

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER- IV EXAMINATION – SUMMER 2026****Subject Code:3140311****Date:25-05-2026****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.

- Q.1** (a) Explain in brief the origin of Bio-potential. **03**
 (b) For any given skeletal muscles in body find the equilibrium potential of the cell using GHK Equation. **04**

Ion	Intracellular Conc. (mili Moles per liter)	Extracellular Conc. (mili Moles per liter)
Na ⁺	12	145
K ⁺	155	4
Cl ⁻	4	120

Consider room temperature of 20 degree Celcius, and typical permeability values for Na⁺ is 2×10^{-8} cm/s, for K⁺ 2×10^{-6} cm/s and for Cl⁻ 4×10^{-6}

- (c) Define Action Potential, draw graph of the same and Explain in detail the propagation of Action Potential across Nerve Fiber. **07**
- Q.2** (a) Define Electrode. Enlist the major differences between Polarizable and Non Polarizable Electrode. **03**
 (b) Explain in detail the Electrode Skin Interface along with circuit diagram. **04**
 (c) Explain in details the various types of Surface electrodes used for measurement of Bio potentials. **07**

OR

- (c) Explain in detail the concept of Electrode-Electrolyte Interface along with values of Half Cell Potential of major ions. **07**
- Q.3** (a) Write short note on EMG and its measurement. **03**
 (b) Explain briefly the various types of Internal Electrodes used in measurement of Bio potential. **04**
 (c) Explain in detail the 10-20 electrode system along with its diagram. **07**

OR

- Q.3** (a) Explain Characteristics of EEG Waveform. **03**
 (b) Enlist various types of Biopotential and explain how electrode can act as Transducer for measurement of Bipotential. **04**
 (c) Explain in detail standard ECG Lead system along with necessary diagram. **07**

- Q.4** (a) Explain Relationship of Flux with Electrochemical Potential. **03**

- (b) Explain briefly the Ion Distribution across the cell along with neat labelled diagram. **04**
- (c) Explain in detail Ca^{2+} Distribution, pumping and exchange with neat labelled diagram. **07**
- OR**
- Q.4** (a) Explain briefly the concept of Facilitated Diffusion and Exchange Diffusion. **03**
- (b) Explain Circuit analysis for Cell Membrane. **04**
- (c) Explain in detail (Na-K) ATPase Pump. **07**
- Q.5** (a) Enlist the various design and selection criteria for Heat Sink. **03**
- (b) Explain briefly the basic approaches towards protection from shock. **04**
- (c) Explain in detail Micro and Macro Shock Hazards and state various threshold values of current for Human Body. **07**
- OR**
- Q.5** (a) Explain the concept of Inductive Cross talk. **03**
- (b) Explain various electrical safety code and standards. **04**
- (c) Explain in detail various Physiological effect of Electricity. **07**
