NAME

ROLL NO.

SUBJECT

STREAM

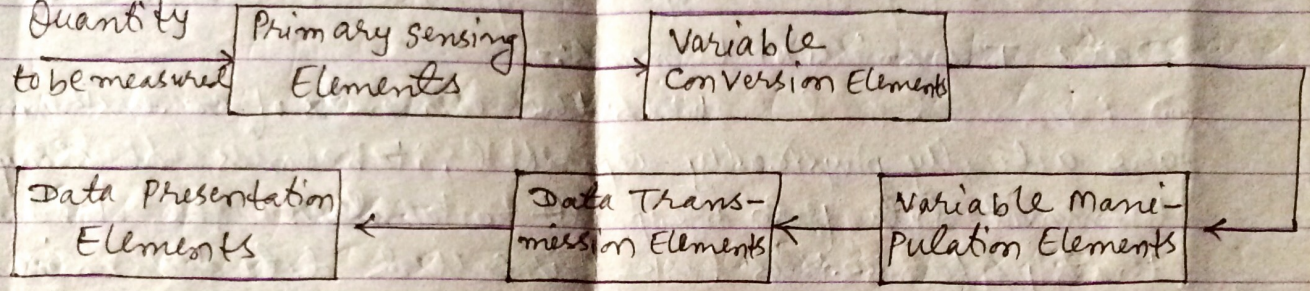
Bhattarai ①

ELE 221.3 Instrumentation (3-2-2)

Chapter - 1

Introduction to Instrumentation System (3hrs):-

Imp. Generalized Block Diagram of Instrumentation System:-



Primary Sensing Elements:-

The quantity under measurement makes its first contact with the primary sensing element, called as transducer. A transducer is a device which converts a physical (non electrical) quantity into an electrical quantity. Eg. Microphone, LDR etc.

Variable Conversion Elements:-

The output of the primary sensing elements may be electrical signal of any forms. It may be voltage or current or other electrical parameters. Sometime, this input is not suited to the system. For digital system, this analog signal will have to be converted into digital form. For example: ADC (Analog to Digital converter).

Variable Manipulation Elements:-

The function of this element is to

manipulate the signal present to it preserving the original nature of the signal. manipulation here means only a change in numerical values of the signal. Eg. Electronic Amplifier, which accepts a small voltage signal and produces an output signal of greater magnitude.

Data Transmission Elements:-

When the elements of an instrument are actually physically separated, it becomes necessary to transmit data from one point to another. The element that performs this task is called data transmission lines. For example, space crafts are physically separated from the earth station where the control stations guiding their moments are located. Therefore, control signals are sent from these stations to space craft by telemetry systems using radio signals.

Data Presentation Elements:-

The information about the quantity being measured should be displayed appropriately for monitoring, control and analysis purposes. In this case, data to be monitored needs visical devices. Eg. Ammeter, Voltmeter, LCD Display etc.

Imp

Signal and its types in Instrumentation:-

Signal:-

→ Something that passes information.
→ that can be represented as a function of one or more independent variables.

Eg. Speech signal can be represented by acoustic pressure as a function of time.

A picture can be represented by brightness as a function of two spatial variables (Co-ordinates).

Types of signals:-

① continuous time and Discrete time signals:-

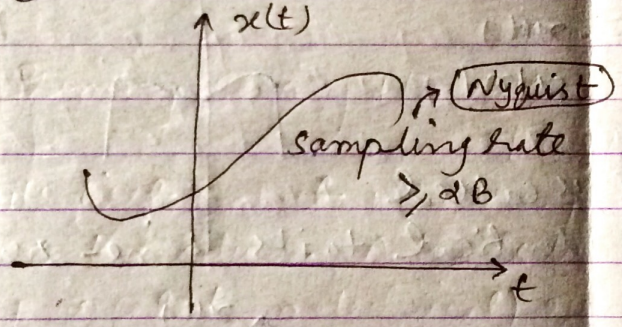


Fig. Continuous time signal

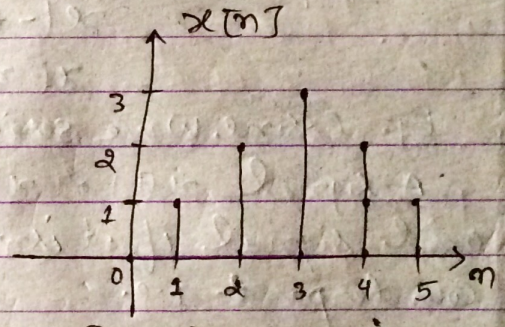


Fig. Discrete time signal

In continuous time signal, the independent variable (time) is continuous, thus the signal is specified for every values of the independent variable. It is denoted by $x(t)$, $g(t)$, $y(t)$.

The discrete time signal is defined only for discrete values of time. It is represented by $x[n]$, $g[n]$, $y[n]$.

② Deterministic and Random signal:-

Signal about which there is no uncertainty with respect to its value at any time and can be represented by explicit mathematical expressions is called deter-

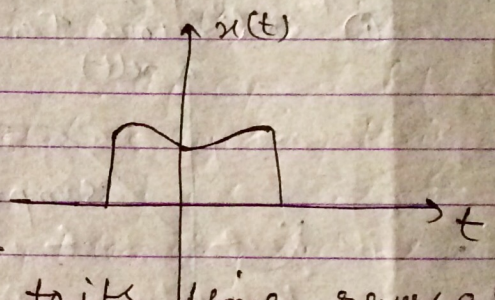
ministic signal. Eg. $x(t) = 5\cos 10t$.

Signal about which there is uncertainity before its actual occurance and therefore cannot be expressed in the form of exact mathematical expression is called random signal. Eg. Noise signal which can be analyse by probability theary and statistical technique.

(iii) Even and Odd signals:-

A signal $x(t)$ or $x[n]$ is called even (symmetric) signal if it is identical to its time-reversed counterpart i.e.

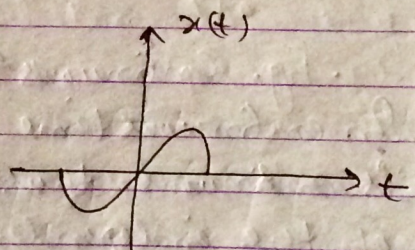
$$x(-t) = x(t)$$
$$x[-n] = x[n]$$



Eg. Cosine wave series.

A signal $x(t)$ or $x[n]$ is called odd signal if it isn't identical to its time-reversed counterpart i.e.

$$x(-t) = -x(t)$$
$$x[-n] = -x[n]$$



Eg. Sine wave series.

(iv) Energy and Power signals:-

A signal with finite energy is called energy signal. A signal is called energy signal if and only if

$$0 < E_x < \infty$$

where

$$E_x = \int_{-\infty}^{\infty} x^2(t)\,dt$$ is the energy of the signal $x(t)$.