

EXPERIMENT - II

[U19CSC012]

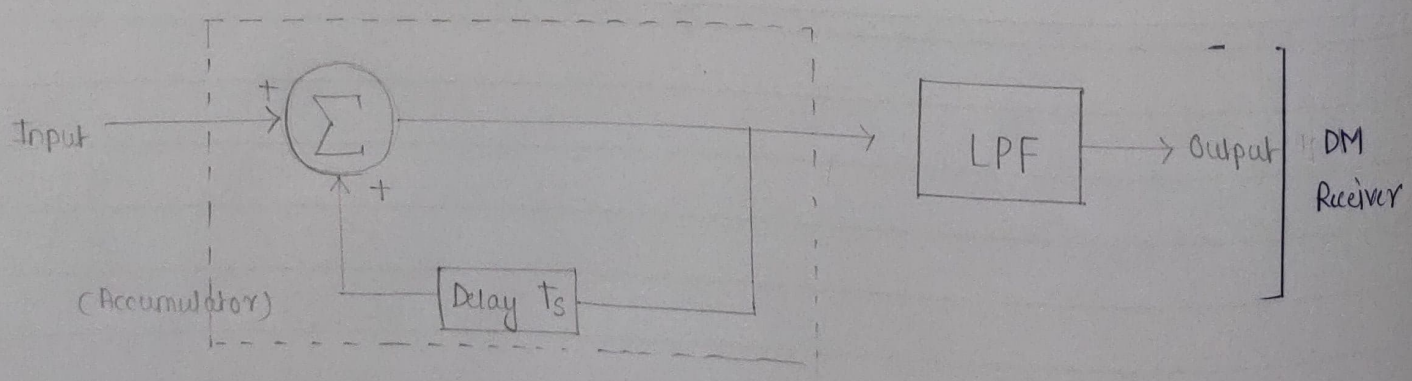
