

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:3140311

Date:29-06-2022

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) Write down the Nernst potential equation & GHK equation with all parameters description/nomenclature. **03**
- (b) Explain briefly the Network equivalent circuit for Nerve/Muscle fiber. **04**
- (c) Explain in detail the block diagram of Medical Instrumentation System. **07**
- Q.2** (a) Define following terms: (i) Transducer (ii) Sensor (iii) Electrode **03**
- (b) Explain briefly the electrode behavior and circuit models. **04**
- (c) Explain in detail various types of Body surface electrodes. **07**
- OR**
- (c) Explain briefly the events in which following electrodes are often used: **07**
- (i) Electrode array (ii) Micro electrode (iii) Internal Electrodes
- Q.3** (a) Discuss the various characteristics of EEG signal. **03**
- (b) Explain Electrode – Electrolyte interface with neat labelled diagram. **04**
- (c) Explain in detail Wigger’s Diagram. **07**
- OR**
- Q.3** (a) Explain physiology of EMG signal. **03**
- (b) Explain Electrode- Skin Interface and motion artifacts. **04**
- (c) Sketch and explain briefly the standard ECG lead system. **07**
- Q.4** (a) Explain briefly Diffusion and Diffusion Co-efficient. **03**
- (b) Enlist the level of normal Distribution of Na⁺, K⁺, Ca²⁺ and Cl⁻ ions across and within the cell. **04**
- (c) Explain step wise process of Na-K ATPase pumping along with diagram. **07**
- OR**
- Q.4** (a) Explain Ca²⁺ pumping processing across cellular membrane. **03**
- (b) Explain the Estimation of the P_{Na}/P_K Ratio From Membrane Potential Measurements **04**
- (c) Explain in detail the circuit analysis for Cell Membrane. **07**
- Q.5** (a) Write down the various values of current shock and its effect on human body. **03**
- (b) Explain briefly various Electrical Safety codes and Standards. **04**
- (c) Classify various Macro and Micro shock hazards and steps for prevention against shock. **07**
- OR**
- Q.5** (a) Discuss the need of cooling in electrical devices and explain its mechanism. **03**
- (b) Explain the concept of EM coupling and its interference. **04**
- (c) Explain in detail the Grounding and Shielding consideration. **07**
