Course No: EQUP 3319 Course Title: Measurements and Sensors for Biomedical Engineering Date: No. of Questions: (5) Time: 1 hours Using Calculator: (Yes)

University of Palestine
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Semester 1 Second Mid
Exam
2018/2019
Total Grade:15

Instructor Name: Eng.Abdulhmid Seyam Student No.: ______ Student Name: ______ College Name: Applied Engineering and Urban Planning Faculty Dep. / Specialist: Biomedical Engineering Using Dictionary: (No)

Question 1:

(4)

Choose the correct (one and only one) answer for each.

1-The process of changing from resting state to action potential is called ------

- a) Polarization
- b) Hyperpolarization
- c) Ionization
- d) Depolarization

2-If a nerve axon has an absolute refractory period of 1 ms, what is the upper limit of its repetitive discharge?

- a) 220 v
- b) 500 impulse/sec
- c) 1000 impulse/sec
- d) 10 m/s

3-A cell with equal permeabilities to Na+, K+ and Cl– and with net charge neutrality both inside and outside has a rest potential of:

- a) +80 mV
- b) +10 mV
- c) 0 mV
- d) -20 mV

4- ----- is a device that can measure the conduction velocity in peripheral nerve.

- a) ECG
- b) EMG
- c) ENG
- d) MRA

5- An ------ is a device that measures eye dipole field.

- a) Electro-retinogram
- b) Electro-oculogram
- c) Electroneurogram
- d) ECG

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6- Which of the following biopotentials has the highest frequency range?

- a) EOG
- b) EEG
- c) ECG
- d) EMG

7- The device which converts an electrical signal to a physical output is ---

- a) The Sensor
- b) The Actuator
- c) Displacement sensor
- d) Electromagnetic sensor

8- Refractory period is the time during which:

- a) Bone recovers from fracture
- b) A neuron does not respond to external inputs
- c) Ions do not travel through membrane proteins
- d) Membrane potential equals zero

Question 2:

Indicate for each statement below whether it is true or false:

- 1- [TRUE / FALSE] The typical resting potential of excitable cells in the human body is positive.
- 2- [TRUE / FALSE] The Nernst equation is a special case of the Goldman-Hodgkin-Katz equation.

(3)

- 3- [TRUE / FALSE] During depolarization the net charge inside the cell shifts from negative to positive.
- 4- [TRUE / FALSE] Volume conduction of large numbers of current dipoles in the body leads to biopotentials that can be measured on the body surface.
- 5- [TRUE / FALSE] In the EEG Beta. Waves, 14 to 30Hz occur during intense mental activity
- 6- [TRUE / FALSE] When an excitable cell is at its resting membrane potential, the membrane is completely impermeable to the movement of ions (all ion channels are closed).

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Question 3:

(3)

(3)

Define the Briefly define each of the following in biomedical instrumentation terms

- a. Direct operational mode of Biomedical instrumentation
- b. Generating sensors
- c. Desired Inputs
- d. Interfering input
- e. Correlation coefficient
- f. Zero drift

Question 4:

Draw a Schematic diagram model of a muscle-length control system for a peripheral muscle (biceps) shown below



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(3)

Question 5:

The concentrations of ions (in millimoles per liter) in the squid axoplasm and the extracellular space are as follows: Assuming room temperature (20"C) and typical values of permeability coefficient ($PNa = 2 \ge 10^{-8} \text{ cm/s}$, $Pk = 2 \ge 10^{-6} \text{ cm/s}$, and $PCl = 4 \ge 10^{-6} \text{ cm/s}$), calculate the equilibrium resting potential for this membrane, using the Goldman (GHK) Equation.

R is the universal gas constant (8.31 J/(mol-K),

T absolute temperature in K

F is the Faraday constant (96500 C/mol)

Species	Intracellular	Extracellular
Na⁺	50	440
K⁺	400	20
Cl	4	120

$$E = \frac{RT}{F} \ln \left\{ \frac{P_{\mathrm{K}}[\mathrm{K}]_{\mathrm{o}} + P_{\mathrm{Na}}[\mathrm{Na}]_{\mathrm{o}} + P_{\mathrm{Cl}}[\mathrm{Cl}]_{\mathrm{i}}}{P_{\mathrm{K}}[\mathrm{K}]_{\mathrm{i}} + P_{\mathrm{Na}}[\mathrm{Na}]_{\mathrm{i}} + P_{\mathrm{Cl}}[\mathrm{Cl}]_{\mathrm{o}}} \right\}$$

End of Questions