

(BM-306) - Bio-Instrumentation and Measurements - I

Course Outline:

Theory:

1. **Introduction to measurements**
 1. Precision
 2. Resolution
 3. Sensitivity
 4. Accuracy
 5. Uncertainty
2. **Bio-potentials, biosensors and transducers**
 1. Biomedical signals of the human body,
 2. Sensors and transducers for bio-potential measurements
 3. Problems encountered in measuring biopotentials of the human body
 4. Invasive and noninvasive measurement techniques and related equipment.
 5. Functional Building blocks of a Biomedical Instrumentation System
3. **Cardiovascular System Devices**
 1. Diagnostic: Electrocardiography, Measurement of Blood pressure, Blood flow
 2. Therapeutic: Cardiac output. Defibrillator, pacemaker
4. **Pulmonary System Devices**
 1. Diagnostic: Pulmonary Function Analyzer, Spirometry, Ventilation Monitors, Respiration: Pulse oximetry, Capnography,
 2. Therapeutic: Ventilators, Heart lung machine, nebulizer
5. **Musculoskeletal & Nervous System Devices**
 1. EMG
 2. EEG
6. **Critical Care Devices**
 1. Patient Monitoring: Patient Monitors, central monitoring system, telemetry system
 2. Surgical/Operation Theatre Devices Equipment: Electrosurgical unit
7. **Genito-urinary System Devices**
 1. Hemodialysis Machine
8. **Quality Assurance and Quality Control**
 1. Common defects in medical equipment
 2. Performance measurement
 3. Calibration
 4. Maintenance and repair

List of Practicals:

1. To study the principle of various Biomedical Transducer
2. To understand methods and instruments for body temperature measurement and compare temperature sensor for selection on the basis of their properties
3. To study the working of photo detectors/photo sensors and their application in biomedical
4. To study the techniques of measuring blood pressure and measure the systolic and diastolic pressure.
5. To become familiar with the electrocardiograph as a primary tool for evaluating electrical events within the heart and observe rate and rhythm changes in the ECG associated with body position and breathing.
6. To record maximum clench strength for right and left hands and correlate motor unit recruitment with increase skeletal force.
7. To record EMG response to increased weights lifted by dominant and non-dominant arms and to record EMG when fatigue is induced.
8. To observe respiratory cycle and record breath per minute and respiratory rate in different conditions eupnoea, hyperventilation and apnea Vera.

9. To record an EEG from an awake, resting subject with eyes open and eyes closed. Identify and examine alpha, beta, delta, and theta components of the EEG complex.
10. To record EOG on the horizontal plane and compare eye movements under the following conditions: pendulum tracking & pendulum simulation.
11. To observe respiratory cycle and record breath per minute and respiratory rate in different conditions eupnea, hyperventilation and apnea Vera.
12. To observe real time monitoring through multipara monitor/bedside monitor.
13. To Study the construction and working of x-ray equipment and to practice the safety aspect using standard procedure.
14. To practice the safety aspect of ultrasound machine using standard procedure
15. To observe the principle and working of ventilator.
16. Open ended lab 1

Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing

Suggested Assessment:

Theory (100%)

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

Laboratory (100%)

Recommended Text and Reference Books:

1. Biomedical Instrumentation & Measures 2nd edition by Leslie Cromwell.1980. ISBN: 978-81-203-0653-0.
 2. Bioinstrumentation by John G. Webster.2004.ISBN: 978-81-265-1369-7
 3. Medical Instrumentation: Application and Design by John G. Webster.4th ed, 2010. ISBN: 978-0-471-67600-3
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