UNIVERSITY OF GHANA

FIRST SEMESTER EXAMINATION, 2012-2013

LEVEL 300: BACHELOR OF BIOMEDICAL ENGINEERING

BMEN 303: BIOINSTRUMENTATION (3credits)

Section-A (40marks) (3 Hours)

Total marks: 100

Answer all Questions:

1. List brain waveforms and their frequency range? Mention their occurrence.
2. Write three differences between perfectly polarized electrode and Non -polarized electrode? Silver/silver-chloride belongs to which type of electrode?
3. What is a filter? List types of filter used in biomedical instrumentation?
4. Explain the working principle of a strain gauge? Name different types of strain gauge?
5. What is Phonocardiogram? What are the different types of Heart sounds?
6. Define the following terms as it relates to biomedical instrumentation:
   a. Operational amplifier
   b. CMRR
7. What is a transducer .Name the two parts of a transducer?
8. If the bio signals have the frequency range from D.C to few hundred Hz. how will you amplify the signals by AC amplifier?
9. What is Electromyography? Mention the electrical characteristic of EMG?
10. How many mole of ions must cross the membrane of a spherical cell 50μm in diameter to create a membrane potential of 20 mV? specific capacitance=1.0μFarad/cm^2,surface area of sphere=4πr2,Faraday constant=9.648*10^4 Coulombs /mole.Avagadro's number=6.022 x 10^{23} ions / mole.

Section-B (60marks)

Answer any Four from the following :

1. a) Explain the basic concepts of medical instruments by using block diagram? (10marks)
   b) Write detail on functional classification of medical instruments? (5marks)

2. a) With necessary waveform explain the generation of bioelectric potential? (5marks)
   b) Write detail on Goldman's equation for resting membrane potential? (10marks)

3. a) What are the different types of electrodes? Discuss the medical application of them? (10 marks)
   b) What are the various problems associated with surface electrodes in measurement of body electric potential? (5marks)

4. a)Find the output voltage of a Solid state PN temperature transducer in if I_{C1} = 2 mA; I_{C2} = 1 mA and the temperature is 37 °C (5marks)
   b) What is called Negative temperature coefficient and Positive temperature coefficient? (3marks)
   c) Define Seebeck effect and Peltier effect. (2marks)
   d) Construct the equation for Wheat-stone bridge circuit (5marks)

5. a) Draw the differences between the unipolar and bipolar types of ECG recording electrodes. (10marks)
   b) Explain in detail the different waves, segments and intervals associated with the ECG waveform and also give their normal values. (5marks)

6. a)List out typical EEG recording artifacts (5marks)
   b) With a neat block diagram explain the principle of operation of an EEG system (10marks)