

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV EXAMINATION – SUMMER 2025

Subject Code:3140311

Date:15-05-2025

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 Biopotentials. Explain different Origins of Biopotentials.	03
	(b) Explain Resting membrane potential and active potential.	04
	(c) Draw and explain the block diagram of medical instrumentation system.	07
Q.2	(a) Explain Nernst Equation.	03
	(b) Draw and explain electrode-electrolyte interface.	04
	(c) Draw and explain Hodgkin Huxley model with necessary equations.	07
	OR	
	(c) Derive the Goldman-Hodgkin-Katz (G-H-K) Equation and also explain how the membrane permeability affects the membrane potential.	07
Q.3	(a) Explain half-cell potential.	03
	(b) Explain the difference between Polarizable and nonpolarizable electrodes. Also give their examples.	04
	(c) Define term: The electrode-skin interface. Draw and explain the electrode-skin equivalent circuit.	07
	OR	
Q.3	(a) Explain physiology of Electromyogram. Enlist different electrodes used for EMG.	03
	(b) Draw and explain different types of Needle Electrodes.	04
	(c) Draw and explain different types of body surface electrodes.	07
Q.4	(a) Explain Capacitive and Inductive crosstalk.	03
	(b) Explain (Na-K) ATPase Pump.	04
	(c) Draw ECG waveform. Explain P wave, QRS complex, ST segment, T wave and QT interval in detail.	07
	OR	
Q.4	(a) Define the terms: Macroshock and Microshock.	03
	(b) Explain design of Heat Sink Selection.	04
	(c) Explain different brain rhythms: alpha (α), beta (β), delta (δ), theta (θ) and gamma (γ). Explain different applications of EEG.	07

- Q.5** (a) Explain permeability coefficient. **03**
(b) Draw and explain Na^+ and K^+ distributions in a myocardial cell. **04**
(c) Write a short note on Electrical- Safety codes and standards. **07**

OR

- Q.5** (a) Explain Diffusion and diffusion coefficient. **03**
(b) Draw and explain Ca^{2+} distribution in a cell. **04**
(c) Explain Electroneurogram (ENG) and Electroretinogram (ERG). Enlist different electrodes used for ENG and ERG. Explain the applications of ENG and ERG. **07**
