

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-IV EXAMINATION – WINTER 2025

Subject Code:3140311

Date:18-11-2025

Subject Name:Fundamentals of Biopotentials

Time:02:30 PM TO 05:00 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
<b>Q.1</b> (a) Define the Action Potential and enlist the different phases of it.	<b>03</b>
(b) Write a short note on the Standard ECG Lead System.	<b>04</b>
(c) Explain the Medical Instrumentation System in detail with necessary block diagram.	<b>07</b>
<b>Q.2</b> (a) Define Membrane Potential & write the Nernst equation for the estimation of the cell membrane potential.	<b>03</b>
(b) Describe the principle of Sodium-Potassium Pump in brief.	<b>04</b>
(c) Explain Polarizable and Non Polarizable Electrodes with necessary schematics.	<b>07</b>
<b>OR</b>	
(c) Explain the structure of various Microelectrodes for intracellular recordings.	<b>07</b>
<b>Q.3</b> (a) Give the difference between Electrical Grounding and Shielding.	<b>03</b>
(b) Describe the Physiology of Electromyogram (EMG).	<b>04</b>
(c) Explain the Initiation & Propagation of Action Potential within the excitable cells in detail.	<b>07</b>
<b>OR</b>	
<b>Q.3</b> (a) Give the definition of Diffusion and Diffusion coefficient.	<b>03</b>
(b) Describe the EEG electrodes and 10-20 EEG system in brief.	<b>04</b>
(c) Derive the Goldman-Hodgkin-Katz (GHK) Equation and justify how the membrane permeability affect the membrane potential.	<b>07</b>
<b>Q.4</b> (a) Enlist different types of Electrodes used for Biopotential measurements with its applications.	<b>03</b>
(b) Describe Electromagnetic Coupling and Interference in brief.	<b>04</b>
(c) Explain the Ion distribution and Ion Exchange mechanism within the Neuron with necessary schematics.	<b>07</b>
<b>OR</b>	
<b>Q.4</b> (a) Define Electroretinography and Electroneurography.	<b>03</b>
(b) Write a short note on Electrical Safety codes and standards.	<b>04</b>
(c) Explain Passive Electrical Membrane model with necessary equations.	<b>07</b>
<b>Q.5</b> (a) Define the terms (i) Macroshock (ii) Microshock.	<b>03</b>

- (b) Describe the Physiological effects of electricity in brief. **04**  
(c) Explain Electrode-Electrolyte interface in detail with necessary schematics. **07**

**OR**

- Q.5** (a) Define the terms (i) Refractory Period (ii) Electrode Potential **03**  
(b) Describe the Basic approaches to protect against shock and methods of Electrical Isolation in brief. **04**  
(c) Explain the Electrode-Skin interface equivalent circuit with necessary schematics. **07**

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