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Department of Biomedical Engineering

Vision Tit 2 Vision Title 3

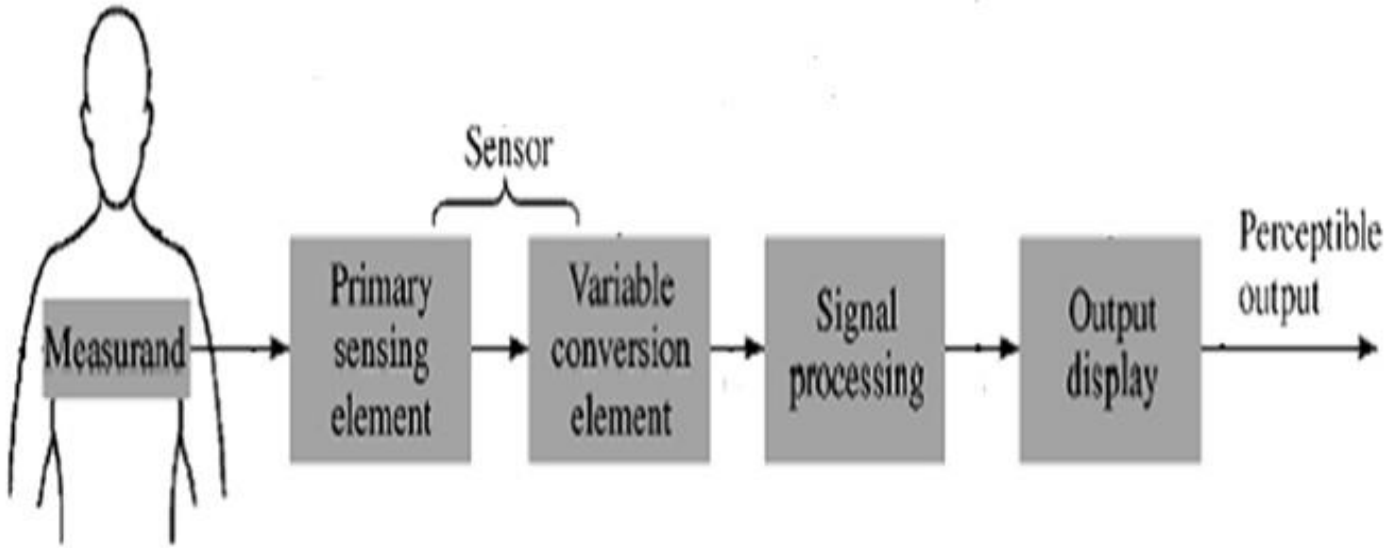
Course Name: 23BMT204 – Biomedical Instrumentation

