

COURSE TITLE : **MEDICAL ELECTRONICS**
COURSE CODE : **5044**
COURSE CATEGORY : **E**
PERIODS / WEEK : **4**
PERIODS / SEMESTER : **52/5**
CREDITS : **4**

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Basics of Anatomy and Bio-Potentials	13
2	Analytical Instruments and Laser	13
3	Therapeutic Instruments	13
4	Imaging System, Bio-Telemetry and Patient Safety	13
Total		52

Course General outcome :

Module	GO	On completion of the study of this course the students will be able :
1	1	To know the basics of bio-electric potentials and electrodes used for measurement.
	2	To understand bio-electric potential recorders.
2	3	To understand the different types of analytical instruments.
	4	To understand the application of lasers in biomedical field.
3	5	To understand the different types of therapeutic instruments.
4	6	To understand the various imaging systems.
	7	To understand the need of bio-telemetry and patient safety.

GO - General Outcome

On the completion of the study the student will be able :

MODULE - I - BASICS OF ANATOMY AND BIO-POTENTIALS

1.1.0 To know the basics of bio-electric potentials and electrodes used for measurement.

1.1.1 To describe the anatomy of human body - mention various physiological systems.

- 1.1.2 To describe resting and action potentials with waveforms.
- 1.1.3 To describe the different types of electrodes used.

1.2.0 To understand bio-electric potential recorders.

- 1.2.1 To explain electrical activity of heart with diagram.
- 1.2.2 To explain the origin and significance of ECG waveform.
- 1.2.3 To explain the block diagram of ECG recorder.
- 1.2.4 To explain the electrical activity of brain.
- 1.2.5 To explain the block diagram of EEG machine.
- 1.2.6 To explain the bio-electrical potentials associated with muscle activity.
- 1.2.7 To explain the setup for EMG measurement using block diagram.

MODULE - II - ANALYTICAL INSTRUMENTS AND LASER.

2.1.0 To understand the different types of analytical instruments.

- 2.1.1 To explain blood cells and their classification.
- 2.1.2 To explain the different methods of blood cell counting.
- 2.1.3 To explain blood pressure and its classes - Arterial BP and Ventricular BP.
- 2.1.4 To describe Sphygmomanometer - Direct and Indirect methods for the measurement of BP.
- 2.1.5 To explain blood gas analyzer.

2.2.0 To understand the application of lasers in biomedical field.

- 2.2.1 To state the Principle of Laser.
- 2.2.2 To explain the Properties of Laser.
- 2.2.3 To explain the Nd-Yag Laser, Argon Laser.
- 2.2.4 To list the application of Laser in Medical Field.

MODULE - III - THERAPEUTIC INSTRUMENTS.

3.1.0 To understand the different types of therapeutic instruments.

- 3.1.1 To state the need of Pacemakers.
- 3.1.2 To classify and compare different types of Pacemakers.
- 3.1.3 To explain the block diagram of a Ventricular Synchronous Demand Pacemaker.
- 3.1.4 To state the need of Defibrillators.
- 3.1.5 To compare AC Defibrillators and DC Defibrillators.
- 3.1.6 To explain the functions of a Dialysis Machine.
- 3.1.7 To list different types of Hemo-Dialysis Machine.
- 3.1.8 To state the working principle of a Portable Hemo-Dialysis Machine with a diagram.
- 3.1.9 To state the use of respirators.

- 3.1.10 To explain the classification of Ventilators according to Pressure Cycling And Volume Cycling.
- 3.1.11 To explain the different types of Diathermy Equipments.
- 3.1.12 To explain the methods of applying electrodes in shortwave diathermy treatment with diagram.
- 3.1.13 To list the advantages and disadvantages of Shortwave Diathermy Treatment.
- 3.1.14 To explain the Schematic Diagram of Microwave Diathermy Unit.

MODULE - IV - IMAGING SYSTEM, BIO-TELEMETRY AND PATIENT SAFETY.

4.1.0 To understand the various imaging systems.

- 4.1.1 To explain the operation of an x-ray machine with a block diagram.
- 4.1.2 To explain the working principle of CT scanner.
- 4.1.3 To explain the working principle of an ultrasonic imaging system.
- 4.1.4 To explain the working principle of nuclear magnetic resonance imaging system.

4.2.0 To understand the need of bio-telemetry and patient safety.

- 4.2.1 To state the need of bio-telemetry.
- 4.2.2 To explain the bio telemetry system with block diagram.
- 4.2.3 To state the application of bio-telemetry system with example.
- 4.2.4 To list the effect of electricity, electromagnetic radiation & magnetism in the human body.
- 4.2.5 To state the precautions to be taken while handling bio-medical instruments.
- 4.2.6 To list the precautions to be taken while handling x-ray machines.
- 4.2.7 To list the electrical safety considerations with respect to machine operators and patients – explanation of macro shock and micro shock.
- 4.2.8 To explain the importance of grounding.

CONTENT DETAILS

Module - I

Anatomy of human body - various physiological systems - sources of bio-electric potentials - resting and action potentials - waveforms - types of electrodes used for measurement. Electrical activity of heart with diagram - origin and significance of ECG wave form - block diagram of ECG recorder. Electrical activity of brain - block diagram of EEG machine. Bio-electrical potentials associated with muscle activity - setup for EMG measurement using block diagram.

Module - II

Blood cells and their classification - different methods of blood cell counting. Blood pressure and its classes - arterial BP and ventricular BP - sphygmomanometer - direct and indirect methods for the measurement of BP - Blood gas analyzers.

Principle of laser action - properties of Laser - Nd-Yag Laser, Argon Laser - application of laser in medical field.

Module - III

Pace maker - need of pacemakers – pacing modes - different types of pacemakers – internal - external - ventricular synchronous demand pacemaker - block diagram.

Defibrillator - need of defibrillators - compare ac defibrillators and dc defibrillators.

Dialysis machine - functions - different types of hemo-dialysis machine - working principle of a portable hemo-dialysis machine with a diagram. Use of respirators - classification of ventilators - pressure cycling and volume cycling. Diathermy - different types of diathermy equipments - methods of applying electrodes in shortwave diathermy treatment with diagram - advantages and disadvantages of shortwave diathermy treatment - schematic diagram of microwave diathermy unit.

Module - IV

Imaging systems – operation of an x-ray machine with a block diagram - working principle of CT scanner, ultrasonic imaging system, nuclear magnetic resonance imaging system. Bio-telemetry - need of bio-telemetry - bio telemetry system - block diagram - application of bio-telemetry system with example. Effect of electricity- electromagnetic radiation & magnetism in the human body - precautions for handling bio-medical instruments - precautions for handling x-ray machines - electrical safety considerations - machine operators and patients - macro shock and micro shock - importance of grounding.

TEXT

1. Handbook of Biomedical Instrumentation - R S Khandpur - Tata McGraw Hill Publishing Company Limited.
2. Biomedical Instrumentation and Measurements - Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer - PHI Learning Private Limited.
3. Biomedical Electrical and Instrumentation - Omkar M Pasndey and Rakesh Kumar - S K Kataria and Sons.