ecture-2

Data and Signals

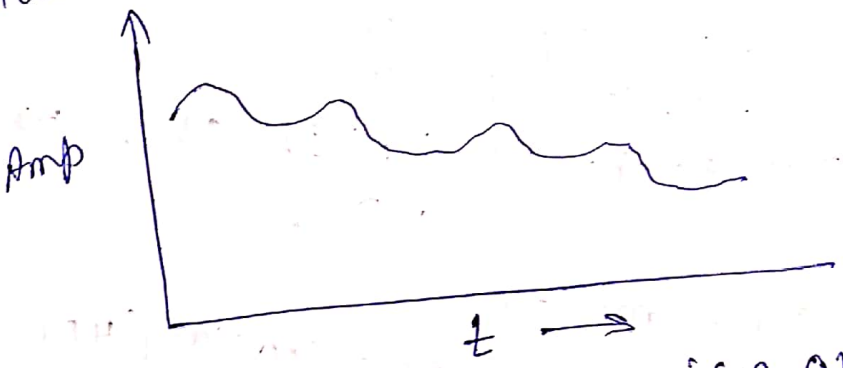
Data :-

Data is an entity that conveys some meaning based on some mutually agreed up rules/conventions between a sender and a receiver

Data types

- Data can be Analog and Digital.

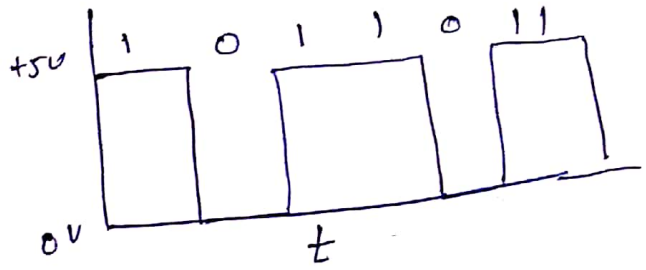
Analog data - Analog Data have continous values over time



Example of Analog Data :- voice and video

Digital Data

Digital Data takes on discrete values.



Example

- text or character string
- Data stored in memory say CD, have two discrete values.

Signals and Signal types

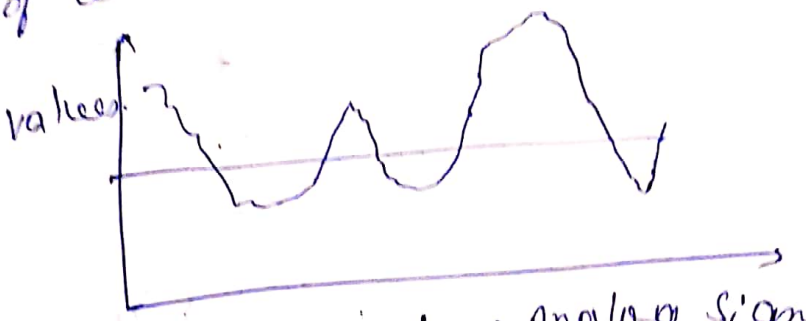
- It is electric, electronic or optical representation of data, which can be sent over a communication media.

Signal types - Analog and Digital

Analog signal has continuous (infinite no. of) values over a period of time.

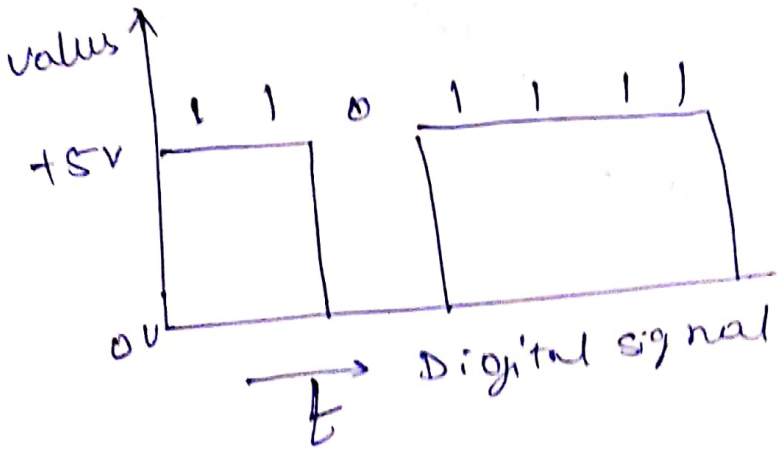
Analog signal examples

- A microphone converts voice data into voice signal, which can be sent over a pair of wire.



Digital signal

Digital signals can have only a limited no. of defined values, usually two values 0 and 1.

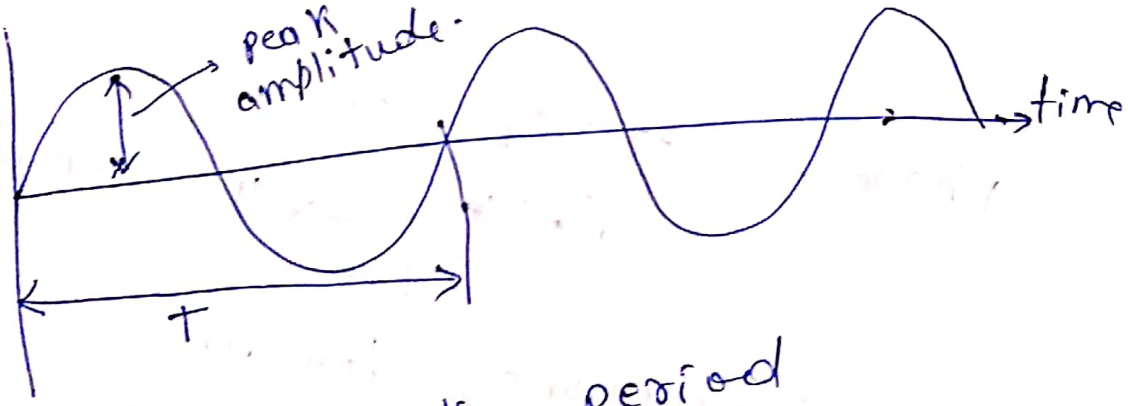


- Analog signals can be classified as simple and composite.
- Example of a simple analog signal is a Sine wave.
- A composite analog signal consists of a combination of multiple simple signals.

- Simple Analog signals are periodic in nature.

Periodic signal

- A signal is periodic if $s(t+T) = s(t)$; for $-\infty < t < \infty$, where T is the time period.
- A periodic signal is characterized by the following three parameters - Amplitude, frequency and phase.



T = time period

$f = 1/T$ frequency.

Amplitude :- value of signal at different instants of time, measured in volts.

frequency :- It is inverse of the time period, it is measured in Hertz.

Phase:- It gives a measure of the relative position of two signals in the time, expressed in degree or radiant

Units of parameters

Amplitude : volts mV = 10^{-3} V
KV = 10^{3} V

frequency :- HZ, KHZ = 10^{3} HZ
MHZ = 10^{6} HZ
GHHZ = 10^{9} HZ
T HZ = 10^{12} HZ

time Period:- S, ms = 10^{-3} s
µs = 10^{-6} s
ns = 10^{-9} s
ps = 10^{-12} s

Phase :- 360° = 2π
45° = $\frac{2\pi}{360}$ x 45 Radian

time and frequency domain

- An electromagnetic signal is commonly a composite signal made up of many frequencies.
- According to fourier analysis, any composite signal can be expressed as a combination of simple sine waves with different

amplitudes frequencies and phases.

$$s(t) = A_1 \sin(2\pi f_1 t + \phi_1) + A_2 \sin(2\pi f_2 t + \phi_2) + \cdots$$