

ELI- 503: Biomedical Instrumentation -I

48 Periods

UNIT 1

Biopotentials, bioamplifiers and bioelectrodes: Introduction to bio-electric potential, bio-amplifier, components of man Instrument system, types of biomedical systems, design factors and limitations of biomedical instruments, terms and transducers to measure various physiological events, types of bio-potential electrodes (Body surface electrodes, Internal electrodes, Micro electrodes), electrolyte interface, electrode circuit model, impedance and polarization, Properties of electrodes . 12 periods

UNIT 2

Cardiac vascular system & measurements: ECG: origin, Instrumentation, bipolar system lead system I, II, III, Einthovan's triangle, Augmented lead system, unipolar chest lead system, types of display. Blood pressure measurements: direct, indirect. Defibrillators: AC, DC. Pacemakers- Internal, External. Blood Flow meters: Electromagnetic blood flow meter, ultrasonic blood flow meter. Oximeters: Different types of oximetry systems, pulse oximeter. 16 periods

UNIT 3

Respiratory Measurement Systems: Types of volume, types of measurements, Instrumentation of respiratory system, principle & types of pneumograph, Spirometer, pneumotachometers, nitrogen wash out technique. Ventilators: Basic principles of ventilators, different generators, inspiratory phase and expiratory phase, types of ventilators.
Nervous system: Action potential of brain, brain wave, Instrumentation of Electroencephalography (EEG), electrodes used for recording EEG analysis. 12 periods

UNIT 4

Medical Imaging system: -Thermal imaging system, working, IR detectors, applications. Radiography- conventional X-ray, properties, generation of X-ray, Fluoroscopy. 8 periods

UNIT 1

Chapter 1, 2, Khandpur R.S., Handbook of Biomedical Instrumentation, Tata MacGraw-Hill Publishing, India (2009), 2nd edition

Chapter 3, 6, 7 - Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Pearson Education Inc (2009), 4th edition

Chapter 1, 2- Mandeep Singh, Introduction to Biomedical Instrumentation, PHI learning private limited (2010), 1st edition

Chapter 2, 3, 4 - Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Prentice Hall (2010), 2nd edition

UNIT 2

Chapter 5, 6, 7- Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Prentice Hall (2010), 2nd edition

Chapter 2, 8, 9, - Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Pearson Education Inc (2009), 4th edition

Chapter 2, 6, 10, 11, 25, 26, - Khandpur R.S., Handbook of Biomedical Instrumentation, Tata MacGraw-Hill Publishing, India (2009), 2nd edition

Chapter 3, 9, 10- Mandeep Singh, Introduction to Biomedical Instrumentation, PHI learning private limited (2010), 1st edition

UNIT 3

Chapter 10, 11, 12, 13- Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Pearson Education Inc (2010), 2nd edition

Chapter 2, 6, 33 - Khandpur R.S., Handbook of Biomedical Instrumentation, Tata MacGraw-Hill Publishing (2009), 2nd edition

Chapter 4, 5- Mandeep Singh, Introduction to Biomedical Instrumentation, PHI learning private limited (2010), 1st edition

Chapter 8, 10 - Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Prentice Hall (2010), 2nd edition

UNIT 4

Chapter 23 -Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Pearson Education Inc (2010), 2nd edition

Chapter 19, 20, 24 - Khandpur R.S., Handbook of Biomedical Instrumentation, Tata MacGraw-Hill Publishing (2009), 2nd edition

Chapter 8- Mandeep Singh, Introduction to Biomedical Instrumentation, PHI learning private limited (2010), 1st edition

Chapter 14 - Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Prentice Hall (2010), 2nd edition

Essential Books:

1. Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Prentice Hall (2010), 2nd edition..
2. Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Pearson Education Inc. (2009), 4th edition.
3. Khandpur R.S., Handbook of Biomedical Instrumentation, Tata MacGraw-Hill Publishing, India (2009), 2nd edition.

Suggested Books:

1. Bertil Jacobson & John G. Webster, Medicine and Clinical Engineering, PHI.
2. Prof. S.K. Venkata Ram-Bio-Medical Electronics and Instrumentation, Galgotia Publications.
3. John G. Webster, Medical Instrumentation-Application and Design, Wiley Student Edition

Practicals (any eight)

1. To design biopotential amplifier for ECG signals.
2. Measurement of heart sound using electronic stethoscope.
3. Real time acquisition and analysis of ECG and EEG signals.
4. Determination of pulmonary function using spirometer.

5. To study fingertip oximeter and analysis of various parameters.
6. Designing of pacemakers.
7. To load various biomedical signal in Matlab/Labview.
8. Filtering of ECG/EEG signals using Matlab/Labview.
9. Adding noise to a biomedical signal using Matlab/ Labview .
10. Display the frequency spectrum of a signal using Matlab/Labview .
11. Analysis of components of ECG Signals using Matlab/ Labview .