NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	Minor in Industrial Automation (Inter-disciplinary) Offered by BTech in Electronics and Instrumentation Engineering.
Semester:	VII
Course Code:	4EI404IE25
Course Title:	Biomedical Instrumentation (Except EC)
Course Type:	Elective Course -II under Minor (Interdisciplinary)
Year of Introduction:	2024-25

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. illustrate medical terminology relevant to biomedical instrumentation (BL2)
2. analyze different diagnostic and therapeutic methods (BL4)
3. describe different medical imaging systems for different pathological diagnoses (BL2)
4. apply machine learning algorithms for biomedical signals and image classifications. (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit- I	**Introduction to biomedical instrumentation** Basic medical instrumentation system, Sources of biomedical signals, general constraints in designing of medical instrumentation systems, biomedical transducers, biopotential amplifiers.	04
Unit- II	**Biopotential electrodes** Theory of electrode, body surface recording electrodes, internal electrodes, microelectrodes, pH electrodes, pO2 electrodes, pCO2 electrodes.	04
Unit-III	**Biomedical recorders** Basics of cardiovascular system, Electrocardiograph machine, Phonocardiograph, Electroencephalograph machine, Electromyograph machine, Pacemakers, Defibrillators.	08
Unit- IV	**Haemodialysis machine** Function of kidneys, artificial kidneys, dialyzers, Haemodialysis machine.	03
Unit- V	**Medical Imaging Systems** Information content of an image, Radiography (X-rays), computed tomography, MRI, ultrasonography.	09
Unit- VI	**Patient monitoring system and Patient Safety** Measurement of heart rate, blood pressure measurement, blood flow meter, blood gas analyzer, wearable medical devices, Laser applications in biomedical field, Physiological effects of electricity, basic approaches to protection against shock.	10

Applications of machine learning for biomedical signals and image classifications.

Self Study:

The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated

Suggested Reading/References:

1. Carr & Brown, *Introduction to biomedical equipment technology,* Prentice – Hall.
2. Leslie Cromwell, *Biomedical Instrumentation and Measurements*, Prentice – Hall.
3. R.S. Khandpur, *Handbook of Biomedical Instrumentation*, Tata McGraw Hill.
4. John G. Webster, *Medical Instrumentation: Application and Design*, John Wiley & Sons.

Suggested List of Tutorials:

Sr. No.	Title
1.	Analyse the construction and working of various types of Biopotential Electrodes
2.	Study the methods used for blood pressure measurement (direct and indirect methods)
3.	Understand Electrocardiograph and ECG Waveform Analysis
4.	Understand Electroencephalograph and EEG Waveform Analysis
5.	Demonstrate the working of X-Ray machines and computed tomography
6.	Demonstrate the working of Magnetic Resonance Imaging system
7.	Understand the working of Haemodialysis machine
8.	Implement machine learning algorithms for biomedical signals classification
9.	Implement deep learning algorithms for medical image classification.
10.	Implement segmentation algorithms for medical images

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