

**Biomedical Instrumentation**

**EC704C**

**Contacts: 3L**

**Credits: 3**

**Module -1 (Fundamentals)**

1.1 Introduction to Physiological Systems –Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinial, Nervous, Muscular, Cellular [2]

1.2 Biological Signals – Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials. [2]

1.3 Fundamentals of Electrophysiology –EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals [2]

**Module 2 (Measurement & Analysis )**

2.1 Biological Sensors- Bio-electrodes, Biosensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. [3]

2.2 Biological Amplifiers –Instrumentation Amplifiers for Electrophysiology ( ECG, EMG, EEG, EOG), Filters, Power Supplies. [3]

2.3 Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution [2]

2.4 Hospital requirements – Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators. [2]

**Module - 3 (Life-Support & Treatment)**

3.1 Cardiac Support: Implantable & programmable Pacemakers, External & Internal Defibrillators, Coronary Angiography. [2]

3.2 Electro-physiotherapy : Shortwave & ultrasonic diathermy, Transcutaneous Nerve Stimulators in pain relief, Traction Systems, Ultrasound in bone fracture regeneration, hypothermia & hyperthermia systems. [3]

3.3 Lasers in treatment and surgery : Ophthalmic, Ablators, Endoscopic [2]

3.4 Assists and Artificial limbs- Orthoses , passive and powered Prostheses [2]

**Module-4 (Imaging)**

4.1 Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. [3]

4.2 Computer Tomography, Image Processing, solid state sensors, whole-body scans. [3]

4.3 Gamma camera & radio- isotope imaging. [1]

4.5 Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler & Colour Doppler [3]

4.6 Fundamentals of Magnetic Resonance Imaging and PET - scans [2]

**Text Books:-**

1. R S Khandpur:- Handbook of Biomedical Instrumentation (Tata –Mcgraw Hill Education)

2. M E Valentiniuzzi:- Understanding the Human Machine- A Primer for Bioengineering (World Scientific Publishing Co. Pte. Ltd, Singapore)

3. L Cornwell, F.J. Weibell & E.A. Pfeiffer:- Biomedical Instrumentation and Measurements(Prentice Hall/ Medical)

4. J G Webster & J W. Clark:- Medical Instrumentation – Application & Design (Houghton Mifflin Pub)

5. J J Carr & JM Brown:- Introduction to Bio-medical Equipment Technology(Regents / Prentice Hall)

6. J Tompkins & J G Webster :-Design of Micro- controller based Medical Instrumentation (Prentice Hall Inc)

**Reference Books:**

1. W.B. Blesser :- A systems approach to Biomedicine (McGraw Hill.,NY)
2. J H U Brown, J E Jacobs & L Stark:- Biomedical Engineering (Davis Co, Philadelphia, USA)
3. L A Geddes & L E Baker :- Principles of Applied Biomedical Instrumentation (John Wiley & sons, NY)
4. J H Milsum:- Biological Control Systems(Mc Graw Hill, NY)
5. R Plonsey:- Bioelectric Phenomena (McGraw-Hill Co, NY)