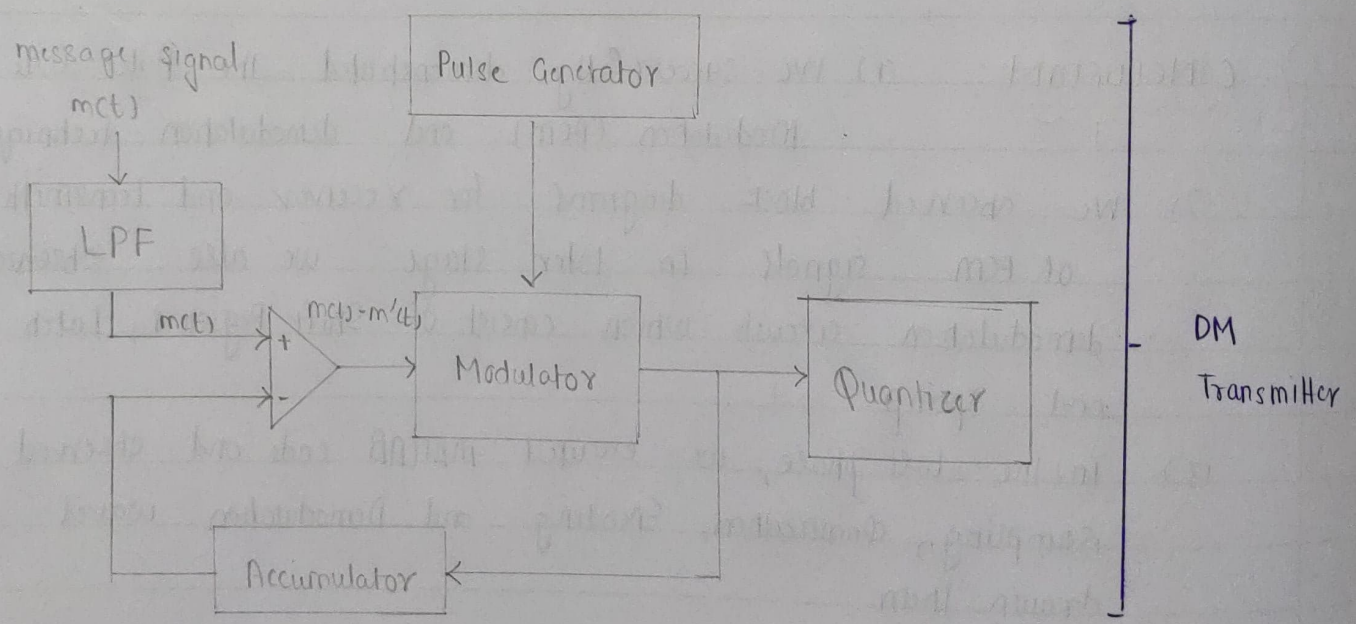
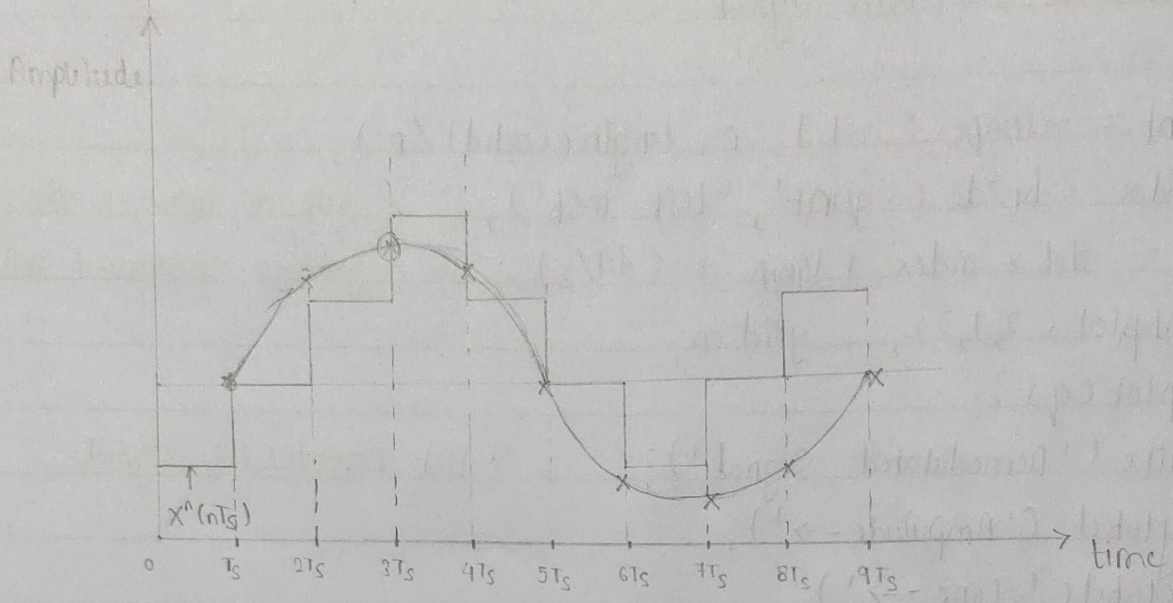
DELTA MODULATION

