

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:3140311****Date:13-07-2023****Subject Name:Fundamentals of Biopotentials****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define the given terms: 1) Biopotential, 2) Half-cell potential.	03
	(b) Write a short note on electrode-electrolyte interface.	04
	(c) Explain Medical Instrumentation System in details with necessary block diagram.	07
Q.2	(a) Define Resting & Action Potential of neuron.	03
	(b) Write a short note on intracellular and extracellular ion distributions in a neuron.	04
	(c) Write Nernst equation for the estimation of the cell membrane potential and find the Nernst potential for K ⁺ Ion at 37°C for the Given Concentration value. (Intracellular concentration of K ⁺ =160mM & Extracellular concentration of K ⁺ =8mM, Gas Constant R=8.314J/K.mol & Faraday's Constant F=96485 J/mol).	07
OR		
	(c) Derive the Goldman-Hodgkin-Katz (GHK) Equation and justify how the membrane permeability affect the membrane potential.	07
Q.3	(a) Define Electrocardiography and enlist different types of ECG electrodes.	03
	(b) Write a short note on physiological effects of electricity.	04
	(c) Draw and explain the electrode-skin interface equivalent circuit.	07
OR		
Q.3	(a) Define Electromyography and enlist different types of EMG electrodes.	03
	(b) Write short note on Electromagnetic Coupling and Interference.	04
	(c) Draw and explain the Body-Surface recording electrodes.	07
Q.4	(a) Give the difference between Macroshock and Microshock.	03
	(b) Write a note on EEG electrodes and 10-20 EEG system.	04
	(c) Explain the Initiation & Propagation of action potential within the excitable cells.	07
OR		
Q.4	(a) Give the difference between Electrical Grounding and Shielding.	03

- (b) Write a short note on Capacitive and Inductive crosstalk. **04**
- (c) Explain Passive Electrical Membrane model and discuss the importance of Cellular Resistance, Capacitance & Time constant parameters in cellular excitation and signaling. **07**
- Q.5** (a) Give the definition of Diffusion and Diffusion coefficient. **03**
- (b) Write short note on Electroneurogram (ENG). **04**
- (c) Explain Polarizable and Non Polarizable Electrodes with necessary schematics. **07**
- OR**
- Q.5** (a) Enlist various functions of Sodium-Potassium Pump. **03**
- (b) Write short note on Electroretinogram (ERG). **04**
- (c) Explain the structure of various microelectrodes for intracellular recordings. **07**
