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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 120010**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024

Fifth Semester

Biomedical Engineering

U19BM510 – BIOMEDICAL INSTRUMENTATION

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

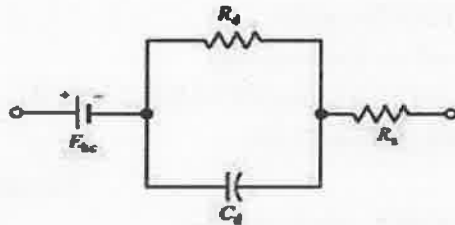
(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What is meant by Half Cell Potential (HCP)? List any two techniques to overcome effect of HCP.	2	K3	CO1
2.	The biopotential from human body originates due to the presence of volume conductor medium. In the above statement, what is indicated by volume conductor?	2	K2	CO1
3.	Specify the amplitude and frequency level of EEG signal.	2	K1	CO2
4.	Differentiate unipolar and bipolar mode of EMG measurements and give their applications.	2	K1	CO2
5.	How do you construct a differential amplifier? Identify the reason for its necessary usage in the field of biomedical instrumentation.	2	K3	CO3
6.	State the meaning of the term 'carrier' in the AC carrier amplifier. Give its medical application.	2	K2	CO3
7.	If a patient's arterial blood pressure is given as 130/85 mmHg, calculate the Mean Arterial Pressure.	2	K3	CO4
8.	Give the principle of operation of a Pneumograph.	2	K2	CO4
9.	Differentiate a potentiometric and amperometric biochemical sensor.	2	K3	CO5
10.	Identify the reason behind polarizing the membrane in a IMFET sensor.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Figure 1 shows an electric circuit that models a particular phenomenon in biopotential recording. Identify the phenomenon that is the basis of surface biopotential recording. Explain the importance of it and its applications.	13	K3	CO1



(OR)

b)	With neat diagrams, illustrate the process of electrical activity that occurs in the excitable cells of human body. How does it give rise to biopotential? Give the Nernst equation. How do motion artifacts affect the biosignals? Give solutions to remove motion artifacts from these recordings.	13	K3	CO1
12. a)	Illustrate the functioning of an ECG recorder with a neat block diagram. Discriminate the roles of Isolation amplifier and Right Leg driver circuitry in removal and reduction of noise.	13	K3	CO2
(OR)				
b)	Illustrate the 10-20 electrode system for recording of EEG signals. Does this 10-20 system apply to all the lobes of brain? Give the challenges involved in preprocessing the EEG signals.	13	K3	CO2
13. a)	Give a detailed account about the operation of Transformer coupled isolation amplifiers and Opto-isolation amplifiers.	13	K2	CO3
(OR)				
b)	Explain the various filtering techniques used in biosignal processing. Give a detailed account of the power line interference and its effect on the quality of biosignals.	13	K2	CO3
14. a)	Name the temperature sensors that are suitable for oral, rectal, forehead, or armpit measurements. Which of the modalities is associated more with the core body temperature? Explain their principle of operation and conversion to Celsius and Fahrenheit scale.	13	K4	CO4

(OR)

- b) Describe the procedure of measuring blood flow in a limb through measuring its volume changes. Consider the statement “The photoplethysmograph that uses an optical sensor is not considered as a true plethysmograph”. Justify the statement. 13 K4 CO4
15. a) Explain the construction and operating principle of an Autoanalyzer. Bring out the role of grating monochromators in testing a sample simultaneously for multiple analytes. 13 K3 CO5

(OR)

- b) Illustrate the method of pH detection in blood using capillary-type glass electrode. Name some clinical conditions where pH measurement is necessary for decision making. 13 K3 CO5

PART – C

(1 x 15 = 15Marks)

- | Q.No.  | Questions  | Marks | KL | CO  |
|--------|--|-------|----|-----|
| 16. a) | An injured patient undergoing treatment is connected to a bedside patient monitor. Recall the vital parameters that are recorded through a typical patient monitor. Identify the number of sensors and electrodes that are connected to the body of the patient. Apart from the sensing application, develop a schematic for the patient monitor to generate alarms when a particular health condition is met e.g. respiration rate falls below a certain limit. Bring out the method and role of measuring end tidal CO <sub>2</sub> in patient monitors. | 15    | K5 | CO4 |

(OR)

- b) Observe the given statement: “Novel cuffless wearable BP technologies can provide large numbers of readings for months without the discomfort of traditional BP monitoring devices”. Identify the factors leading to discomfort in the use of traditional BP monitoring devices. Explain the various methods of pressure measurement and indicate which of them are suitable for the design of cuffless wearable BP devices. Justify your answer. 15 K5 CO4