

# 19BM213 BIOMEDICAL INSTRUMENTATION

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	10	-	2	8	-	2



**SOURCE:**

<https://navaarinfocom.in/wp-content/uploads>

**PREREQUISITE COURSES:** Signals and Systems, Analog and Digital Electronics.

## COURSE DESCRIPTION AND OBJECTIVES:

This course includes the basic and advanced principles, concepts, and operations of medical sensors and devices, the origin and nature of measurable physiological signals and also including design of electronic instrumentation. This course aimed to impart the knowledge of realistic design and experimentation with amplifiers for biopotential measurement.

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes.

COs	Course Outcomes	POs
1	Analyze the various biomedical equipment and their functionality.	2
2	Design and verify the different bio amplifiers and filters in teams.	3
3	Acquire and analyze the ECG, EEG and EMG signals.	1, 5
4	Design different prototypes/ working of different diagnostic and therapeutic hospital equipment's.	3, 6, 9 10
5	Investigate the circuits in by usage of LabVIEW in projects.	6, 12

## SKILLS:

- ✓ Study of biomedical instrumentation and their parameters.
- ✓ Study of different display devices.
- ✓ Determination of bio potentials and how they are interpreted.
- ✓ Extraction of biological signals and feeding them to instruments to make meaning out of it.

**UNIT - I** **L-9**

**INTRODUCTION TO MEDICAL INSTRUMENTATION:** Block diagram of a medical instrumentation system; Bio-signals: Origin and characteristics of Bio potentials-ECG, EEG, EGG, EMG, ENG, EOG, and ERG; Problems encountered with measurements from human beings; Generalized medical Instrument specifications, Electrode - electrolyte interface, half cell potential, offset voltage; Types of Electrodes - external, internal and microelectrodes; Mathematical treatment of electrodes - equivalent circuits and applications.

**UNIT - II** **L-9**

**MEDICAL DISPLAY DEVICES AND RECORDERS:** Display devices, Basic requirements for the display and recording of biosignals, Types of medical display devices; Medical recorders - classification of recorders, PMMC writing systems, general features of ink jet, thermo sensitive and optical recorders; Oscilloscopes - basic description, cathode ray oscilloscope (CRO), Dual beam oscilloscope, analog storage oscilloscope, digital storage oscilloscope, multi beam and non-fade display systems; Liquid crystal displays - introduction, passive-matrix and active, matrix addressed LCDs.

**UNIT - III** **L-9**

**CARDIAC INSTRUMENTATION:** Electrocardiography, Block diagram, Circuits, Electrodes and their placement; Lead configuration and general ECG waveforms; ECG monitors - single channel and multi channel ECG systems, Holter monitors, stress test systems; Blood pressure measurement-introduction to blood pressure, direct and indirect methods of blood pressure measurements; Blood flow measurement - introduction to hemodynamics, electromagnetic and ultrasonic techniques of blood flow measurement; Phonocardiography, Plethysmography; Cardiac Pacemaker - internal and external; AC and DC defibrillator - internal and external.

**UNIT - IV** **L-9**

**NEURO-MUSCULAR INSTRUMENTATION:** Electroencephalography, EEG block diagram and circuits, Electrodes and their placement, Lead configuration and general EEG graphs; Evoked potentials and their measurement, Filters for EEG rhythm analysis, Electromyography - introduction to EMG signals, EMG block diagram and circuits, Electrodes and their placement; Nerve conduction velocity determination using EMG, Stimulators for EMG recording.

**UNIT - V** **L-9**

**MEDICAL ANALYTICAL INSTRUMENTATION:** Methods of chemical analysis, Absorption photometry, Emission photometry, Fluometry, Colorimeter, Spectrophotometer, Flame photometer, Mass spectrophotometer, Chromatography, Blood gas analyzer, Semi and fully automated analyzers.

## LABORATORY EXPERIMENTS

### LIST OF EXPERIMENTS

TOTAL HOURS: 30

1. Study of wet, dry and gel electrode configurations using Impedance analyzer.
2. Study ECG system.
3. Study of EEG system.
4. Study of EMG system.
5. Study of GSR system.

### Study and analysis of clinical instruments

6. Colorimeter.
7. Spectrophotometer.
8. Blood pressure measurement by using sphygmomanometer and automatic digital BP machine.

### Design Experiments using Lab View

9. Design of Instrumentation amplifiers for ECG/ EEG/ EMG.
10. Design of filters for ECG/ EMG/ EEG.

### TEXT BOOKS:

1. Webster J.G., "Medical Instrumentation Application and Design", 4<sup>th</sup> edition, Houghton Mifflin,2009.
2. Khandpur R.S. "Hand Book of Biomedical Instrumentation", 3<sup>rd</sup> edition, tata McGraw-Hill, 2003.

### REFERENCE BOOKS:

1. Carr and Brown, "Introduction to Biomedical Equipment Technology", 4<sup>th</sup> edition, Pearson,2000.
2. Khandpur R.S., "Hand Book of Analytical Instrumentation", 2<sup>nd</sup> edition, Tata McGraw-Hill, 2010.
3. John Enderle, Susan M. Blanchard, and Joseph Bronzino, "Introduction to Biomedical Engineering", 2<sup>nd</sup> edition, 2005.