

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN							
Department of Electrical and Electrical Engineering							
Name of the Subject	Basics of Biomedical Instrumentation			Name of the handling Faculty	VINODH.S.V		
Subject Code	OMD551			Year / Sem	III/V		
Acad Year	2022-2023			Batch	2020-2024		
Course Objective							
To study about the different bio potential and its propagation							
To understand the different types of electrodes and its placement for various recording							
To study the design of bio amplifier for various physiological recording							
To learn the different measurement techniques for non-physiological parameters.							
To familiarize the different biochemical measurements.							
Course Outcome							
CO1: Describe the different bio potential and its propagation.							
CO2: Compare the different types of electrodes and its placement for various recording							
CO3: Design of bio amplifier for various physiological recording							
CO4: Analyze different measurement techniques for non-physiological parameters							
CO5: Explain the different biochemical measurements.							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc)	Blooms Level (L1-L6)	CO	PO
		Book					
UNIT I BIO POTENTIAL GENERATION AND ELECTRODES TYPES							
1	Introduction	T 2	1	PPT	L1	CO1	PO1-PO3
2	Origin of bio potential	T 2	1	PPT	L1	CO1	PO1-PO3
3	Bio potential propagation	T 2	1	PPT	L1	CO1	PO1-PO3
4	Types of electrodes - surface electrodes	T 2	1	PPT	L2	CO1	PO4
5	Types of electrodes - needle electrode	T 2	1	PPT	L1	CO1	PO6
6	Types of electrodes - micro electrodes	T 2	1	PPT	L1	CO1	PO6
7	Equivalent circuits of all types of electrodes	T 2	1	PPT	L2	CO1	PO1-PO3
8	Recording problems	T 2	1	PPT	L3	CO1	PO1-PO3
9	Measurement with two electrodes	T 2	1	PPT	L2	CO1	PO1-PO3
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any Assignment on Recording problems							
Evaluation method Paper Based Evaluation							
UNIT II BIOSIGNAL CHARACTERISTICS AND ELECTRODECONFIGURATIONS							
10	Biosignals characteristics - Frequency and amplitude ranges	T2	1	PPT	L1	CO2	PO1-PO3

11	ECG	T2	1	PPT	L2	CO2	PO1-PO3
12	Einthoven's triangle,	T2	1	PPT	L1	CO2	PO1-PO3
13	ECG - Standard 12 lead system	T2	1	PPT	L1	CO2	PO1-PO3
14	EEG	T2	1	PPT	L2	CO2	PO1-PO3
15	EEG - 10-20 electrode system	T2	1	PPT	L2	CO2	PO1-PO3
16	EEG - unipolar, bipolar and average mode	T2	1	PPT	L1	CO2	PO1-PO3
17	EMG	T2	1	PPT	L2	CO2	PO1-PO3
18	EMG– unipolar and bipolar mode	T2	1	PPT	L2	CO2	PO1-PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Assignment on EEG

Evaluation method

Quiz on EEG,ECG,EMG

UNIT III SIGNAL CONDITIONING CIRCUITS

19	Need for bio-amplifier	T2	1	PPT	L1	CO3	PO1-PO3
20	Differential bio-amplifier using BJT	T2	1	PPT	L2	CO3	PO1-PO3
21	Differential bio-amplifier using OPAMP	T2	1	PPT	L2	CO3	PO1-PO3
22	Impedance matching circuit	T2	1	PPT	L1	CO3	PO1-PO3
23	Isolation amplifiers	R2	1	PPT	L2	CO3	PO1-PO3
24	Power line interference	T3	1	PPT	L1	CO3	PO1-PO3
25	Right leg driven ECG amplifier	T2	1	PPT	L2	CO3	PO1-PO3
26	Band pass filtering	T2	1	PPT	L1	CO3	PO1-PO3
27	Problems in bio-amplifiers	T2	1	PPT	L1	CO3	PO1-PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Assignment on Right leg driven ECG amplifier

Evaluation method

Paper Based Evaluation

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS

28	Temperature measurement	R2	1	PPT	L1	CO4	PO1-PO3
29	Respiration rate measurements	R2	1	PPT	L1	CO4	PO1-PO3
30	Pulse rate measurements	R2	1	PPT	L1	CO4	PO1-PO3
31	Blood Pressure: indirect methods Auscultatory method	R3	1	PPT	L1	CO4	PO1-PO3
32	Blood Pressure: Direct methods: electronic manometer	R2	1	PPT	L2	CO4	PO1-PO3
33	Systolic, diastolic pressure	T3	1	PPT	L1	CO4	PO1-PO3
34	Blood flow measurement - Indicator dilution, and dye dilution method	T3	1	PPT	L2	CO4	PO1-PO3
35	Ultrasound blood flow measurement	T3	1	PPT	L2	CO4	PO1-PO3
36	Cardiac output measurement - Dilution method	T2	1	PPT	L1	CO4	PO1-PO3
37	Cardiac output measurement - Impedance method	T3	1	PPT	L2	CO4	PO1-PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Assignment

on Ultrasound blood flow measurement.