> AIM: To demonstrate the delta modulation (DM) and demodulation technique.

> SOFTWARE: MATLAB

> THEORY: ① Delta Modulation

- It is a technique used to convert analog-to-digital and digital-to-analog signal.
- In this modulation signal is sent in differential form, the data is encrypted/ transmitted in 1 bit.
- The analog signal is approximated with series of segments and each segment is compared to original analog to determine the change in relative Amplitude.
- Hence, only changes in information is sent and if no change occurs it remains on the same state.
- This is the simplified form of Differential Pulse Code Modulation and also called as 1 bit (2 level) version of DPCM.
- It provides a staircase approximation of over-sampled base-band signal. Here, the difference between the present sample and



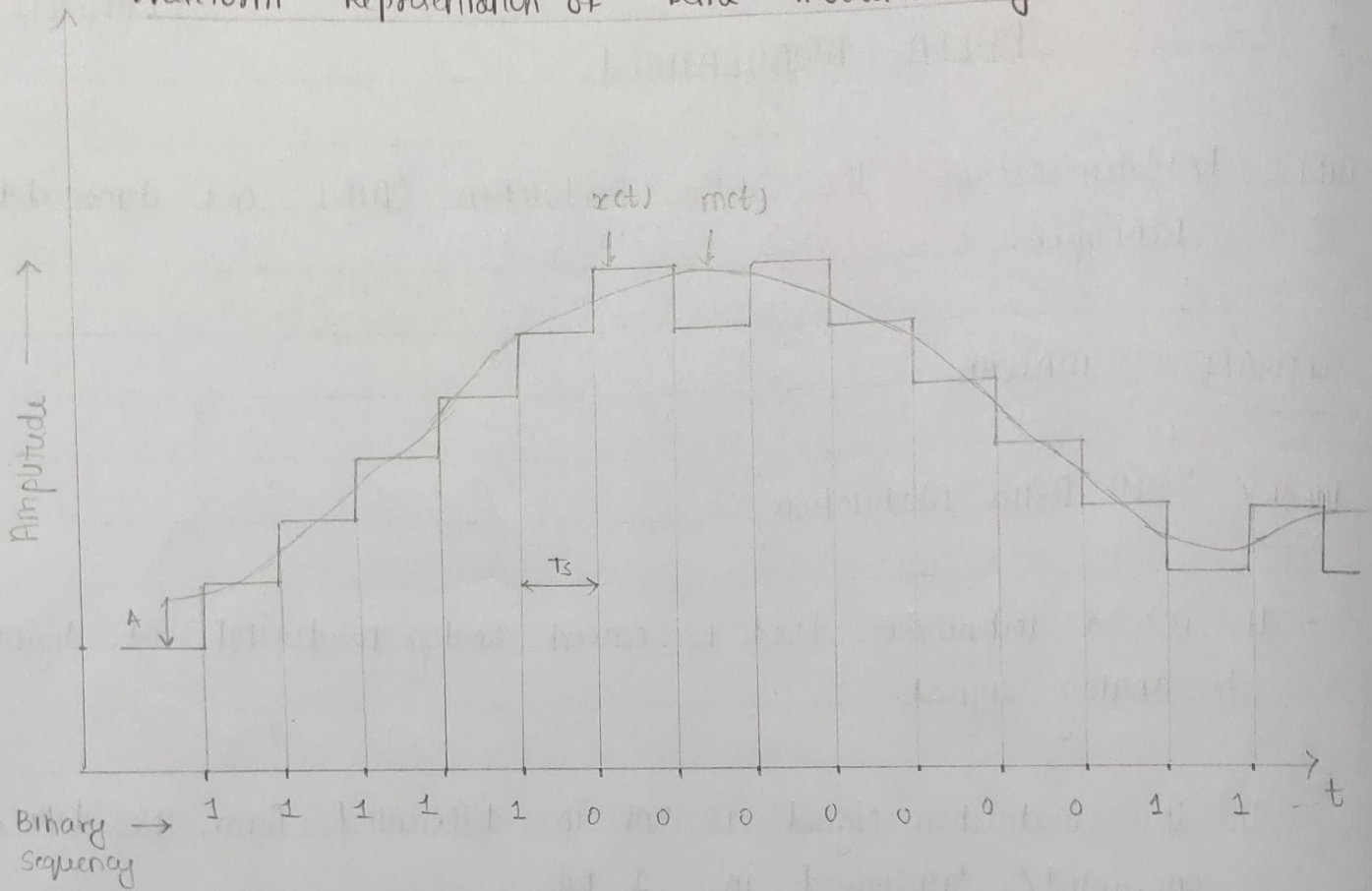
previous approximate sample is quantized into two levels i.e. Δ (delta).

- This is used for voice transmission.

2.7 Operating Principle

- The operating principle of DM is such that, a comparison between present and previously sampled value is performed, the difference of which decides the increment or decrement in the transmitted values.
- When the two sample values are compared, either we get difference having a positive polarity or negative polarity.
- If the difference polarity is positive, then the step of the signal denoted by Δ is increased by 1. As against in case when difference polarity is negative then step of the signal is decreased i.e. reduction in Δ .
- When $+\Delta$ is noticed i.e. increased the step size, then 1 is transmitted, However, in case of $-\Delta$ i.e. decrease in step size, 0 is transmitted.

