INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, NAGPUR

Subject: - Digital communication

Enrollment number : BT19ECE010

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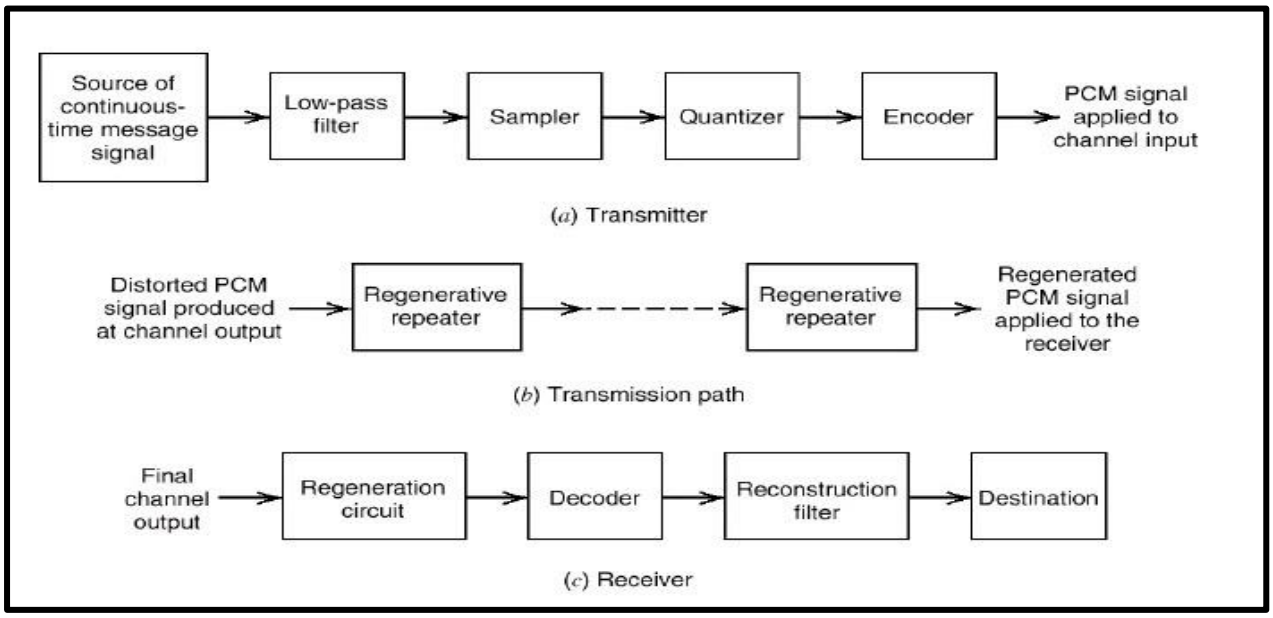
LAB REPORT- 2

Aim : To study transmission and reception of digital signal

Theory :-



Procedure:-

Give analog message signal to analog input pin

Give sampling frequency to board which may be provided by external or internal.

Analog signal is amplified using op-amp amplifier provided within the kit.

We have two option to hold or to pass signal.

Now signal irrespective of order of signal is passed through low pass filter for sampling.

Now we transmit digital signal to receiver kit.

Join receiver pin with the output of sampled pin.

At receiver side we provide sampled frequency equal to the sampled frequency during sampling.

In order to proper signal transmission and reception we connect kit with transmission clock.

We verify the demodulated PCM with the help of digital CRO. From channel pin

Input signal with sampling signal

Code:

```
close all;
clearvars;
n=input('Enter for n-bit PCM system : '); %Entering Bit Length
n1=input('Enter the Sampling Frequency : '); % Entering Sampling Frequency
L = 2^n; %Number of Quantisation Levels
Vmax = 8;
x = 0:pi/n1:4*pi; %Construction of Signal
ActualSignl=Vmax* sin(x); % Its an Actual input
subplot (3,1,1);
plot (ActualSignl);
title('Analog signal');
subplot (3,1,2); %Sampled Version
stem (ActualSignl);grid on; title('Sampled Sinal');
%% Now perform the Quantization Process
Vmin=-Vmax; %Since the signal is sine
SSize=(Vmax-Vmin)/L; % variation between each quantisation level
```

```
QuantizationLevels=Vmin: SSize: Vmax; % Quantisation Levels - For comparison

codebook=Vmin-(SSize/2): SSize: Vmax+ (SSize/2); % Quantisation Values - As Final output of qunatiz

[ind, q]=quantiz (ActualSignl, QuantizationLevels, codebook); % Quantization process

NonZeroInd = find (ind ~= 0);

ind (NonZeroInd) = ind (NonZeroInd) - 1;

BelowVminInd = find (q == Vmin-(SSize/2));

q(BelowVminInd) = Vmin+ (SSize/2);

subplot (3,1,3);

stem (q);grid on; % Display the Quantize values title ('Quantized Signal');

title('Quantised Signal') %% Having Quantised the values, we perform the Encoding Process

figure

TransmittedSig = de2bi(ind,'left-msb'); %Encode the Quantisation Level

SerialCode = reshape(TransmittedSig',[1 size(TransmittedSig,1)*size(TransmittedSig,2)]);

subplot (2,1,1); grid on;

stairs (SerialCode); %Display the SerialCode Bit Stream

axis ([0 100 -2 3]); title('Transmitted Signal');

%% Now we perform the Demodulation of PCM signal

RecievedCode=reshape (SerialCode, n, length (SerialCode) /n); %Again Convert the Serialcode into Frames of 1 Byte

index = bi2de (RecievedCode', 'left-msb');  %Binary to Decimal Conversion 37

q = (SSize*index); %Convert into Voltage Values

q = q + (Vmin+(SSize/2)); % Above step gives a DC shfted version of Actual siganl

subplot(2,1,2); grid on;

plot (q); % Plot Demodulated signal

title ('Demodulated signal');
```

