amplitude: 3.5V

Frequency for bit 1: 10Mhz

Frequency for bit 0: 5Mhz

## B 1.1 Determine the NRZ encoding of the text string

The given 2-character ASCII string is first converted to its binary representation,

V = 86 = 1010110

N = 78 = 1001110



a = 3.5.\*[1 -1 1 -1 1 1 -1 1 -1 -1 1 1 1 -1 -1];

x = [0:length(a)-1];

stairs(x, a, 'LineWidth', 2);

ax1 = gca;

set(ax1, 'FontSize', 14);

xticks(0:length(a)-1);

xticklabels({' 1', ' 0', ' 1', ' 0', ' 1', ' 1', ' 0',...

' 1', ' 0', ' 0', ' 1', ' 1', ' 1', ' 0'});

yticks([-3.5 0 3.5])

axis([0 length(a)-1 -5 5])

grid on;

xlabel('$t \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

ylabel('$V \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

legend({'NRZ(VN)'}, 'Interpreter', 'latex', 'FontSize', 14);

## B 1.2 Determine and plot the Continuous Time (CT) signal for the entire string:

Transmission Rate =

Bit Duration =

Number of cycles in a bit 0 with frequency,

Number of cycles in a bit 1 with frequency,

freq\_zero = 10\*10^6;

freq\_one = 5\*10^6;

bit\_duration = 10^-6;

bits = [1 0 1 0 1 1 0 1 0 0 1 1 1 0];

A = 3.5;

time = 0:bit\_duration:length(bits)\*bit\_duration;

syms t;

for i = 1:length(bits)

if bits(i) == 0

f = freq\_zero;

else

f = freq\_one;

end

fplot(A\*sin(2\*pi\*f\*t), [time(i) time(i+1)], 'color', [.5 .4 .7], 'LineWidth', 2);

hold on;

end

axis([0 max(time) -5 5])

xticks(time)

yticks([-3.5 0 3.5])

ax1 = gca;

set(ax1, 'FontSize', 14);

grid on;

xlabel('$t \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

ylabel('$V \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

legend({'SINE PULSE NRZ(VN)'}, 'Interpreter', 'latex', 'FontSize', 14);



## B 1.3 Compute the energy for the characters in the text and energy per character of the CT Signal

The Energy of the Non-Periodic signal obtained in B1.2 is given by

Where,

Now we can compute it for the entire signal,

Since there are 2 characters, Energy per character is,

## B 1.4 Conclusion

Students are expected to draw conclusions based on the discussions and suggestions (not to exceed 100 words)

# **Question No. 3**

**Solution to Question No. 2 Part B:**

Given data:

: Amplitude 6, from t = -1 to t = 1

: Amplitude 2, from t = 0 to t = 2

: Amplitude 4, from t = 2 to t = 3

Plots:







## B 2.1 Compute and plot the signal received by the second link:

The given signal is in terms of the variable , which is first converted to the variable , to give,



Now to get , first the signal is converted to and then reflection of it is done to get , to this formed signal we add to get our final signal,



Comparing the values of overlaps from the x-axis we obtain,

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CASE 1

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| --- | --- |
| Range :  Terms involved : |  |

CASE 2

|  |  |
| --- | --- |
| Range :  Terms involved : |  |

CASE 3

|  |  |
| --- | --- |
| Range :  Terms involved : |  |

CASE 4

|  |  |
| --- | --- |
| Range :  Terms involved : |  |

Hence the output from the first convolution is:



%% plot for y1(t)

syms t

hold off;

y1 = (12\*t+12).\*(heaviside(t+1)-heaviside(t-1)) + (36-12\*t).\*(heaviside(t-1)-heaviside(t-3));

fplot(y1, [-3 4], 'LineWidth', 2)

xlabel('$\tau \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

legend({'$y\_1(\tau)$'}, 'Interpreter', 'latex', 'FontSize', 14);

grid on;

ax1 = gca;

set(ax1, 'FontSize', 14);

axis([-3 4 -1 26])

yticks([0 4 10 24])

## B 2.2 Compute and plot the signal received at the destination:

The output from the previous link is the input for the second link which will give the signal received at the destination,



Now to get , first the signal is converted to and then reflection of it is done to get , to this formed signal we add to get our final signal,



Comparing the values of overlaps from the x-axis we obtain,

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CASE 1

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| --- | --- |
| Range :  Terms involved : |  |

CASE 2

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| --- | --- |
| Range :  Terms involved : |  |

CASE 3

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| --- | --- |
| Range :  Terms involved : |  |

CASE 4

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| --- | --- |
| Range :  Terms involved : |  |

CASE 5

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| --- | --- |
| Range :  Terms involved : |  |

CASE 6

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| --- | --- |
| Range :  Terms involved : |  |

CASE 7

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| --- | --- |
| Range :  Terms involved : |  |

Hence the output from the second convolution is:



%% plot for y(t)

syms t;

y = (24\*(t-1).^2).\*(heaviside(t-1)-heaviside(t-2)) + ...

(48\*t-72).\*(heaviside(t-2)-heaviside(t-3)) + ...

(-48\*t.^2+336\*t-504).\*(heaviside(t-3)-heaviside(t-4)) + ...

(264-48\*t).\*(heaviside(t-4)-heaviside(t-5)) + ...

(24\*(t-6).^2).\*(heaviside(t-5)-heaviside(t-6));

fplot(y , [-1 8], 'LineWidth', 2);

axis([-1 8 -5 90]);

grid on;

xlabel('$t \rightarrow$', 'Interpreter', 'latex', 'FontSize', 14)

ax1 = gca;

set(ax1, 'FontSize', 14);

legend({'$y(t)$'}, 'Interpreter', 'latex', 'FontSize', 14);

## B 2.3 Obtain the formula for the overall impulse response of the network:

The impulse response at first link:

Which can be written as,

**Bibliography**

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