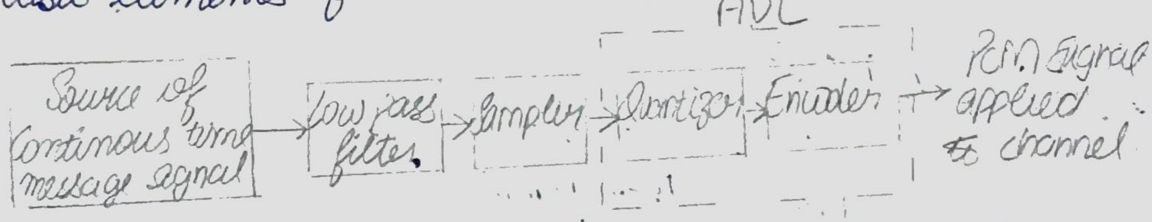
Experiment-2

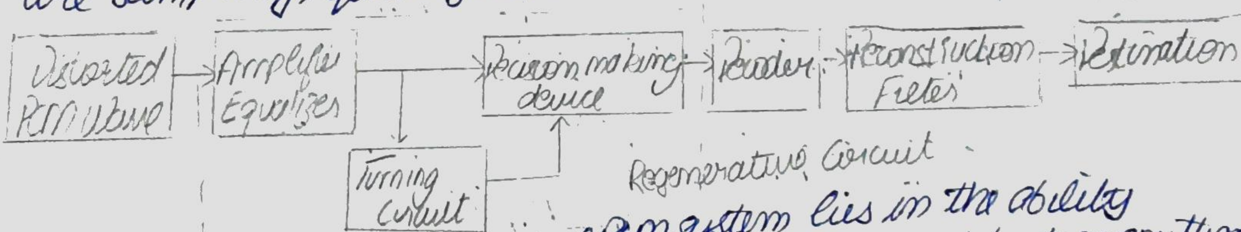
Aim:- To study Pulse Code Modulation (PCM) and Study Probability Error using Matlab/Octave.

Software Used:- Matlab/Octave.

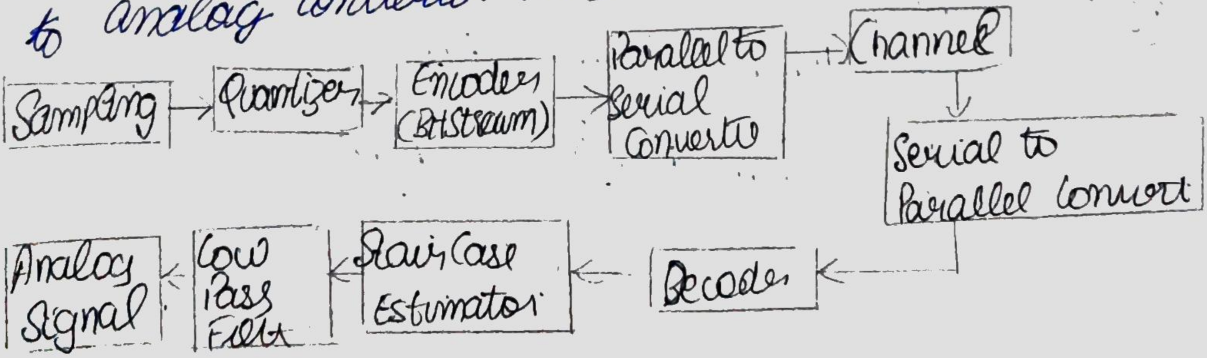
Theory:- Pulse Code Modulation is the process in which the message signal is sampled & the amplitude of each sample is rounded off the nearest one of the finite set of allowable val. The basic elements of a PCM system are as



The essential operation in the transmitter of a PCM system are sampling, quantization & encoding



The most important part of PCM system lies in the ability to control the effects of distortion & noise produced by transmitting a PCM through a channel. The essential operation in the receiver & regenerative of impaired signal, decoding & demodulation of the train of quantized samples. These operations are usually performed in the same circuit which is a digital to analog convertor (DAC).



Transmission of Bandwidth:

$L = 2^n$; 'n' no: of binary bits

$f_s \geq 2f_m$

BW needed in PCM is 1/2 of signalling rate

$$BW = \frac{1}{2} n f_s$$

$$\boxed{BW = n f_m}$$

Quantization Noise:

$$\frac{S}{N_q} = \frac{12 P_s}{\left(\frac{m_{max} - m_{min}}{L}\right)^2}$$

Case 1: m(t) is a sinusoid

$m_{max} = m_{min} = A_m$; $P_s = \frac{A_m^2}{2}$

$$\frac{S}{N_q} = \frac{12 A_m^2}{2} \times \frac{2^{2n}}{A_m - (A_m)^2} = \frac{3}{2} 2^{2n}$$

$$\left(\frac{S}{N_q}\right)_{dB} = 10 \log_{10} \frac{3}{2} 2^{2n} = 6.02n + 1.8\, dB$$

Case 2: m(t) is uniform RV with zero mean

$m_{max} = -m_{min} = A_m$

$$P_s = \frac{(A_m - (A_m))^2}{12} = \frac{A_m^2}{3}$$