Screenshots:

lab1_DC.m | lab2_DC.m | lab3_DC.m

```
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[ind, q]=quantiz (ActualSignl, QuantizationLevels, codebook);
NonZeroInd = find (ind ~= 0);
ind (NonZeroInd) = ind (NonZeroInd) - 1;
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figure
TransmittedSig = de2bi(ind,'left-msb'); %Encode the Quantisati
SerialCode = reshape(TransmittedSig',[1 size(TransmittedSig,1)
subplot (2,1,1); grid on;
stairs (SerialCode); %Display the SerialCode Bit Stream
axis ([0 100 -2 3]); title('Transmitted Signal');
%% Now we perform the Demodulation of PCM signal
RecievedCode=reshape (SerialCode, n, length (SerialCode) /n);
```
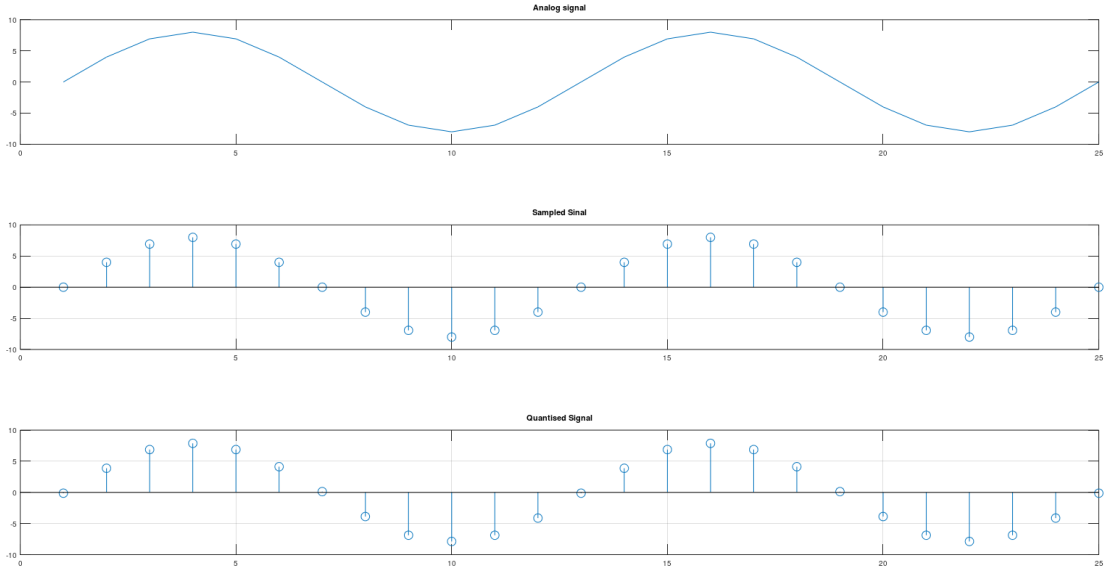
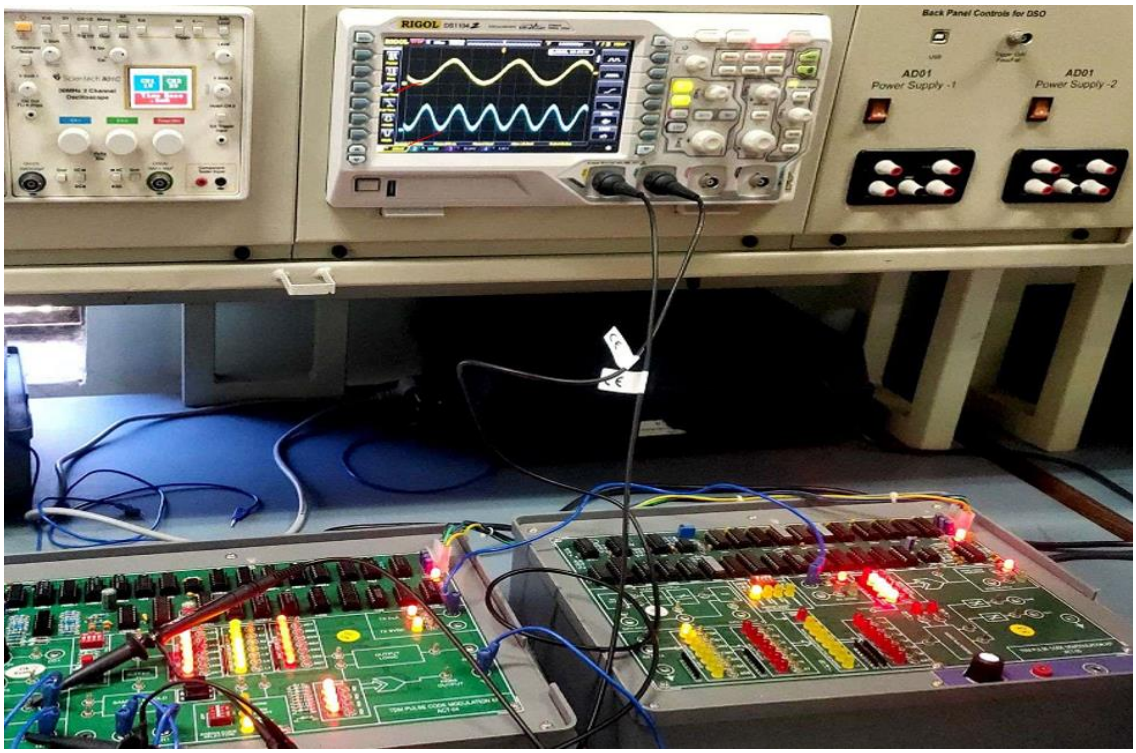
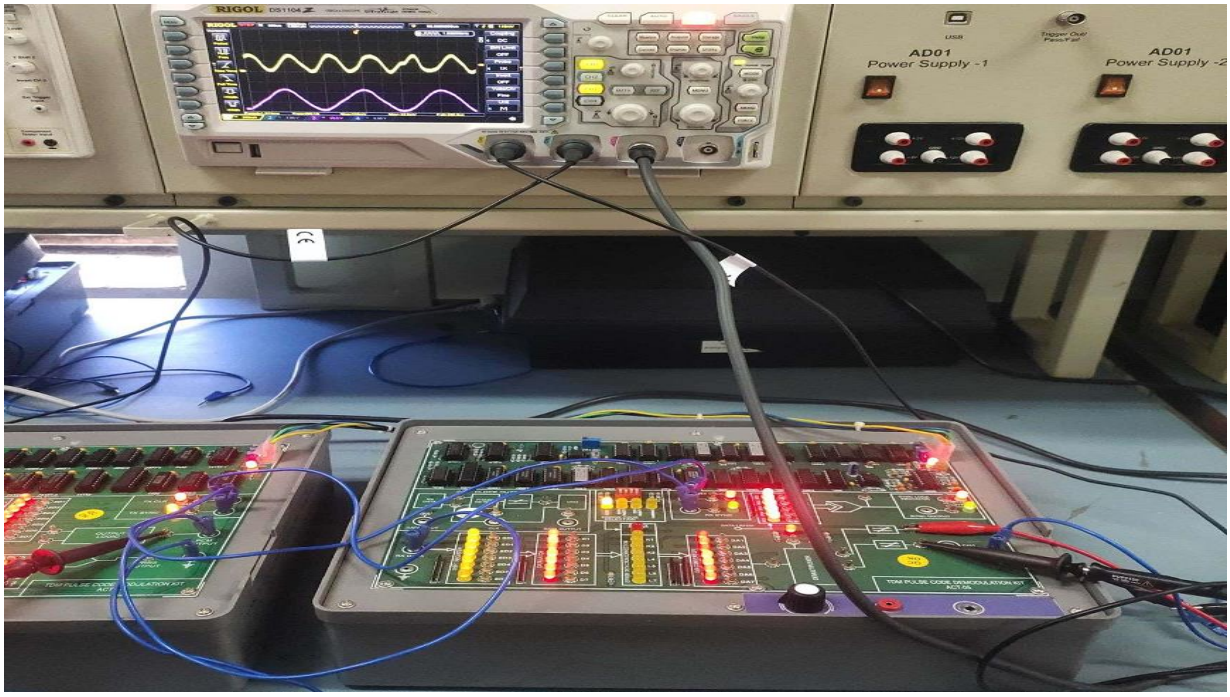

Output:





Comparing message signal with demodulated signal



Result and Discussion :- We successfully transmit and received the output of demodulated digital signal and we verified it with the practical outputs.

Conclusion:- we performed the transmission and reception of digital signal.