Evaluation method

Quiz on MEASUREMENT OF NON-ELECTRICALPARAMETERS

UNIT V BIO- CHEMICAL MEASUREMENT										
38	Blood gas analyzers	T2	1	PPT	L1	CO5	PO1-PO3			
39	Non-Invasive monitoring	T2	1	PPT	L2	CO5	PO1-PO3			
40	Colorimeter	T2	2	PPT	L1	CO5	PO1-PO5			
41	Sodium Potassium Analyser	R2	1	PPT	L2	CO5	PO1-PO3			
42	Spectrophotometer	R3	1	PPT	L1	CO5	PO1-PO3			
43	Blood cell counter - Hematocrit determination & Laser based method	R2	2	PPT	L2	CO5	PO1-PO3			
44	Blood cell counter - Manual method & Conductivity method	R2	2	PPT	L2	CO5	PO1-PO3			
45	Auto analyzer (simplified schematic description)	R2	1	PPT	L1	CO5	PO1-PO5			
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any										
Assignment on Spectrometer										
Evaluation method										
Quiz on Biochemical measurement techniques										
Content Beyond the Syllabus Planned										
1	Bio electric signals used in medical field									
2	Measurement Techniques used in medical equipment									
Text Books										
1	Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007									
2	John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004. (Units I, II & V)									
Reference Books										
1	Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw Hill Publisher, 2003									
2	Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.(Units II & IV)									
3	Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004									
Website / URL References										
1	https://nptel.ac.in/courses/108/105/108105101/									
2	https://www.youtube.com/watch?v=cP1h_uuXBR4									
3	https://www.youtube.com/watch?v=UXNJTUvHnlg									
Blooms Level										
Level 1 (L1) : Remembering		Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing					Higher Order Thinking	Projects / Mini Projects
Level 2 (L2) : Understanding				Level 5 (L5) : Evaluating						
Level 3 (L3) : Applying				Level 6 (L6) : Creating						
Mapping syllabus with Bloom’s Taxonomy LOT and HOT										
Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	BIO POTENTIAL GENERATION AND ELECTRODES TYPES	4	5	0	0	0	0	9	0	9
Unit 2	BIOSIGNAL CHARACTERISTICS AND ELECTRODECONFIGURATIONS	5	4	0	0	0	0	9	0	9
Unit 3	SIGNAL CONDITIONING CIRCUITS	5	4	0	0	0	0	9	0	9
Unit 4	MEASUREMENT OF NON-ELECTRICAL PARAMETERS	4	5	0	0	0	0	9	0	9
Unit 5	BIO- CHEMICAL MEASUREMENT	5	4	0	0	0	0	9	0	9
Total		23	22	0	0	0	0	45	0	45

Total Percentage						51.1111	48.8889	0	0	0	0	100	0	100
CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1											
CO2	3	2	2											
CO3	3	3	3											
CO4	3	3	3	1	1									
CO5	3	3	3	1	1									
Avg	3	2.8	2.4	0.4	0.4									
Justification for CO-PO mapping														
CO1	High correlation for PO1,PO2 and low correlation for PO3 it can be used to get knowledge about different bio potential and its propagation.													
CO2	High correlation for PO1 and medium correlation for PO2 & PO3 it can be used to understand physiological measurements like EEG, ECG, EMG .													
CO3	High correlation for PO1, PO2,PO3 it have various bio amplifier for physiological recording													
CO4	High correlation for PO1, PO2 ,PO3 and low correlation for PO4,PO5 it can be used to apply knowledge of non electrical physiological measurement techniques.													
CO5	High correlation for PO1, PO2,PO3 and low correlation for PO4,PO5 it is applicable for different biochemical measurements													
0		High level			4		Moderate level			1		Low level		
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Name & Sign of Subject Expert : Dr.j.Jeha														
Head of the Department :Dr.J.Jeha														

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