BIOMEDICAL INSTRUMENTATION

**Course Objectives**:  
To provide specific engineering and instrumentation methods and principles to acquire basic knowledge of design, its application and maintenance of different biomedical instruments.

1. **Fundamental of Medical Instrumentation (4 hours)**
   1. Biomedical Engineering and Areas of Engineering Contribution
   2. Biometrics and Design Consideration Factors for Medical Instruments
   3. Man Instrument System and their Objectives
   4. Components of Man Instrument System

1. **Bioelectric Signals and Electrodes (4 hours)**
   1. Body System and Bioelectric Phenomenon
   2. Sources of Bioelectric Signals
   3. Resting and Action Potentials
   4. Electrode Theory and their Equivalent Circuits
   5. Types of Biopotential Electrodes
   6. Application of electrodes in medical instrumentation

1. **Physiological Transducers (4 hours)**
   1. Classification of Transducers
   2. Performance Characteristics of Transducers
   3. Active Transducers and their Application in Medical Instruments
   4. Passive Transducers and their Types used in Medical Instruments

1. **Bioelectric Signals Measurement and Recording System (10 hours)**
   1. Aspects of Bioelectric Signals
   2. Electrocardiography (ECG)
      1. Normal Characteristics of Electrocardiogram
      2. ECG Lead Configuration and Recording Techniques
      3. Computer –Aided Electrocardiograph Analysis
   3. Electroencephalography (EEG)
      1. Electroencephalogram and Evoked Potential
      2. EEG Pre amplifier Design
      3. EEG Electrode Configuration and Recording Techniques
      4. Practical Details of EEG
   4. Electromyography(EMG)
      1. Electromyography Recording Technique
      2. Applications of EMG

1. **Non- Invasive Diagnostic Instruments (12 hours)**
   1. Blood Flow Measurement
      1. Magnetic Blood Flow meter
      2. Ultrasonic Blood Flow meter
      3. Blood Flow Measurement by Thermal Convection
      4. Blood Flow Measurement by Radiographic Method
   2. Diagnostic Medical Imaging System
      1. Radiographic Imaging System
         1. Principle of generation of X-rays and its medical properties
         2. Functional X-ray Machine
         3. Biological Effects of X-rays
      2. Ultrasonography Imaging System
      3. Computer Tomography (CT-Scan) System
      4. Magnetic Resonance Imaging System (MRI)
      5. Nuclear Medicine Machine

1. **Therapeutic Instruments (4 hours)**
   1. Function of Kidneys
   2. Principle of Artificial Kidneys
   3. Heamodialysis Machine
   4. Types of Dialyzers
   5. Lithotripsy and its principle
   6. Lithotripter Machine
   7. Defibrillator Machine

1. **Biomedical Telemetry and Telemedicine (3 hours)**
   1. Wireless Telemetry
   2. Single Channel Telemetry System
   3. Multi channel Telemetry
   4. Telemedicine Using Mobile Communication Equipments

1. **Electrical Safety of Medical Equipment  
   (4 hours)**
   1. Physiological Effects of Electricity
   2. Leakage Currents and Methods of Accident Prevention
   3. Micro shocks and Macro shocks Hazards
   4. Electrical Safety Codes and Standards
   5. Special Safety Measures for Electrical Susceptible Patients
   6. Power Distribution and Protection System of the Hospital

**Practicals:**

1. Three practical exercises based on availability of the portable medical and clinical based equipments.
2. Field Visit to Medical Institution
3. Field Visit Report and Viva Voce.

**References:**

1. Leslie Cromwell, et Al, " Biomedical Instrumentation and Measurements", Prentice Hall, India
2. R S Khandpur, "A Hand Book of Biomedical Instrumentation", Tata McGraw Hill

**Evaluation Scheme:**  
The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Hours** | **Marks Distribution\*** |
| 1, 2 | 4, 4 | 16 |
| 4 | 10 | 16 |
| 5 | 12 | 16 |
| 3, 6 | 4, 4 | 16 |
| 7, 8 | 3, 4 | 16 |
| **Total** | **45** | **80** |

\*There could be minor deviation in mark distribution.