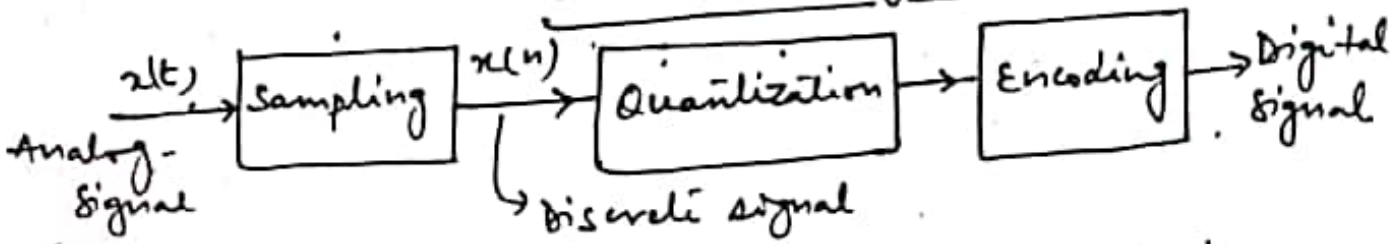
Unit-4

* [Unit-4 & Unit-5] both units are the part of digital communication.
* Almost all natural signals are analog (or continuous) signal, so for digital communication, we have to first convert analog signal to discrete signal and then to digital signal.

Basic Block diagram:



* Sampling process is the most important part in digital communication.

* Sampling Theorem—

Sampling of the signals is the fundamental operation in signal-processing. A continuous time signal is first converted to discrete-time signal by sampling process. The sufficient number of samples of the signal must be taken so that the original signal is represented in its samples completely. Also, noted that it shall be possible to recover or reconstruct the original signal completely from its samples. The number of samples to be taken depends on maximum signal frequency present in the signal.

The statement of sampling theorem is —

" A continuous-time signal may be completely represented in its samples and recovered back if the sampling frequency is $[f_s \geq 2f_m]$. Here f_s is the sampling frequency & f_m is the max. frequency present in the signal".

Note - " Sampling frequency (f_s) should not be less than ~~or equal~~ to $2f_m$. Since in this case, the successive cycles of the sampled spectrum will overlap each other & hence in this case, the original spectrum or original signal cannot be extracted out or recovered back".

** Nyquist Rate & Nyquist Interval —

When the sampling rate becomes exactly equal to $2f_m$ samples per second, then it is called Nyquist rate. Nyquist rate is also called the minimum sampling rate. It is given by — $f_s = 2f_m$ — (1)

Similarly, max. sampling ~~interval~~ interval is called Nyquist interval.

$$\therefore \text{Nyquist Interval } (T_s) = \frac{1}{2f_m} \text{ seconds.} \quad — (2)$$