

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>			<b>III Year B.E. Medical &amp; Analytical Instrumentation</b>				
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>EIR6C2 Medical &amp; Analytical Instrumentation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>

**Learning Objectives:** To understand the linkage between Medical Science & Engineering.

**Prerequisites:** Knowledge of Basic Electronics and Fundamentals of biology & chemistry.

### COURSE CONTENTS

#### UNIT-I

Sources of biomedical signals, Medical instrumentation system, General constraints in design of medical instrumentation system, Patient safety, Electric shock hazards, Effects of electric current on human body, Precautions to minimize electric shock hazards, Leakage current & its types, Testing of biomedical equipment.

#### UNIT-II

Origin & types of bioelectric signals, Electrodes used for ECG, EEG, EMG, Electrical conductivity of electrode jellies & cream, Microelectrodes, Biomedical recorders: ECG, EEG, EMG, PCG, VCG, Lasers used in medical field, Bedside patient monitoring system, Biomedical telemetry & Telemedicine.

#### UNIT-III

X-ray machine & Digital radiography, Principles & system components of Computed-Tomography, Magnetic Resonance Imaging: Principles of NMR, its Components & Biological effects, Ultrasonic & Thermal imaging systems.

#### UNIT-IV

Cardiac pacemaker like External, Implantable pacemaker, Artificial kidney, Dialyzers, Haemodialysis machine, Stone disease problem, Lithotripter system, Principle of surgical diathermy, Surgical diathermy machine, Electro-surgery techniques, Electrodes used with surgical diathermy, Introduction to Defibrillators, Mechanics of Respiration, Artificial ventilation, Types of ventilators.

## **UNIT-V**

Fundamentals of analytical instruments, Electromagnetic radiation and its interaction with matter, Laws of spectroscopy, Various components of Absorption instruments, Ultraviolet & Visible absorption spectroscopy, Different types of Photometers and Spectrophotometers, Infrared & FTIR spectroscopy, Nuclear magnetic resonance spectroscopy: Principal & its types, Introduction to chromatography: Gas & Liquid, Computer-based analytical instruments.

### **Learning Outcomes:**

Upon Completing the Course, Student will able to:

- Understand the various sources of bioelectric signals & their processing.
- Describe the fundamentals of various recording & diagnostic instruments.
- Acquire & develop skills for preventive maintenance and repairing of medical instruments.
- Study & understand the fundamentals of medical & analytical laboratory instrumentation.

### **BOOKS RECOMMENDED:**

- [1] R.S.Khandpur, *Handbook of Biomedical Instrumentation*, 2/e, Tata McGraw-Hill, 2007
- [2] John G. Webster, *Medical Instrumentation*, 4/e, Wiley, 2015
- [3] Carr Brown, *Introduction to Biomedical Equipment Technology*, 4/e, Pearson, 2007
- [4] R.S.Khandpur, *Handbook of Analytical Instruments*, 2/e, Tata McGraw-Hill, 2012
- [5] H.H Willard, *Instrumental Methods of Analysis*, 7/e, Publisher Name, 1988

### **List of Practical Assignments:**

1. Study of ECG Simulator for understanding the ECG signal & its generation process.
2. Using ECG Amplifier & CRO measure the amplitude, frequency & nature of ECG signal.
3. Study of EEG Simulator for understanding the EEG signal & its generation process.
4. Using EEG Amplifier & CRO measure the amplitude, frequency & nature of EEG signal.
5. Study of EMG Simulator for understanding the EMG signal & its generation process.
6. Using EMG Amplifier & CRO measure the amplitude, frequency & nature of EMG signal.
7. Study of Heart & Pacemaker.
8. Study of Defibrillator system.
9. Study of Respiratory system.
10. Experimental study of ph meter & UV-Spectrophotometer.