GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: V

Bio-Medical Engineering

Subject Name: **Biomedical Transducers**
Subject Code: **150302**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Internal Assessment (I)**
3	0	2	5	70	30	50

Sr. No	Course content
1.	**Generalised Instrumentation Scheme:** Transducers and their Static and Dynamic performance characteristics. Electrical Design Consideration
2.	**Transduction Principles:** Resistive, Inductive and Capacitive Transduction; Photoconductive and Photo voltaic Transduction. Fibre Optic Sensor. Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. LVDT- construction, sensitivity, merits etc. Capacitive Transducer- variable seperation, variable area and variable dielectric type; merits and demerits. Piezoelectric Transducer: piezo crystals- output equation, mode of operation, merits and demerits.
3.	**Temperature Transducers:** Thermo resistive transducer- RTD and Thermister; Thermo emf Transducer- thermo couples; Non contact type infrared thermometry; optical pyrometer. Thermister used for cardiac output measurement, nasal air flow measurement.
4.	**Pressure Transducers:** Extra vascular and Intra vascular pressure sensors; Strain Gauge type Blood pressure transducers; Diaphragm type capacitive pressure transducer; Piezo electric pressure transducer; Intra vascular fibre optic pressure transducer; Fibre optic pressure transducer for intracranial pressure measurement in new borns; Tonometry; Stethoscopes; Phonocardiograph sensor.
5.	**Flow Transducers:** Electromagnetic Blood flow transducer; Elasto resistive plethysmographic transducer; Air flow transducer for Fleish pneumotachometer; Ultrasonic flow transducer.
6.	**Displacement Transducers:** LVDT and resistive potentiometric transducers for translational and angular displacement measurement; Strain gauge displacement transducer; capacitive and displacement transducer for respiration sensing.
7.	**Nuclear Radiation Transducers:** Ionization transducer- GM counter; Scintillation transducer- Scintillation counter.

8.	**Bioanalytical Sensors:** Enzyme based glucose sensor; Microbial biosensor for ammonia and nitrogen dioxide; optical biosensor for antibody-antigen detection. Blood-gas sensors- Polarographic clark PO2 sensor; Transcutaneous PO2 sensor, PCO2 electrode, SO2 sensor of pulse oximeter.
9.	**Biopotential Measurement:** Electrode-Electrolyte interface, half cell potential, Polarization- polarizable and non-polarizable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body Surface recording electrodes for ECG, EMG, EEG and EOG. Electrodes standards. Internal Electrodes- needle and wire electrodes. Micro electrodes- metal microelectrodes, micropippet electrodes. Electrical properties of micro electrodes. Electrodes for electric simulation of tissue; Methods of use of electrodes.
10.	**Introduction to smart sensors, MEMS and Nano Sensors.**

Reference Books:

1. Biomedical Sensors- Fundamentals and applications. By- Harry.N. Norton.
2. Transducers for Biomedical measurements. (Principles and Applications.) By- Richard S.C. Cobbold.
3 Medical Instrumentation application and design. By- John G. Webster.
4. Principles of Applied Biomedical Instrumentation By- Geddes,L.A and Baker,L.E
5. Bio-Sensors. By-Hall, E.A.H.
6. Biomedical Transducers and Instruments (CRC Press) By- Tatsoo Togawa., Toshiyo Tamura, P. Ake Oberg.
7. Biomedical transducers: by H. T Kashipara, Akshat Pub.