

GANPAT UNIVERSITY
B.Tech. Semester VI (BM&I), Regular May-June Examination 2014.

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

[12]

- (a) Explain the process of propagation of action potential in nerve cells.
- (b) Draw the electrical equivalent circuit of a cell membrane with K^+ , Na^+ and Cl^- channels. Give the reason for choosing the particular orientation of the battery polarity for each.

OR

Q.1

[12]

- (a) What is Nernst potential? Derive the Nernst potential for Sodium and Potassium ions. (Assume necessary concentration values for both ions)
- (b) In a nerve cell, at the peak of the action potential, P_{Na} is observed to have increased to 450 times its value at rest, P_K not to have changed, and P_{Na}/P_K to be 10. Take $[Na]_o=120$ mM, $[Na]_i=10$ mM, $[K]_o=5$ mM, $[K]_i=140$ 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

- (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. [11]
- (b) Discuss the effect of TTX and TEA on sodium current and potassium current.

OR

Q.2

- (a) Define the factors that determine the rising phase and falling phase of an action potential. [11]
- (b) Explain the chemical transmission process occurs at neuromuscular junction.

Q.3

- (a) The resting potential of a cell is determined by 3 ions A^+ , B^+ and C^- ions. The equilibrium potential of A^+ , B^+ and C^- ions are -30 mV, $+30$ mV and $+90$ mV. Given the ratio of conductance for A^+ and C^- is equal to 1, what will be the direction of change of membrane potential on doubling B^+ conductance? [12]
- (b) Draw and explain the setup of voltage clamp experiment. Also discuss the I-V relationship for sodium channel.

SECTION - II

Q.4.

- (a) Define recorder. Explain different types of recorder and their biomedical applications. [12]
- (b) Explain isolation amplifier for ECG.

OR

Q.4.

- (a) Draw and explain direct writing recorder. [12]
- (b) Draw and explain block diagram of Electroencephalogram.

Q.5. (a) Explain Notch filter with neat diagram. Design Notch filter of 60Hz frequency. [11]

(b) Write a short note on effects of artifacts on ECG recording.

OR

Q.5 (a) Draw and explain Instrumentation amplifier. Also derive gain equation. [11]

(b) Design a wide band pass filter with cut off frequency $f_L=100\text{Hz}$, $f_H=2\text{kHz}$ with pass band gain 10. Also calculate value of figure of merit Q.

Q.6. [12]

(a) Explain narrow band pass filter with neat diagram.

(b) Draw and explain optically coupled isolation amplifier.

(c) What do you mean by filter? Give classification of filters. What are the advantages of active filter over passive filter? Write application of filters.

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