SEMESTER S7

BIOMEDICAL INSTRUMENTATION

Course Code	PEEIT752	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)	PBEIT304 Sensors and Transducers	Course Type	Theory

Course Objective:

1. To give a brief introduction to human physiology and various instrumentation systems for the measurement and analysis of various physiological parameters

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Introduction to Biomedical Instrumentation** - Block diagram, Problems encountered in biomedical measurements. Brief introduction on physiological systems of the body-Nervous, cardio-vascular and respiratory systems. Sources of bioelectric potentials- resting potential, action potential. Electrode theory, Nernst equation and various types of electrodes. Bio electric signals - ECG, EEG, EMG and ERG.	9
2	**ECG Measurements –** Electro conduction system of the heart. Electrocardiography, electrodes and leads – Einthoven triangle, ECG machine – block diagram. Measurement of blood pressure – direct and indirect measurement – oscillometric measurement – ultrasonic method. Blood flow cardiac output, plethysmography, cardiac arrhythmia. Pace makers, defibrillators. Respiratory parameters – Spiro meter, pneumograph.	9
3	**EEG and EMG Measurements –** EEG instrumentation, electrode placement, EEG patterns. Muscle response – Electromyogram (EMG) – Nerve Conduction velocity measurements.	9

	Patient monitoring systems – Intensive cardiac care, bedside and central monitoring systems. Sources of electrical hazards and safety techniques.	
4	**Biomedical Imaging Techniques** X-rays, laser applications. Basic principle of computed tomography. Magnetic resonance imaging system and nuclear medicine system. Ultrasonic imaging system - introduction and basic principle. Color doppler systems, Holter monitoring, Endoscopy.	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

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

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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	Describe the basic principles of physiological systems of human body	**K2**
CO2	Illustrate the design principles and development of various biomedical instruments	**K3**
CO3	Explain the principle of patient monitoring systems and identify safety issues related to biomedical instrumentation.	**K2**
CO4	Describe the applications of medical imaging techniques in biomedical instrumentation.	**K3**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Medical Instrumentation Application and Design	John G. Webster, Amit J. Nimunkar	Wiley	5th edition, 2021
2	Biomedical Instrumentation And Measurements	Leslie Cromwell	Pearson Education India;	2nd edition, 2015
3	Handbook of Biomedical Instrumentation	Khandpur R.S	Tata McGraw-Hill, New Delhi, 2 Edition	2003

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Biomedical Instrumentation	M. Arumugam	Anuradha Publications	1994
2	Introduction to Biomedical Equipment Technology	Joseph J. Carr and John M. Brown	Wiley and sons, New York	2012

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/105/108105101/
2	https://archive.nptel.ac.in/courses/108/105/108105101/
3	https://archive.nptel.ac.in/courses/108/105/108105101/
4	https://archive.nptel.ac.in/courses/102/105/102105090/

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