

Ermine  
Date: 13/5/2015.

GANPAT UNIVERSITY  
B.Tech. Semester VI (BM&I), Regular April-June Examination 2015.

2BM 602 Biopotential and Recorders

Time:- 3 Hours

Marks:- 70

Instructions:

1. Answer to the questions must be written in separate answer books.
2. Figure to the right indicate marks.
3. Assume data, if needed.
4. Conventional terms / notations are used.
5. All the questions are compulsory.

SECTION-I

Q.1

(a) In a cell, on increasing the permeability of an ion, how will the following parameters get affected? a) Membrane potential b) Equilibrium potential of the ion. c) Current carried by the ion. Give reasons for your answers. [12]

(b) What is Nernst potential? Derive the Nernst potential for Sodium and Potassium ions. ( Assume necessary concentration values for both ions)

OR

Q.1

(a) Draw the electrical equivalent circuit of a cell membrane with  $K^+$  and  $Na^+$  channels. Give the reason for choosing the particular orientation of the battery polarity for each. [12]

(b) In a nerve cell, at the peak of the action potential,  $P_{Na}$  is observed to have increased to 300 times its value at rest,  $P_K$  not to have changed, and  $P_{Na}/P_K$  to be 10. Take  $[Na]_o=125$  mM,  $[Na]_i=10$  mM,  $[K]_o=5$  mM,  $[K]_i=145$  mM, temperature to be  $27^\circ C$ ,  $R=8.31$  J/(K-mole), and  $F=96,500$  Coul/mole. What was the resting membrane potential of the cell? What was the membrane potential at the peak of the action potential?



Q.2 [11]  
(a) Define the passive transport and active transport phenomena for biological fluids.

(b) Draw and explain the generation of an action potential process in synchronization with the sodium and potassium conductance graph.

OR

Q.2 [11]  
(a) Explain the chemical transmission process occurs at neuromuscular junction.

(b) What is GHK equation? Explain the physiological significance of the equation.

Q.3 [12]  
(a) What is the resting potential of a cell whose internal (cytoplasmic) solution is 200 mM KCl and whose external solution is 20 mM KCl if  $\frac{P_{Cl}}{P_K} = 0.2$ ? Also, find the resting potential for  $\frac{P_{Cl}}{P_K} = 0.1$ .

(b) Draw and explain the setup of voltage clamp experiment. Discuss the ionic currents curves obtained at different clamp voltages.

## SECTION - II

Q.4. [12]  
(a) What is NCV? Mention the Normal Value of NCV for peripheral Nerves. Find out the conduction velocity if the distance of separation between 2 electrodes  $l_1=210\text{mm}$ ,  $l_2=60\text{mm}$  and the latencies  $t_1=9\text{ms}$  and  $t_2=6\text{ms}$ .

(b) What Do you understand by Cardiac Vector? Explain Saggitalplane ECG Measurement.

OR

Q.4. [12]  
(a) Draw the 10-20 placement system for EEG. Given the EEG output is 51mV and Noise output is 0.005mV calculate CMRR.

(b) Draw and Explain the Instrumentation Scheme for EOG and ERG.

Q.5. [11]  
(a) Explain Lead fail Detector Circuit and Overload Protection circuit in detail.

(b) Mention Required Characteristics of Recorders used for recording Biopotentials. Explain Electro static Recorder in Brief.



OR

Q.5

[11]

- (a) Mention the various waveforms associated with EEG with their Frequency and Amplitude. Which waveforms are generated in newborns? Draw Bipolar lead Configuration for 3 channel EEG Recording.
- (b) What is the frequency range of ECG? Explain the various Lead Configuration Associated with ECG.

Q.6.

Write short note on following.(Any Two)

[12]

- (a) Photo Transduction in Retina.
- (b) Electro Nystagmography.
- (c) Saccadic Eye Movements.

-----END OF PAPER-----