Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

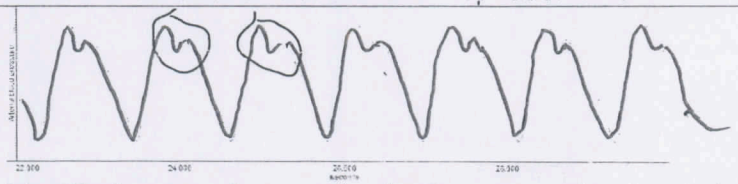
B.E BIOMEDICAL ENGINEERING
IV Semester
BM23401 BIOMEDICAL INSTRUMENTATION
(Regulation2023)

Time:3hrs Max.Marks: 100

CO1	Recall the Electrophysiology of bio potentials and electrodes for its measurement.
CO2	Describe the Bio signal characteristics and get practical knowledge.
CO3	Design preamplifiers for Bio signal measurements.
CO4	Design and implement amplifiers for various bio electrical signal measurements.
CO5	Describe the principle of various non electrical measurement.
CO6	Perform various non electrical measurement in practical.

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Define "All or none law".	2	1	2
2	What are the components of overpotentials and mention the parameters contributing it?	2	1	1
3	Draw the ERG waveform and show the important parameters and mention its causes.	2	2	1
4	What are the advantages of bipolar measurement?	2	2	1
5	Mention the basic requirements of biopotential amplifier	2	3	2
6	Why do we need standard ECG lead positions?	2	3	2
7	List the methods to examine the respiration rate.	2	5	1
8	 Identify the waveform and write the causes for the circled portion.	2	4	3
9	List the demerits of EM blood flow meter.	2	5	2
10	Define the principles involved in Fick's technique.	2	5	1

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	What is Half-cell potential? With neat schematics discuss the electrical equivalent of electrode electrolyte interface and skin electrode interface.	13	1	3
	OR			

11 (b)	i) Differentiate the electrical properties of Metal Micro electrode and Glass micro pipette with respective equivalent circuits. ii) Draw the action potential waveform and explain how it is generated.	6 7	1	3
12 (a)	i) Describe the standard 12 lead system used to record ECG. Also discuss the characteristics of typical ECG waveform. ii) Write short notes on characteristics of EMG signal.	10 3	2	2
	OR			
12 (b)	i) Explain the origins for heart sounds. ii) Show the standard 10-20 electrode system for recording the spontaneous EEG with neat diagram.	5 8	2	2
13 (a)	Design a circuit with one opamp bandpass filter that amplify the EMG signal to have the maximum gain possible without exceeding the linear output range and will pass the range of frequencies. Justify your design values with valuable comments.	13	3	4
	OR			
13 (b)	Identify the frequent problems associated while designing bio amplifier and discuss suitable design ideas to overcome the issues.	13	3	4
14 (a)	Write detailed on following (i) Auscultatory Method of BP measurment. (ii) Oscillometric Method of BP measurment.	7 6	4	3
	OR			
14 (b)	(i) How the respiration rate is measured using impedance technique? (ii) Discuss the direct Blood Pressure measurment using extravascular pressure sensor.	6 7	4	3
15 (a)	Explain how the Blood flow is measured using Electromagnetic wave blood flow meter and its types with neat diagram.	13	5	4
	OR			
15 (b)	In detail discuss how the cardiac output is measured using Ficks method and dye dilution methods.	13	5	4

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	i) Calculate the maximal audio frequency of a Doppler ultrasonic blood flowmeter that has a carrier frequency of 5MHz, a transducer angle of 30", a blood velocity of 150 cm/s. and an acoustic velocity of 1350m/s. ii) Design the circuit with correct specifications to detect the pulse rate signal.	5 10	4	5