III Year : V Semester

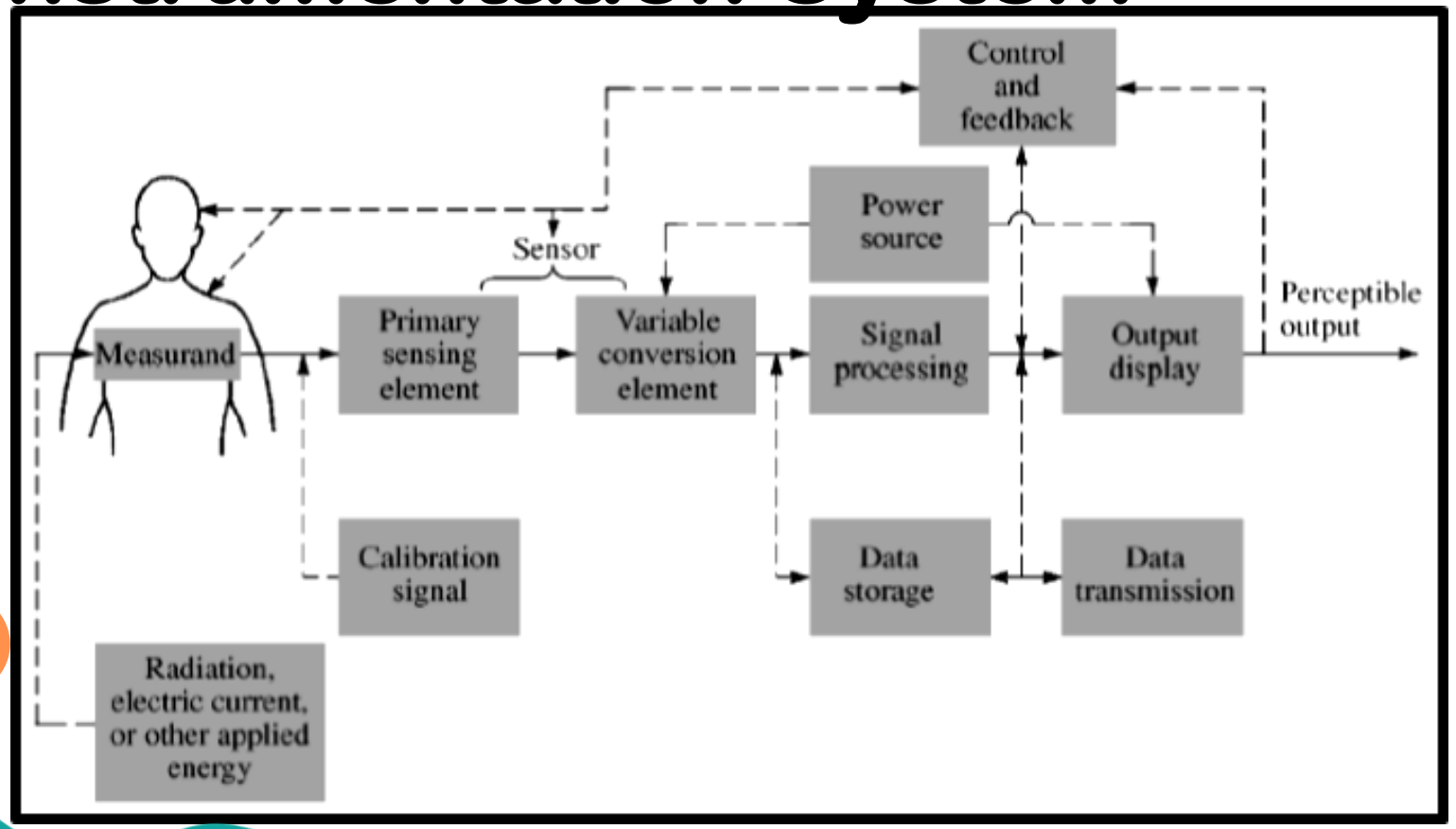
UNIT 1- FUNDAMENTALS OF MEDICAL INSTRUMENTS

Topic : Basic Instrumentation System

Basic Instrumentation System



Generalized Medical instrumentation System



Components of Medical Instrumentation System

- Measurand
- Sensor / Transducer
- Signal Conditioning
- Output Display
- Auxiliary Components

Measurand

- The physical quantity, property, or condition that the system measures is called measurand.
- The accessibility of the measurand is important because it may be:
  - Internal (Blood Pressure)
  - On the Body Surface (Electrocardiogram)
  - Emanate from the body (Infrared Radiation)
  - Derived from Tissue Sample (such as Blood or a Biopsy)

Cont…

- Most medically important measurands can be grouped in the following groups:
  - Biopotential,
  - Pressure,
  - Flow,
  - Dimensions (Imaging),
  - Displacement (Velocity, Acceleration, And Force),
  - Impedance,
  - Temperature, And
  - Chemical Concentrations
- The measurand may be localized to a specific organ or anatomical structure.

Sensor

- The **transducer** is defined as a device that converts one form of energy to another.
- A **sensor** converts a physical measurand to an electric output.
- The sensor should respond only to the form of energy present in the measurand, to the exclusion of all others.
- The sensor should non invasive and minimally invasive

Signal Conditioning

- Simple signal conditioners may only amplify and filter the signal or merely match the impedance of the sensor to the display.
- Often sensor outputs are converted to digital form and then processed by specialized digital circuits or a microcomputer.
- For example, signal filtering may reduce undesirable sensor signals.
- It may also average repetitive signals to reduce noise, or it may convert information from the time domain to the frequency domain.

Output Display

- The results of the measurement process must be displayed in a form that the human operator can perceive.
- The best form for the display may be:
  - Numerical
  - Graphical,
  - Discrete or Continuous,
  - Permanent or Temporary
  - Visual / Hearing

Auxiliary Components

- A **calibration signal** with the properties of the measurand should be applied to the sensor input or as early in the signal-processing chain as possible.
- Many forms of **control** and **feedback** may be required to elicit the measurand, to adjust the sensor and signal conditioner, and to direct the flow of output for **display**, **storage** or **transmission.**
- The **control** and **feedback** may be **automatic** or **manual** .

Cont...

- Data may be **stored** briefly to meet requirements of signal conditioning or to enable operator to examine the data that precede alarm conditions. Or data may be **stored** before signal conditioning, so that different processing schemes can be utilized.
- Conventional **principles of communication** can often be used to **transmit data** to remote displays at nurses' stations, medical centers, or medical data-processing facilities.