

Vidyalankar

S.E. Sem. IV [BIOM]
Transducers in Biomedical Instrumentation

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks

Oral : 25 Marks

Term Work : 25 Marks

- 1. Generalized Instrumentation System, General Properties of Input Transducer**
Static characteristics : Accuracy, Precision, Resolution, Reproducibility, Sensitivity, Drift, Hysteresis, Linearity, Input Impedance and Output Impedance.
Dynamic characteristics : First Order and Second Order characteristics, Time Delay, Error Free Instrument, Transfer Functions. Design Criteria, Generalized Instrument Specifications.
- 2. Displacement and Pressure Measurement : (with applications)**
Resistive: Potentiometers, Strain Gauges and Bridge Circuits. Inductive: Variable Inductance and LVDT. Capacitive type, Piezoelectric Transducers. Types of Diaphragms, Bellows, Bourdon Tubes.
- 3. Temperature Measurement :**
Thermistor, Thermocouple, Resistive Temperature Detector, IC based Temperature Measurement.
- 4. Electro chemistry and Biopotential Electrodes :**
Electrodes Electrolyte Interface, Half-Cell Potential, Polarization, Polarizable and Non Polarizable, Electrodes, Calomel Electrode, Electrode Circuit Model, Electrode Skin -Interface and Motion Artifact. Body Surface Electrodes. Internal Electrodes: Needle and Wire Electrodes (Different Types). Microelectrodes: Metal, Supported Metal Micropipette (Metal Filled Glass And Glass Micropipette Electrodes)
- 5. Chemical Sensors :**
Blood gas and Acid-Base Physiology Potentiometric Sensors, Ion Selective Electrodes, ISFETS. Amperometric Sensors, Clark Electrode with examples – pH, pO₂, pCO₂ Electrodes, Transcutaneous Arterial Oxygen Tension, Carbon Dioxide measurements: capnostat, electrolyte sensors, O₂ cell.
- 6. Biosensor :**
Classifications: Biological phenomenon, transduction phenomenon i.e. Enzyme sensor and Electrode based: affinity sensors (Catalytic Biosensors), Two examples of each biosensors and Immunosensors.
- 7. Fiber optic sensor :**
Design Principles in fabrication of fiber optic sensors – Temperature, Chemical, Pressure.
- 8. Radiation Sensors and Applications**

References :

1. Medical Instrumentation-Application and Design (*John G. Webster*)
2. Transducers for Biomedical Measurements : Principles and Applications (*Richard S.C. Cobbold, John Wiley & Sons*) 1974
3. Biomedical sensors – fundamentals and application (*Harry N. Norton*)
4. Principles of applied Biomedical Instrumentation (*La Geddes and L.E. Baker*)
5. Instrument Transducer – An Intro to their performance and design (*Hermann K.P. Neubert*)
6. Biomedical Instrumentation and measurement (*Leslie Cromwell, Fred J. Weibell and Pfeiffer*)
7. Principles of Biomedical Instrumentation and Measurement (*Richard Aston*) Merrill Publishing Co., Columbus, 1990.
8. Measurement Systems, Application and Design (*Ernest O. Doebelin*) McGraw-Hill, 1985
9. Handbook of Modern Sensors – Physics, Design and Application (*Jacob Fraden*) AIP press.

