

## 4/4 B.Tech - SEVENTH SEMESTER

EC7T4D

Bio Medical Instrumentation

Credits: 4

Lecture : 4 periods/week

Tutorial: 1 period /week

Internal assessment: 30 marks

Semester end examination: 70 marks -----

### Course Objectives:

- To the basics of Electro-physiology and its measurements, non-electrical parameters related to various systems of human body and their measurements.
- Electrodes and Transducers used in bio signal acquisition.
- Various Medical Imaging techniques used for diagnosis along with other diagnostic and therapeutic devices

### Learning Outcomes:

- Students will be able to understand the Origin of Bioelectric potential and their measurements using appropriate electrodes and Transducers.
- Students will be able to understand the Electro-physiology of various systems and recording of the bioelectric signals
- Students will be able to understand the working principles of various Imaging techniques
- Students will be able to understand the design aspects of various Assist and Therapeutic Devices

### UNIT- I

**Bioelectric Potentials, Electrodes and Transducers:** Sources of Bioelectric potentials - Resting and action potential - Propagation of Action potential Electrode theory- Equivalent circuit- Types of electrodes.

### UNIT- II

**Physiological Transducers:** Inductive, Capacitive, Piezoelectric transducers and Thermistors, Biochemical Transducers- pH, pCO<sub>2</sub> and pO<sub>2</sub> electrodes.

### UNIT- III

**Electrophysiological Measurements:** Electrophysiology of Heart, Nervous system and Muscle activity. Bio-signals: ECG - EEG, Evoked potential - EMG- ERG- Electrodes and lead system, typical waveforms and signal characteristics. Signal Conditioning circuits: Design of low noise medical amplifier, Isolation amplifier, Protection circuits and Electrical safety.

### UNIT- IV

**Non-Electrical Parameter Measurements:** Measurement of blood pressure, blood flow, Plethysmography, Cardiac Output, Heart Sounds- Lung volumes and their measurements- Auto analyzer - Blood cell counters, Oxygen saturation of Blood.

### UNIT- V

**Medical Imaging Techniques - I:** X-Ray Machine - Computer Tomography - Angiography - Ultrasonography - Magnetic Resonance Imaging System.

## **UNIT- VI**

**Medical Imaging Techniques – II :** Nuclear imaging techniques - Thermography - Lasers in Medicine - Endoscopy.

## **UNIT- VII**

**Bio-Telemetry:** Bio telemetry - Elements and design of Bio telemetry system- Radio Telemetry Systems- Problems in implant telemetry-Uses Bio-Telemetry.

## **UNIT- VIII**

**Assist And Therapeutic Devices:** Cardiac pacemakers - Defibrillators - Artificial heart valves - Artificial Heart Lung machine - Artificial Kidney - Nerve and Muscle Stimulators - Respiratory therapy equipment - Patient Monitoring System.

### **Learning Resources**

#### **Text Books:**

1. Biomedical Instrumentation and Measurement, Leslie Cromwell, Fred J. Weibell and Erich A. Pfeifer., 2<sup>nd</sup> Edition, Pearson Education. 2006
2. Biomedical Instrumentation, M. Arumugam Anuradha Agencies Publications, 2<sup>nd</sup> Edition, 1997

#### **References:**

1. Handbook of Biomedical Instrumentation, R.S. Khandpur Tata McGraw Hill, 2<sup>nd</sup> Edition,. 2006
2. Medical Instrumentation Application and Design, John G. Webster, Wiley India, 3<sup>rd</sup> Edition, 2007