BYM 501E FUNDAMENTALS OF BIOMEDICAL ENGINEERING (14030)

Inci ÇiLESiZ

Midterm Examination 18 November 2013 14.00-15.00

PART A – CLOSED BOOK

1. Name and briefly explain (2x4 points)
   a. major static characteristics of a biomedical measurement system.
   b. the significance of dynamic properties when monitoring biological signals.

2. Assume you have a frequency modulated bioelectric signal with an amplitude of approx. 50 µV embedded in a wide band noise of at least 1 mV. How would you amplify and recover your original signal? (8 points)

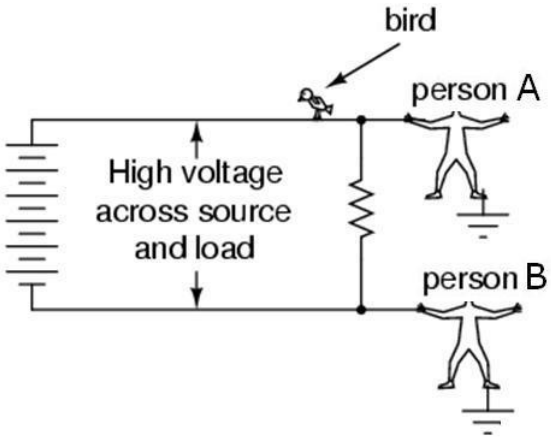
3. Why is an instrumentation amplifier used for amplification of most bioelectric signals? (4 points)

4. When studying excitable cells: (3x4 points)
   a. What are the main factors involved in the movement of ions across the cell membrane at steady state?
   b. How do membrane characteristics change during an action potential?
   c. Why is it necessary for the ventricular action potential to have a relatively long refractory period?

5. Assuming a leakage current of 5 mA spreads throughout the body, why are 50 Hz and 60 Hz more dangerous than 50 kHz? (5 points)

6. What are the main interfering or modifying inputs to equipment in a hospital environment? How can you minimize them? (5 points)

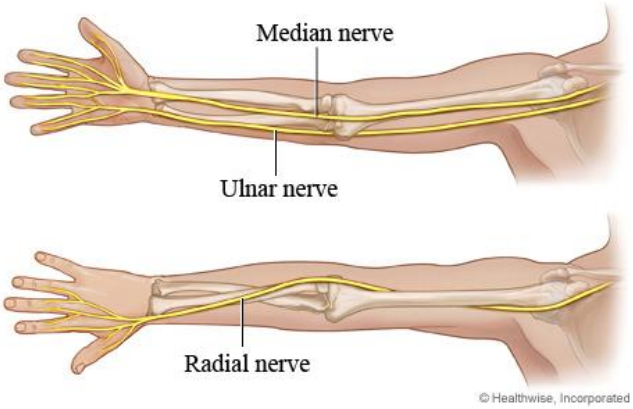
7. Study the figure shown on the left. What do you think will happen to person (a) A, (b) B, and the bird; WHY? (8 points)



50 points total - GOOD LUCK!

BYM 501E FUNDAMENTALS OF BIOMEDICAL ENGINEERING (14030)
Inci ÇiLESiZ
Midterm Examination 18 November 2013 15.15-16.45
PART B – OPEN BOOK

8. How does the "volume conductor" influence the shape and duration of measured EKG (8 points).
9. Looking at Fig. 4.21 and thinking of the movement of the cardiac vector during the whole cycle, interpret elevations and depressions on the EKG wave. (8 points).
10. A nerve conduction velocity test is an electrical test that is used to determine the adequacy of the conduction of the nerve impulse as it courses down a nerve. This test is used to detect signs of nerve injury. In this test, the nerve is electrically stimulated, and the electrical impulse 'down stream' from the stimulus is measured. You are asked to measure conduction velocity on the median nerve of the arm.



    a. Where would you place your stimulation and detection electrodes, why?
    b. Which sort of electrodes would you use, why? (2x6 points)
11. Is an electrode made of stainless steel polarizable or non-polarizable? Why? (6 points)
12. Solve Problem 6.14. (6 points)
13. Solve Problem 6.30. (10 points)

Use of internet resources via smart phones or laptops is illegal during the open part of this exam. Please do NOT force me to penalize any of you. Use the precious organ inside your skull to analyze problems please….

50 points total - GOOD LUCK!