USN | | | | | | | | | | 06EC834

Eighth Semester B.E. Degree Examination, June/July 2013
Biomedical Signal Processing

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Explain briefly how action potentials are generated and propagated in a human body.
      (10 Marks)
   b. With a neat block diagram, explain the objectives of biomedical signal analysis. **(10 Marks)**

2 a. Explain briefly about the 12-lead ECG system. Also derive the expressions for aV_R, aV_L and aV_F using mesh equations and vector diagram. **(10 Marks)**
   b. Discuss about the two types of electrodes used in ECG. **(06 Marks)**
   c. Explain briefly about monitoring lead systems. **(04 Marks)**

3 a. What are the different elements of a digital filter? Mention the advantages of digital filters over analog filters. **(10 Marks)**
   b. If the output sequence of a digital filter is {1, 3, 2} in response to a unit impulse, what is the transfer function of this filter? Draw the poles and zeros of this transfer function mentioning the ROC. **(05 Marks)**
   c. The Z-transform of a filter is $H(z) = \frac{1}{4}\left(1 + 2z^{-1} + z^{-2}\right)$. What is the   i) amplitude response; ii) phase response; iii) difference equation? **(05 Marks)**

4 a. Explain the cancellation of 60-Hz interference in an ECG signal using adaptive filters.
      (10 Marks)
   b. Discuss briefly about different applications of adaptive filters. **(10 Marks)**

PART – B

5 a. Show that a signal averaging improves the signal to noise ratio (SNR) by a factor of $\sqrt{m}$, where m is the number of sweeps considered. **(10 Marks)**
   b. With a neat block diagram, explain a typical signal averages. **(06 Marks)**
   c. In a signal averaging application, the noise amplitude is initially 16 times as large as the signal amplitude. How many sweeps must be averaged to give a resulting signal-to-noise ratio of 4:1? **(04 Marks)**

6 a. Classify the different data reduction techniques. Explain the turning point algorithm used for the ECG data reduction. **(10 Marks)**
   b. Given a sequence of 28 data points,
      {1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7}. Illustrate Huffman and modified Huffman coding. **(10 Marks)**

7 a. Explain briefly the QRS detection algorithm. **(10 Marks)**
   b. With a neat sketch, explain the power spectrum of an ECG. Also explain automata based template matching of QRS detection. **(10 Marks)**

8 a. Explain briefly about portable arrhythmia monitor with a neat sketch. **(10 Marks)**
   b. Explain briefly about VLSI applications in medicine. **(10 Marks)**

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