Waveform Representation of Delta Modulated Signal



3> Advantages of Delta Modulation

- Due to transmission of 1 bit per sample, it permits low channel bandwidth as well as signaling rate.
- ADC is not required. Thus permits easy generation and detection.

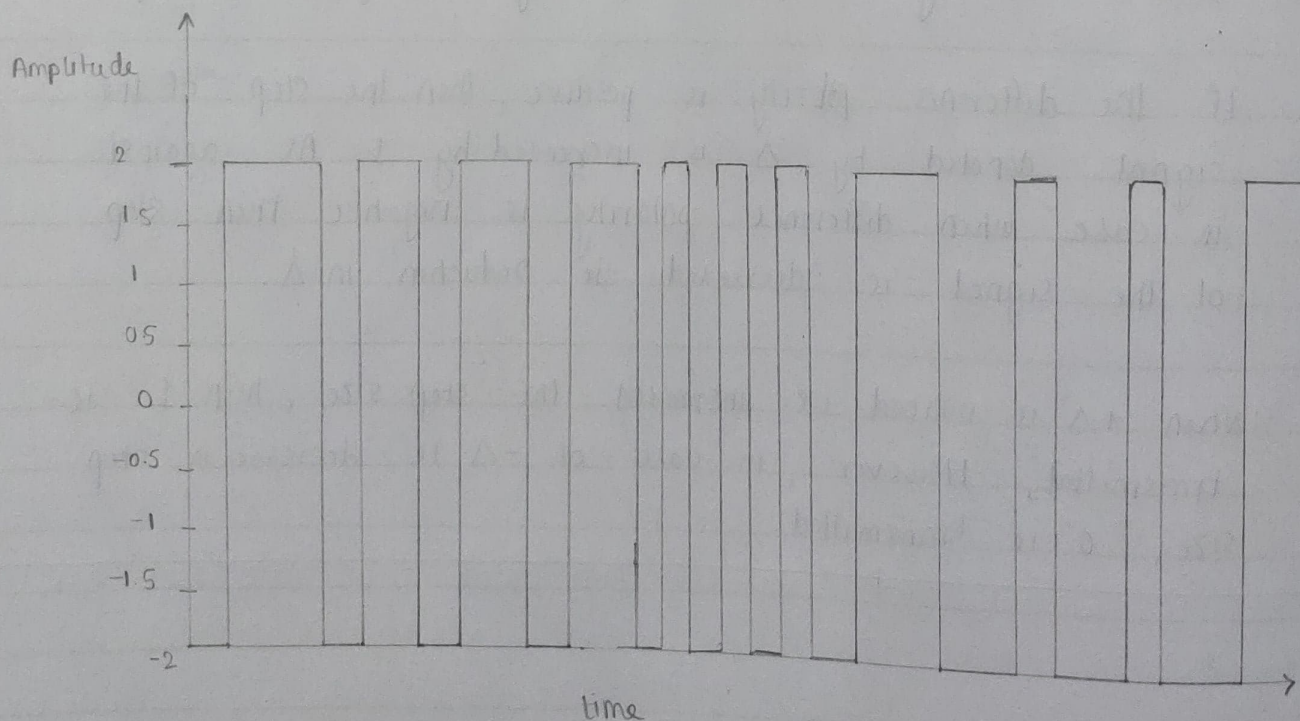
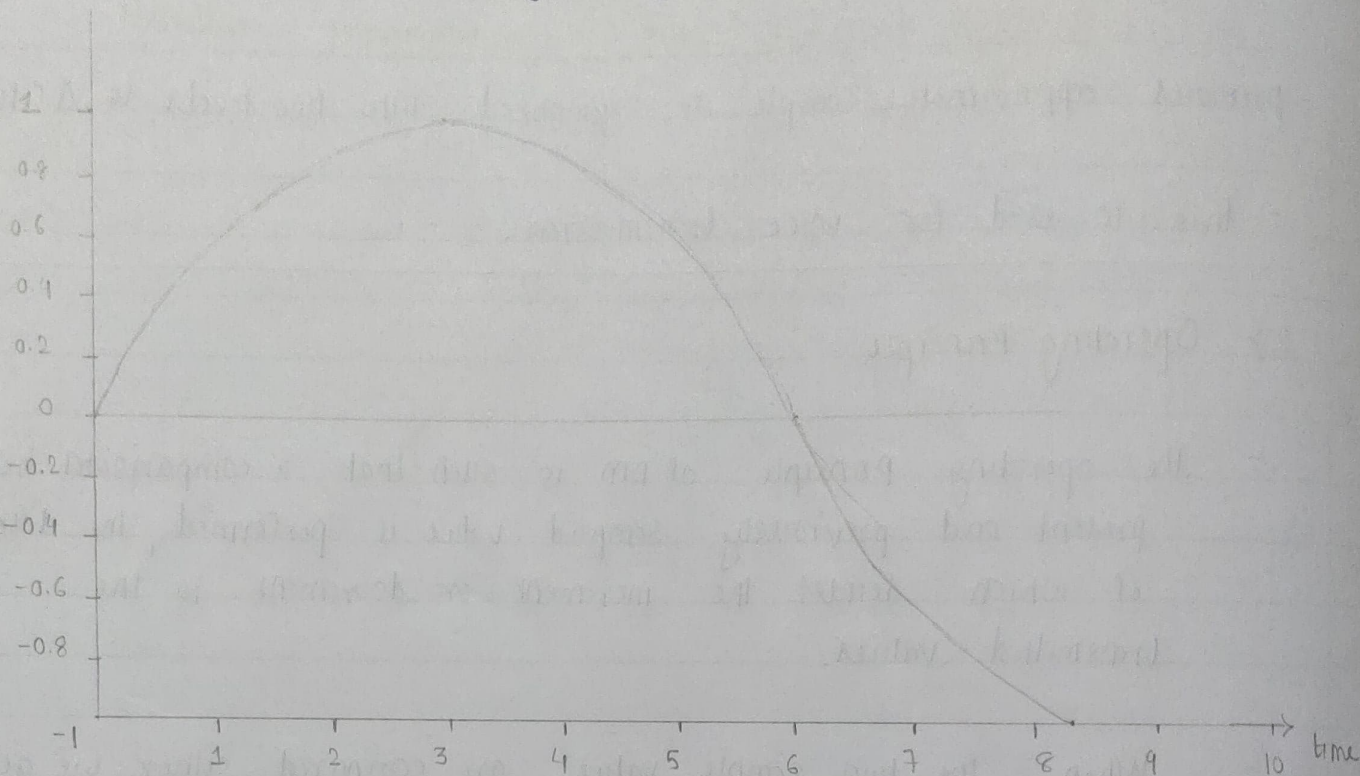
4> Disadvantages of Delta Modulation

