SEMESTER S7

BIOMEDICAL INSTRUMENTATION

Course Code	OEEBT721	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3-0-0-0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	Course Type	OE/ ILE

Course Objectives:

1. Understand the principles of bioelectric potentials, including resting and action potentials, and their applications in clinical diagnostics such as ECG, EEG, and EMG.
2. Learn the fundamentals of various biomedical imaging and measurement technologies, such as X-ray radiography, MRI, and ultrasound, and their applications in diagnosing and treating medical conditions.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Origin of bioelectric potentials – resting and action potentials - propagation of action potentials. Examples of bioelectric potentials - ECG, EEG, EMG, – Electrodes for measurement of biopotentials. Body surface electrodes, Microelectrodes, Transducers for measurement of temperature, pressure, displacement. Electrical activity of brain - Electro encephalogram – 10-20 lead system, Instrumentation of EEG machine. Evoked potential -types & applications.	9
2	Electrical activity of heart, electrocardiogram - lead systems -ECG machine – block diagram, Arrhythmia Monitor, Cardiac pacemakers – internal and external pacemakers, Defibrillators –principles of operation, Measurement of heart sounds –phonocardiography Measurement of blood pressure – sphygmomanometer & Oscillo metric methods. Photo plethysmography - for pulse rate measurement - Pulse oximeters, Patient monitoring systems. Heart-lung machine, Principle of operation, applications, Artificial heart valves. Electrical activity of Muscle – Electromyogram (EMG) –.	9

	Electromyograph	
3	Spirometer - measurement of respiratory parameters. Blood flow meters. Electromagnetic blood flow meter, Ultrasonic Doppler blood flow meter. Lithotripsy–principles, types- Ultrasonic lithotripsy, Extracorporeal shock wave lithotripsy (ESWL) &applications. Surgical diathermy – Principle of operation, applications, Ventilators- controls, modes, assisted mechanisms.	**9**
4	X-ray radiography - Principles of x-ray generation – Block diagram of x-ray machine – X-ray computed tomography - Principle of operation, sectional imaging, scanner configurations. Ultrasonic imaging – Basic principles - Ultrasonic transducers- modes of image display-Principles & Applications. Magnetic resonance imaging -MRI instrumentation, Imaging modes. Electric shock hazards – Leakage currents – Test instruments for checking safety parameters of biomedical equipment.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

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Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Summarize the origin of bioelectric potentials and principle of different transducers used in biomedical instrumentation.	**K2**
CO2	Infer the electrical activity of the brain, heart and muscles, and understand the principles and applications of biomedical devices.	**K4**
CO3	Examine the respiratory and blood flow measurement techniques, and understand the principles and applications of lithotripsy, surgical diathermy, and ventilators.	**K3**
CO4	Discuss the principles and instrumentation of medical imaging techniques as well as the safety considerations for biomedical equipment.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1			2						3
CO2	3	3	1			2						3
CO3	3	3	1			2						3
CO4	3	3	1			2						3

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Compendium of Biomedical Instrumentation	Khandpur, Raghbir Singh	McGraw-Hill Education	2020
2	Biomedical engineering fundamentals	Bronzino, Joseph D., and Donald R. Peterson	Biomedical engineering fundamentals	2014
3	Medical Instrumentation: Application and Design	John G. Webster	Wiley	2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The biomedical engineering handbook	Bronzino, Joseph D, and Donald R. Peterson	CRC press	2018
2	Principles of biomedical instrumentation	Webb, Andrew G	Cambridge University Press	2018
3	Handbook of biomedical engineering	Kline Jacob	Elsevier	2012
4	Encyclopaedia of Medical Devices and Instrumentation	John G. Webster	Wiley	2006
5	Fundamentals of Biomedical Instrumentation and Measurement	Richard Aston and Steven A. Hunsaker	CRC Press	2017
6	Medical Imaging: Principles and Applications	Thomas L. Szabo	Springer	2019

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/nou24_bt07/preview
2	https://onlinecourses.swayam2.ac.in/nou24_bt07/preview
3	https://onlinecourses.swayam2.ac.in/nou24_bt07/preview
4	https://www.youtube.com/watch?v=2O1nW_KzVEo

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