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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

BIOMEDICAL ENGINEERING

Fourth Semester

BM5403 BIOMEDICAL INSTRUMENTATION

(Regulation2019)

Time:3hrs Max.Marks: 100

CO1	Describe the electrode behavior and circuit models.
CO2	Describe the fundamentals of Bio potential recording.
CO3	Design various bio amplifiers.
CO4	Measure various nonelectrical physiological parameters.
CO5	Measure various biochemical parameters.

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 half-cell potential.	2	CO1	L1
2	State the reasons for preferring silver-silver chloride electrodes over other electrodes.	2	CO1	L2
3	Give different types of lead systems used in ECG.	2	CO2	L2
4	Draw the waveform of a typical PCG signal and label its components.	2	CO2	L2
5	Mention the methods used to design isolation amplifiers.	2	CO3	L2
6	Design a differential amplifier with a gain 50.	2	CO3	L3
7	Provide Fick's equation of Cardiac output measurement.	2	CO4	L2
8	Define stroke volume. How is it related to Cardiac output?	2	CO4	L2
9	Provide typical expected values of blood gas parameters.	2	CO5	L2
10	What is a colorimeter? What are the essential units in it?	2	CO5	L2

PART- B(5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Describe the sources of bioelectric signals. Draw a typical cell potential waveform, label it properly, and analyze the phenomena of polarization, depolarization, and repolarization.	13	CO1	L3
	OR			
11 (b)	Discuss about surface Bio potential electrode with electrolyte skin interface and electrode tissue interface.	13	CO1	L3
12 (a)	Draw a typical Electroencephalogram (EEG) waveform. Give the frequency range of various bands for EEG analysis. Describe evoked potential and provide the block diagram of the EEG machine.	13	CO2	L3

	OR			
12 (b)	Describe the standard 12 lead system used to record ECG signals. Also, discuss the characteristics of typical ECG waveform with neat diagrams.	**13**	CO2	L3
13 (a)	The output of a pressure sensor is measured as 800 uV. Design an instrumentation amplifier to amplify this output to 3 V. Mention the design equations and justify the choice of resistors. Evaluate the overall gain of the amplifier.	**13**	CO3	L5
	OR			
13 (b)	Design a bio-potential amplifier for measuring ECG signals, with a gain of 25 in dc-coupled stages, and a gain of 32 in the high pass filter stage. Evaluate the overall gain of the amplifier. Investigate the use of high pass filter stage and mention its benefits.	**13**	CO3	L5
14 (a)	Explain the working principle of electromagnetic blood flow meter. Discuss its advantages and disadvantages	**13**	CO4	L3
	OR			
14 (b)	Discuss the three methods of pulse rate measurements. Discuss the significance of pulse rate in the human body.	**13**	CO4	L3
15 (a)	What is the function of a blood gas analyzer? Discuss about the measurement of pO_2, pCO_2 with neat diagrams.	**13**	CO5	L3
	OR			
15 (b)	What is the function of a blood gas analyzer? Why is it necessary to maintain acid-base balance in the body? Discuss about the measurement of pH, with neat diagrams	**13**	CO5	L3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Explain the origin of electrical activity of the heart with the help of a diagram. Provide the details about the electrodes used in ECG measurement.	**15**	CO2	L3