

## **EI8073 BIOMEDICAL INSTRUMENTATION**

### DETAILED SYLLABUS

#### **OBJECTIVES:**

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

#### **UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING**

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems - Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

#### **UNIT II NON-ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES**

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO<sub>2</sub>, pO<sub>2</sub>, finger-tip oxymeter - ESR, GSR measurements.

#### **UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS**

Electrodes – Limb electrodes –floating electrodes – pregelled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

#### **UNIT IV IMAGING MODALITIES AND ANALYSIS**

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging – Imaging application in Biometric systems.

#### **UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system – Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

#### **TEXT BOOKS:**

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2<sup>nd</sup> edition, 2003

3. Joseph J Carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th edition, 2012

### **REFERENCES**

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.

2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.

3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.

4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.

5. M. Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.