- Delta modulation leads to drawbacks such as slope overload distortion (when Δ is small) and granular noise (when Δ is large).

5> Application of Delta Modulation

- It is widely used in radio communication devices and digital voice storage and voice transmission.

original signal



DM output

6) MATLAB CODE:

% Delta Modulation (DM)

predictor = [0 1];

partition = [-1:1:9];

step = 0.2

parthion = [0]

codebook = [-1*step step];

% DM Quantizer

t = [0: pi/20 : 2*pi];

x = 1.1 * sinc(2*pi*0.1*t); % Analog Signal

% Quantize x(t) using DPCM

encoded_x = dpcmenco(x, codebook, partition, predictor);

% Try to recover x from modulated signal

decoded_x = dpcmdeco(encoded_x, codebook, predictor);

% Plots

figure

plot(t, x);

xlabel('time');

title('original signal');

figure

stairs(t, 10 * codebook(encoded_x + 1) * 'g');

xlabel('time');

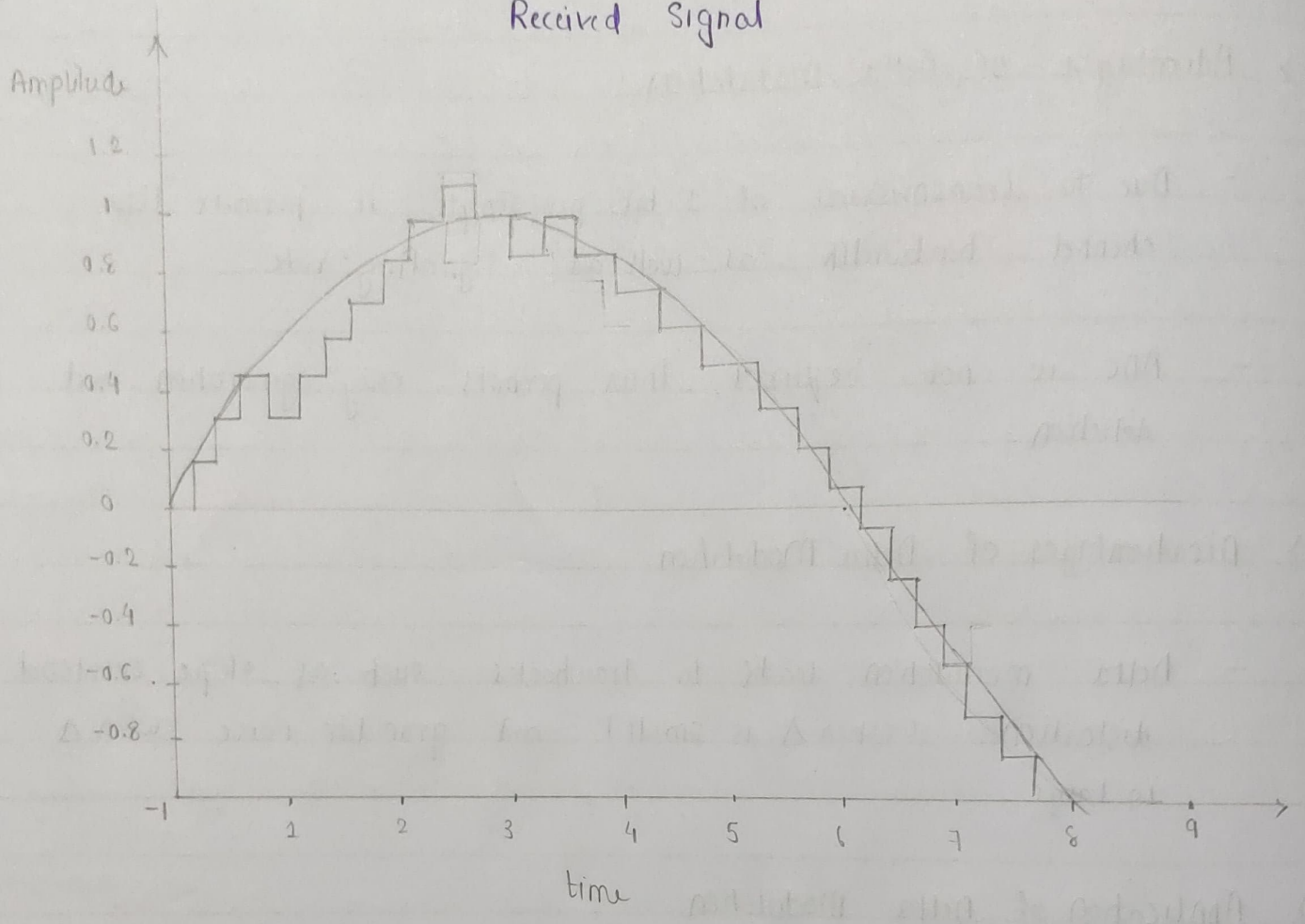
title('DM output');

figure

plot(t, x)

hold;

Received Signal



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stairs ( t, decoded x );  
grid;  
xlabel ('time');  
title ('received signal');
```

7 CONCLUSION: We have successfully understood and demonstrated the delta modulation (DM) and demodulation technique. and also verified it with sampled, quantized / encoded and decoded time domain signal using MATLAB in virtual LAB mode.

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END OF DCOM JOURNAL

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